PRODUCTION PERFORMANCE ANALYSIS OF COAL BED METHANE, SHALE GAS, AND TIGHT GAS RESERVOIRS WITH DIFFERENT WELL TRAJECTORIES AND COMPLETION TECHNIQUES

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PRODUCTION PERFORMANCE OF COAL BED METHANE, SHALE GAS AND TIGHT GAS RESERVOIRS WITH DIFFERENT WELL TRAJECTORIES AND COMPLETION TECHNIQUES

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ABSTRACT

PRODUCTION PERFORMANCE OF COAL BED METHANE, SHALE GAS AND TIGHT GAS RESERVOIRS WITH DIFFERENT WELL TRAJECTORIES AND COMPLETION TECHNIQUES

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The large amount of produced oil and gas come from conventional resources all over the world and these resources are being depleted rapidly. This fact and the increasing oil and gas prices force the producing countries to find and search for new methods to recover more oil and gas. In order to meet the demand, the oil and gas industry has been turning towards to unconventional oil and gas reservoirs which become more popular every passing day. In recent years, they are seriously considered as supplementary to the conventional resources although these reservoirs cannot be produced at an economic rate or cannot produce economic volumes of oil and gas without assistance from massive stimulation treatments, special recovery processes or advanced technologies.

The vast increase in demand for petroleum and gas has encouraged the new technological development and implementation. A wide range of technologies have been developed and deployed since 1980. With the wellbore technology, it is possible to make use of highly deviated wellbores, extended reach drilling, horizontal wells, multilateral wells and so on. All of the new technologies and a large number of new innovations have allowed development of increasingly complex economically marginal fields where shale gas and coal bed methane are found.

In this study, primary target is to compare different production methods in order to obtain better well performance and improved production from different types of reservoirs. It is also be given some technical information regarding the challenges such as hydraulic fracturing and multilateral well configuration of the unconventional gas reservoir modeling and simulation. With the help of advances in algorithms, computer power, and integrated software, it is possible to apply and analyze the effect of the different well trajectories such as vertical, horizontal, and multilateral well on the future production performance of coal bed methane, shale gas, and tight gas reservoirs. A commercial simulator will be used to run the simulations and achieve the best-case scenarios. The study will lead the determination of optimum production methods for three different reservoirs that are explained above under the various circumstances and the understanding the production characteristic and profile of unconventional gas systems.

Keywords: Coal Bed Methane, Shale Gas, Tight Gas, Vertical, Horizontal Drilling, Multilateral Drilling, Hydraulic Fracturing, Adsorption

ÖZ

FARKLI KUYU YÖRÜNGELERİ VE TAMAMLAMA TEKNİKLERİ İLE KÖMÜR YATAĞI METAN, ŞEYL GAZ VE SIKI GAZ REZERVUARLARININ ÜRETİM PERFORMANSLARININ ANALİZİ

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Tüm dünyada üretilen petrol ve gazın büyük bir miktarı geleneksel kaynaklardan sağlanmaktadır ve bu kaynaklar hızla tükenmektedir. Bu gerçek ve artan petrol ve gaz fiyatları üretim yapan ülkeleri daha çok petrol ve gaz kurtarımı yapmak için yeni yöntemler aramaya ve bulmaya zorlamaktadır. Petrol ve gaz endüstrisi talebi karşılamak için gün geçtikçe daha da popüler olan geleneksel olmayan petrol ve gaz rezervlerine yönelmektedir. Son zamanlarda, ekonomik bir oranda üretilemeyen, büyük iyileştirme uygulamaları yardımı, özel kurtarım işlemleri ya da ileri teknoloji olmaksızın ekonomik miktarda üretemeyen, bu kaynaklar ciddi bir şekilde ele alınmaktadırlar.

Petrol ve gaza olan çok büyük talep yeni teknolojik gelişmeleri ve uygulamaları teşvik etmiştir. 1980 yılından itibaren çok çeşitli teknolojiler geliştirmiş ve uygulanmıştır. Bunlardan biri olan kuyu sondaj ile, yüksek derecede sapan, erişimi uzayan sondaj, yatay kuyular ve çoklu yanal kuyular ve bunların benzerlerinden yararlanmak mümkündür. Tüm bu yeni teknolojiler ve çok sayıdaki yenilikler şeyl ve kömür yatağı metan gazının bulunduğu ekonomik olarak marjinal sahaların gittikçe karmaşıklaşan gelişimine olanak sağlamaktadır.

Bu tezde, farklı rezervuar türlerinden daha iyi kuyu performansı ve iyileştirilmiş üretim elde etmek ana hedeftir. Ayrıca, hidrolik çatlatma ve çok yönlü kuyu konfigürasyonu gibi geleneksel olmayan gaz rezervuarlarının modellenmesi ve simülasyonun zorlukları hakkında bazı teknik bilgiler verilmiştir. Algoritmalardaki ilerlemelerin, güçlü bilgisayarın ve entegre yazılımların yardımıyla, dikey, eğimli, yatay, ve çoklu yanal kuyu yörüngelerinin geleneksel, şeyl gaz ve kömür yatağı gazı rezervuarlarının gelecekteki üretim performansları üzerindeki etkilerini incelemek eve bütünleştirmek mümkündür. En iyi durum senaryolarına ulaşmak ve simülasyonları çalıştırmak için ticari bir yazılım kullanılmıştır. Bu çalışma çeşitli koşullar altında bahsedilen üç farklı rezervuar tipi için optimum üretim yöntemlerinin belirlenmesine ve geleneksel olmayan gaz sistemlerinin üretim karakteristiği ve profilini anlamaya öncülük edecektir.

Anahtar Kelimeler: Kömür Yatağı Metan, Şeyl Gaz, Sıkı Gaz, Yatay Sondaj, Çok Yönlü Sondaj, Hidrolik Çatlatma, Adsorpsiyon

To my family

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NOMENCLATURE

Abbreviations

CBM : Coalbed Methane
LGR: Local Grid Refinem
SEM: Scanning Electron Microscopy
SRV: Stimulated Reservoir Volume
UGR: Unconventional Gas Reservoir

Symbols

A = Surface area of matrix element, m^2
D = Diffusion constant, m^2/day
f_a = fraction of ash content
F_{CD} = Dimensionless fracture conductivity
f_m = fraction of moisture content
G_s = Gas Storage Capacity, scf/ton
k = Permeability, md
k_f = fracture permeability, md
L = Fracture spacing, ft, m
P = Pressure, psia, bar
P_L = Langmuir Pressure, psia, bar
Q = Flow rate, m^3/s
V_L = Langmuir Volume Constant, scf/ton
w_f =Fracture width, ft, m
x_f = Fracture half-length, ft, m
μ = Viscositty, cp
σ =Shape factor, ft^{-2}, m^{-2}

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CHAPTER 1

INTRODUCTION

The vast majority of gas production all over the world comes from conventional reservoirs that become ever-increasingly difficult to discover and exploit. However, business cycles and higher gas prices affect and change the gas production strategy of the industry. Concordantly, the significance of unconventional gas reservoirs has been increasing for recent years owing to economic viability of their development and, therefore identification of the challenges and common pitfalls regarding those have been gaining importance at the same time.

In the last decades, the exploitation of unconventional gas reservoirs such as coalbed methane, shale gas, and tight gas has become an ever increasing part of world gas supply. With state of the art technology and high gas prices, these resources can be developed by achieving economical gas production. The economic viability of many unconventional gas developments hinges on effective stimulation of extremely low permeability rock by creating very complex well trajectories and fracture networks.

Generally, unconventional gas reservoir are described as having very large hydrocarbon reserves in place, a low expected ultimate recovery, and low permeability (Schenk, 2002). These reservoirs cannot provide efficient amount of gas with an economical rate and they require some special stimulation treatment techniques. Mostly, horizontal wells or multilateral wells with transverse hydraulic fractures make the feasible production rates possible, and improved performance of these reservoirs should be taken into account as much accurate as possible. Evaluation of unconventional gas reservoirs is much more challenging as compared to conventional gas reservoirs due to their complex rock properties, drilling and completion techniques, and production mechanism.

The main effort of this study is to investigate the well performance of coalbed methane, shale gas, and tight gas reservoirs with different well configurations and stimulation scenarios. In order to obtain the outcome of these analyses, a 3D layered geological model with a 25x25x52 grid having four different zones with different thicknesses was constructed and modified for each reservoir system with different characteristics as a means of providing some distributed properties by Petrel. On the other hand, the reason the models were created with similar areal extend is to compare the gas in place and recovery of each system.

A series of reservoir simulation were performed by Eclipse 300 as the compositional numerical simulator with two types of porosity system; dual porosity for coalbed methane and shale gas reservoirs, single porosity for tight gas reservoir. In some reservoir systems, hydraulic fractures were represented and included into the model by local grid refinement and well multiplier facilities of Eclipse 300 for vertical, horizontal, and multilateral well types.

CHAPTER 2

LITERATURE REVIEW

2.1 Unconventional Gas Reservoirs

Unconventional gas reservoirs are defined as formations that cannot be produced at economic flow rates or that do not produce economic volumes of oil and gas without assistance from massive stimulation treatments or special recovery processes and technologies such as hydraulic fracturing, a horizontal wellbore, and multilateral well-bores (Miskimins, 2008). The three most common types of unconventional gas resources are coalbed methane, shale gas and tight-gas reservoirs.

On the contrary, the definition is almost opposite for conventional gas reservoirs. They are produced at economic flow rate and produce economic volumes of oil and gas without large stimulation treatments or any special recovery process. Fundamentally, permeability range is from medium to high for these reservoirs and one can drill a vertical well, perforate the pay interval, and then produce the well at commercial flow rates and recover economic volumes of oil and gas (Holditch, 2002).

Figure 2.1 demonstrates the schematic of natural resources and depositional environment differences of the unconventional and conventional gas reservoirs.

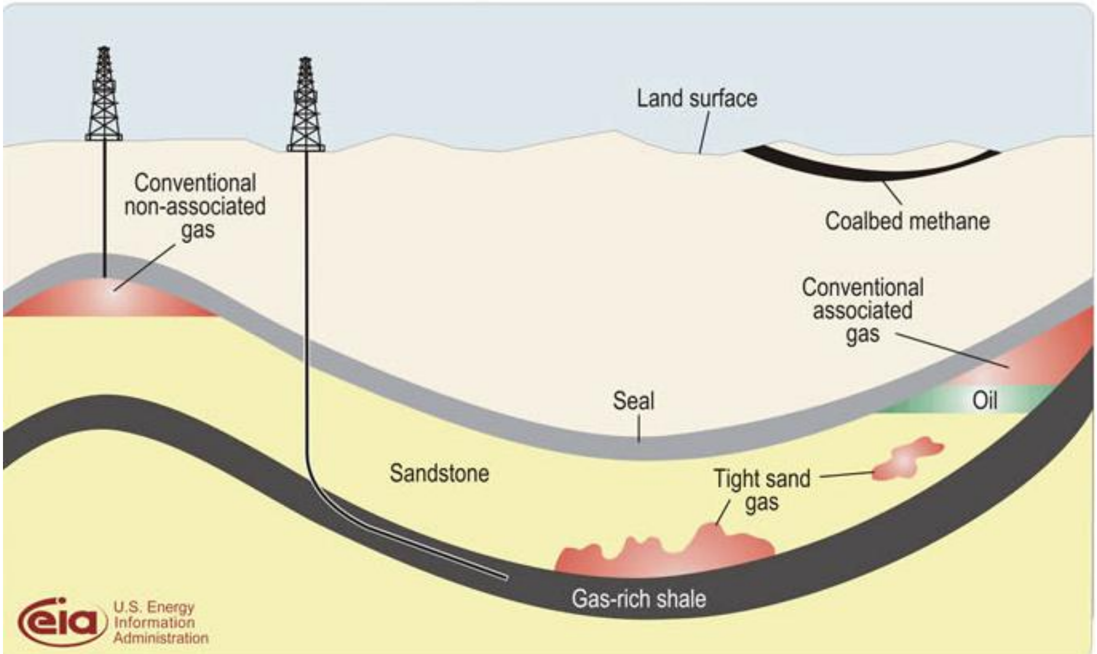

Figure 2.1 Schematic view of natural resources (EIA 2009)

The concept of the resource triangle was introduced by Master's, J.A. (1979). According to the concept, any type of natural resources such as gold, silver, oil or natural gas are distributed log normally in nature. Figure 2.2 illustrates the principal of resource triangle concept for conventional and unconventional gas resources. As it can be understood from the resource triangle, the conventional reservoirs consist of high and medium quality area with small volumes of gas in place, easy to develop and difficult to attain, and the unconventional reservoirs lie on low quality area which is generally large in size, but much more difficult to develop. Namely, the volume of gas that is available in the unconventional reservoirs is considerably larger than that stored in the conventional reservoirs. Another point is that, if it is desired to produce natural gas from low-quality deposits or unconventional reservoirs, advanced technology and high gas prices are required to make an economical investment.

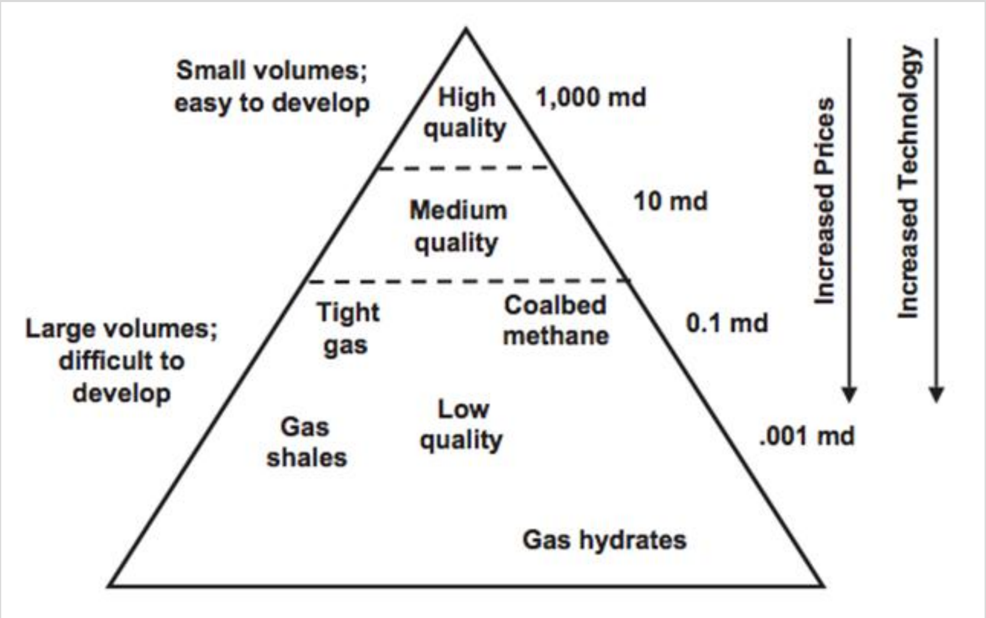

Figure 2.2 Resource Triangle for Natural Gas (Master 1979; Holditch, 2006)

2.1.1 Coalbed Methane Reservoirs

The characteristics of CBM reservoirs vary from conventional gas reservoirs in a number of ways. (Table 2.1). One of the major differences between CBM reservoirs and conventional gas reservoirs is that coal represents both the source and the reservoir rock at the same time. They are also found to be considerably different from normal porous gas reservoirs in both their storage and flow characteristics. That makes coal gas reservoirs different than conventional gas reservoirs. Coalbed methane system is a heterogeneous and anisotropic porous media characterized by two distinct porosity (dual porosity) systems: macropores that constitute natural fractures of the system and micropores that contain the vast majority of the gas.

Table 1.1 Comparison of CBM and Conventional Gas Reservoir Characteristics (Aminian, 2004)

Characteristic	Conventional	CBM
Gas Generation	Gas is generated in the source rock and then migrates into the reservoir.	Gas is generated and trapped within the coal.
Structure	Randomly-spaced Fractures	Uniformly-spaced Cleats
Gas Storage Mechanism	Compression	Adsorption
Transport Mechanism	Pressure Gradient (Darcy's Law)	Concentration Gradient (Fick's Law) and Pressure Gradient (Darcy's Law)
Production Performance	Gas rate starts high then decline. Little or no water initially. GWR decrease with time.	Gas rate increases with time then declines. Initially the production is mainly water. GWR increases with time.
Mechanical Properties	Young Modules ~ 10^6 Pore Compressibility ~10^{-6}	Young Modules ~ 10^5 Pore Compressibility ~10^{-4}

Gas is held in coal in three possible ways; free gas within natural fractures that are initially water saturated, dissolved gas in water within natural fractures, and adsorbed gas within the coal matrix. Generally, 95 % of gas comes from adsorbed gas volume.

The coalbeds are naturally fractured system with the gas adsorbed into the coal matrix. Primary production occurs by initially de-watering the natural fractures (cleats) and hence reducing the pressure in the fracture system. The reduced pressure in the fractures (cleats) allows gas desorption from the surface of the coal to the fracture. Gas diffuses from the bulk of the coal towards the fracture (cleat) surface.

Figure 2.3 shows schematic production history for a coalbed methane well. The production profile of a coal well is remarkably different from the conventional gas well and it has three distinct stages. Typically, most coalbed methane reservoirs initially produce water which controls flow to the well and this is called as dewatering stage. As the reservoir pressure in the natural fractures decrease until the critical desorption pressure, gas starts to desorb from the matrix, and then water and gas flow through the cleat system in the stable production stage. During this process, water production rate decreases continuously and gas production rates reaches the peak point. Finally, gas is depleted in a positive decline trend and water production rate sees its lowest level. (Zuber, 1996)

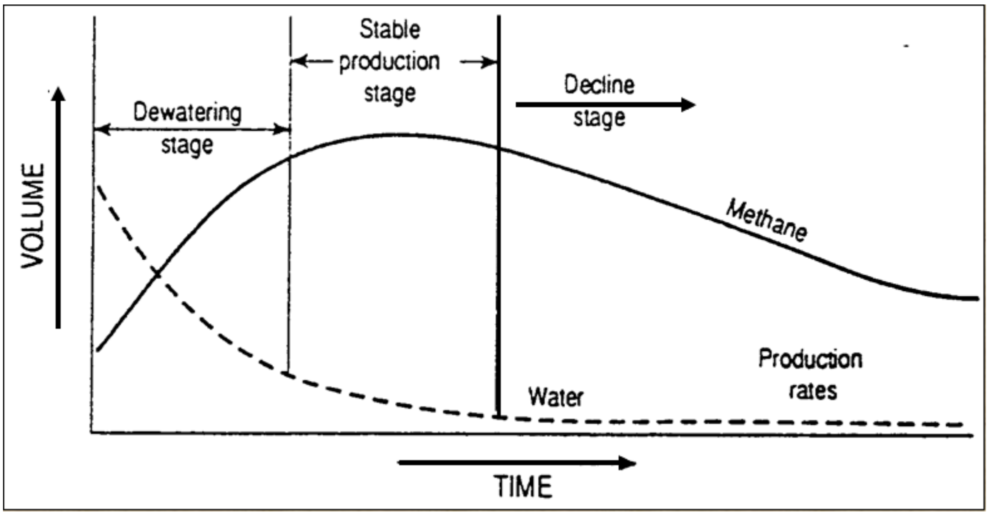

Figure 2.3 Schematic Production History for a CBM Well (Kuuskraa, 1989)

2.1.1.1 Langmuir Isotherm

The adsorbed concentration on the surface of the coal is assumed to be a function of pressure at a constant temperature (reservoir temperature) described by a Langmuir Isotherm developed by Irving Langmuir in 1916. The Langmuir isotherm represents the gas storage capacity of a coal and is used to predict the release of gas from the reservoir as the reservoir pressure is reduced. Figure 2.4 demonstrates a typical coal sorption isotherm.

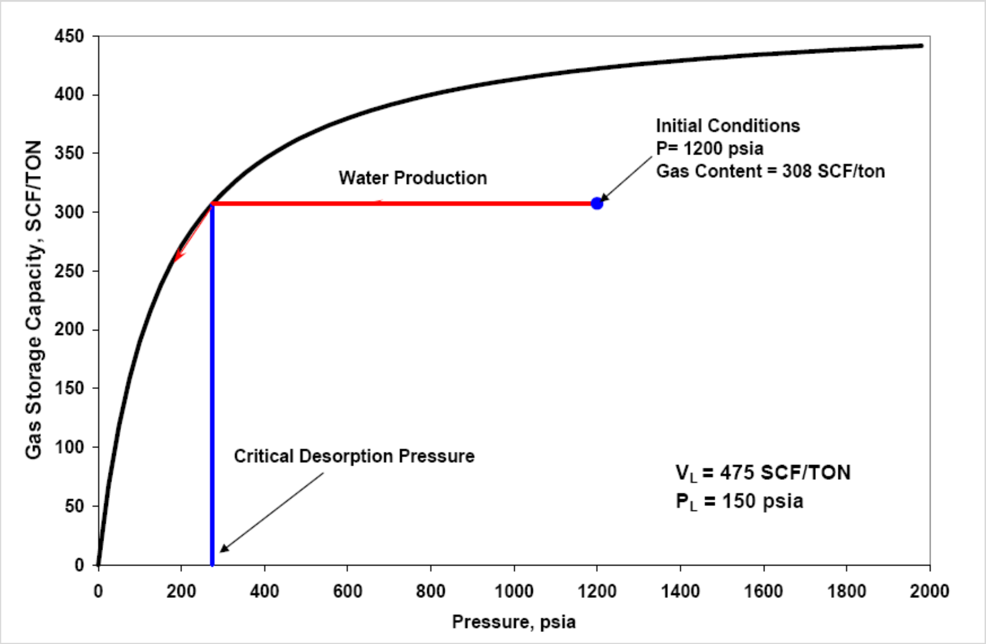

Figure 2.4 a Typical Langmuir Isotherm (Aminian, 2004)

Langmuir's Equation describes relationship of the sorption mechanism in coalbed methane reservoirs:

$$G_S = \frac{V_L P}{P_L + P} \qquad (2.1)$$

Where:

G_S = Gas storage capacity, SCF/ton
P = Pressure, psia
V_L = Langmuir volume constant, SCF/ton
P_L = Langmuir pressure constant, psia

The above equation is only valid for pure coal since it does not include ash and moisture contents of the coal. Therefore, it is not valid for the application in the field. Some modifications are required to represent these types of properties. The following equation is used to add ash and moisture effects.

$$G_S = \ 1 - f_a - f_m \ \frac{V_L P}{P_L + P} \qquad (2.2)$$

Where:

f_a = fraction of ash content
f_m = fraction of moisture content

V_L is called Langmuir volume constant to show the maximum adsorbed gas as pressure approaches to infinity. The units for that can be scf/ton, scm/ton, etc. The Figure 2.5 shows V_L on a typical Langmuir isotherm.

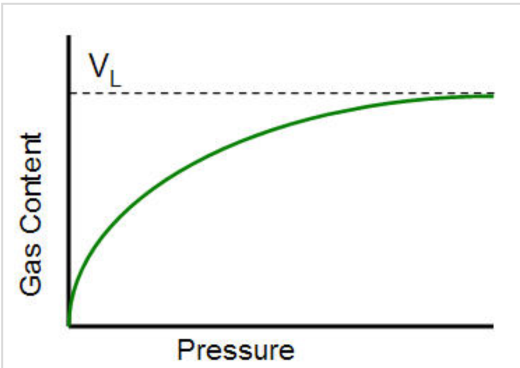

Figure 2.5 "Description of Langmuir volume on a typical Langmuir isotherm"

P_L is Langmuir pressure constant at which the amount of adsorbed methane is one half of its maximum amount. This is depicted in the following Figure 2.6.

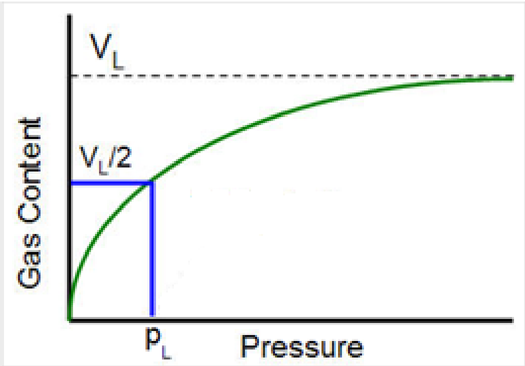

Figure 2.6 “Description of Langmuir pressure on a typical Langmuir isotherm”

2.1.1.2 Gas Transport in CBM

The transport of gas through a coal seam is governed by Fick’s law and Darcy’s law. With the pressure drop due to the produced water in the system, adsorbed gas in the coal blocks starts desorbing and draining into the cleats (fractures). That results in the gas diffusion from inside the matrix to the matrix walls by molecular diffusion. This process is controlled by the concentration gradient and described by Fick’s Law (Cervik, 1967 & King, 1993). Finally, gas and water flow together throughout the cleat system into the well bore with gradient of pressure as the driving force. Figure 2.7 illustrates the schematic of fluid transport in a coal seam. (Remner, 1984)

Fick’s Law:

$$Q_{gas} = -DA\frac{dC}{dL} \tag{2.3}$$

Where:

D = the diffusion constant, m^2/ day
A = the surface area of matrix element, m^2

The concentration of gas is a function of pressure as described by Langmuir Isotherm

Darcy’s Law:

$$q = -\frac{kA}{\mu}\frac{dP}{dL} \tag{2.4}$$

Where:
k = permeability of the medium, md
A = cross sectional area to flow, cm^2
μ = viscosity, cp

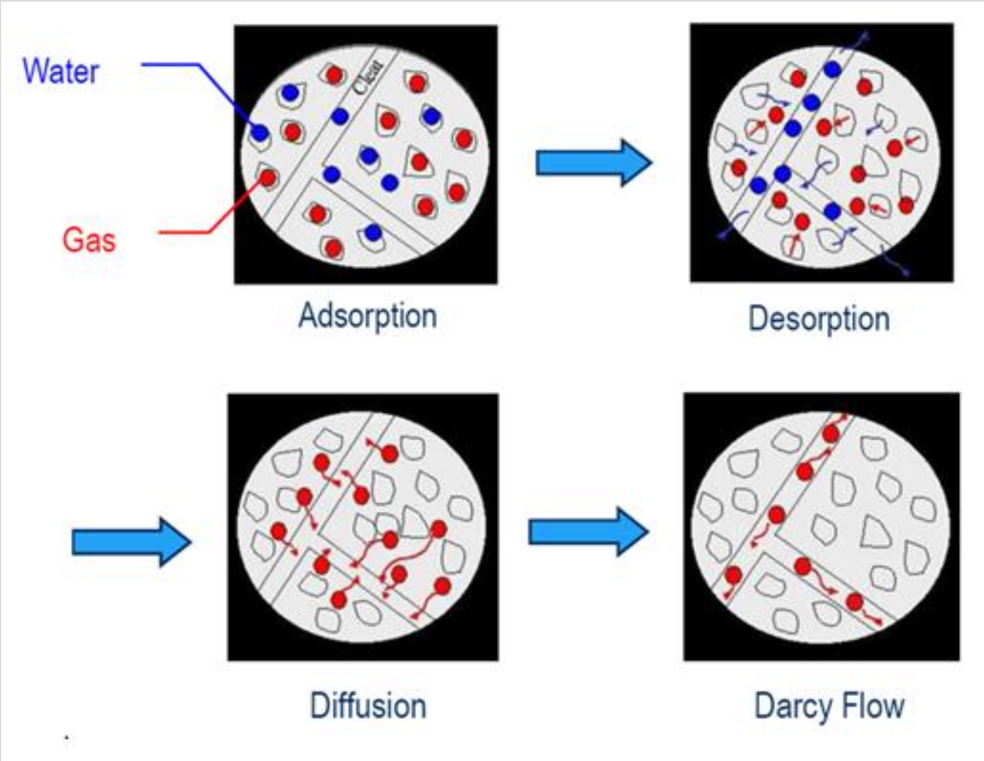

Figure 2.7 Schematic of the fluid transport in a coal seam (Remner, 1984)

2.1.2 Shale Gas Reservoirs

Typically, shale-gas is a dry gas mainly composed of methane (90 % or more); some formations produce wet gas also. Shales are fissile and organic-rich shale formations. These formations were previously considered as only source rocks and seals for gas accumulating in conventional strati-graphic reservoirs, (Martini et al, 1998). However, the shales have been defined as both a source and reservoir rock in recent years. In shale, the natural gas volumes can be stored in a local macro-porosity system (fracture porosity), or within the micro- or nano-pores of the shale. It can also be adsorbed onto minerals or organic matter within the shale. The following figure 2.8 illustrates the gas storage in shale gas reservoirs.

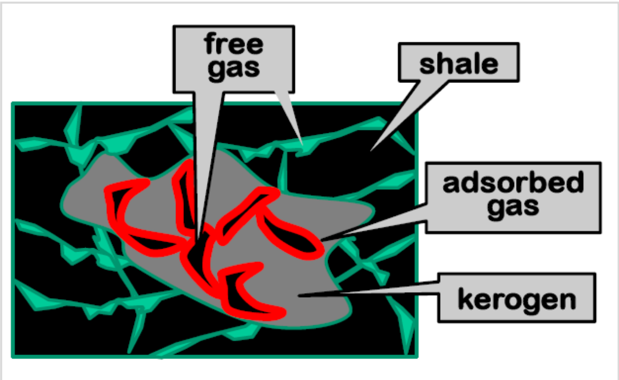

Figure 2.8 Illustration of gas storage in a shale system (SLB, 2009)

Gas can be stored in intergranular pores and the kerogen pores as free gas, as adsorbed gas on the surface of the organic content, and as soluble gas in solid organic materials (kerogen, clays, etc.) (Schettler and Parmely, 1991)

2.1.2.1 Production Mechanism of Shale Gas

Shale gas reservoirs have ultra-low matrix permeability (from 10^{-3} md to 10^{-9} in the nano-Darcy range) owing to the fine-grained nature of the original sediments, (Ning, 1993) and narrow, calcite-sealed natural fractures that can be re-activated by hydraulic fracturing. Pore and pore throat size are described in terms of nanometers to micrometer. Figure 2.9 shows the scanning electron microscopy image of a shale surface. Porosity of most shale reservoirs, if not all, is between 0.01 and 0.06, (Sondergeld et al, 2010).

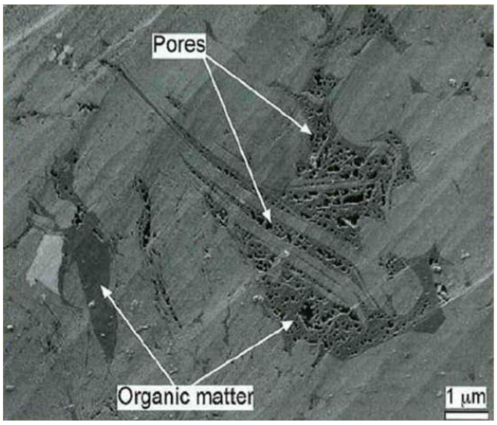

Figure 2.9 SEM image of shale surface (Roger, 2011)

Traditionally, shale gas reservoirs have long production lives (up to 20 years) with low decline rates (2 to 3 percent per year). Daily production rates (20 to 500 Mscf) are low compared to conventional gas reservoirs. Initially, free gas stored in the high permeability fracture network is produced and gas rates decrease sharply because of the limited storage capacity of the fractures. The depletion of free gas in the matrix follows this process. Finally, desorption begins to dominate production. Shale properties play an important role on produced gas amount by desorption or from matrix. (Powers, 2005) Figure 2.10 depicts distribution of free and adsorbed gas in a Shale Play.

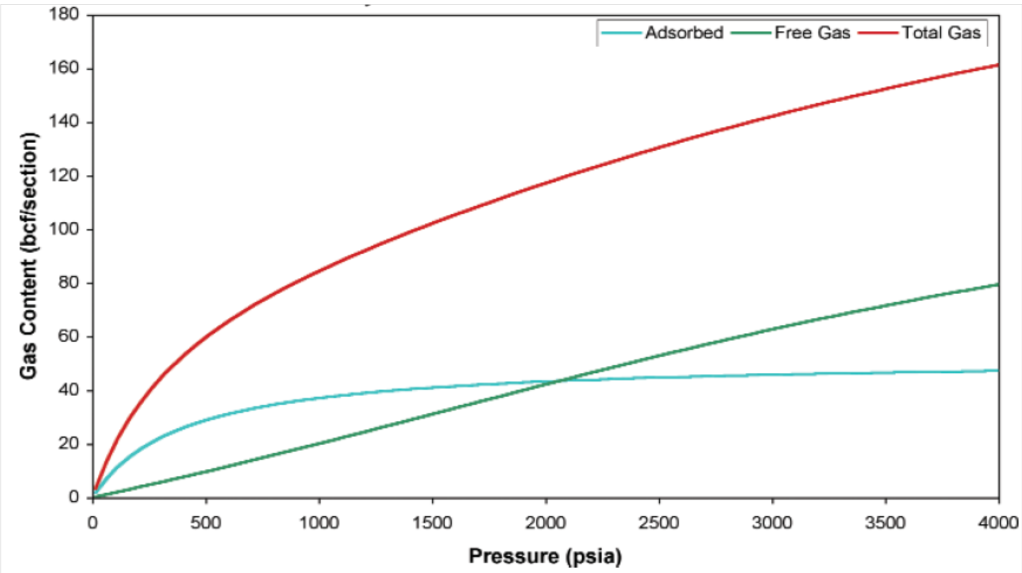

Figure 2.10 Distribution of free and adsorbed gas in a Shale Play (SLB Glossary)

2.1.2.2 Adsorption (Desorption) of Shale Gas

In most shale gas reservoir systems, approximately 50 % of the total gas in place is stored as adsorbed gas on the surface of the organic matter, (Faraj et al, 2004). Different conditions such as varying kerogen types and total organic carbon values yield different results. Ordinarily, adsorption potential of shales range from 20 scf/ton to 250 scf/ ton and is less than that in a given coalbed methane reservoirs, (Clarkson, 2000). Impact of adsorbed gas should be considered in the well production life and defined with the Langmuir Isotherm as explained in the coalbed methane section.

2.1.3 Tight Gas Reservoirs

There are several definitions to tight gas reservoirs differing from the conventional gas reservoirs with respect to depositional environment and rock properties. Pankaj and Kumar (2010) defined the tight gas as having low permeability (< 0.1 mD) and low porosity (< 10 %) reservoir system. Holditch's (2006) definition is that a reservoir system cannot be produced at economic flow rates nor recover economic volumes of natural gas unless the well is stimulated by hydraulic fractures. It is also defined as a reservoir requiring "man-made" permeability system for economic production by Addis and Yassir (2010). Figure 2.11 (a) & (b) illustrates comparison of thin section photos of a conventional sandstone and a tight gas sandstone.

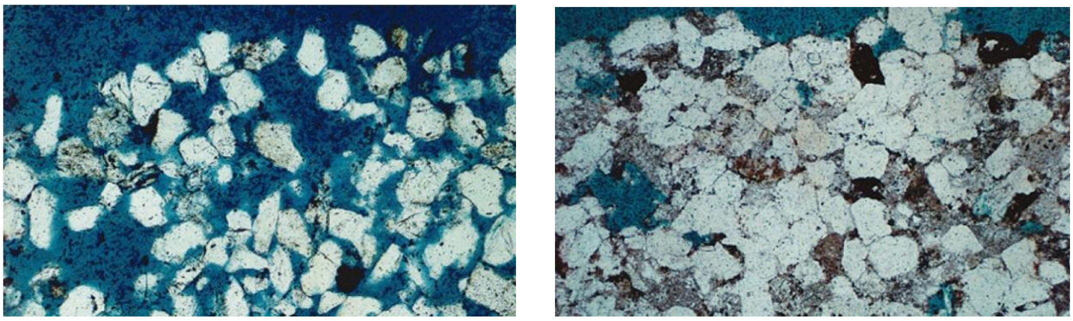

Figure 2.11 (a) Conventional Sandstone (b) Tight Gas Sandstone (Curtis, 2002)

The blue areas injected with blue epoxy represent the pore space containing gas. For conventional sandstone reservoir, most of the pore space area interconnected and flow of gas occurs easily. On the other hand, the irregular distribution of poorly connected pores decreases the porosity and affects the permeability in a negative way, thus gas flow rates are generally too low and required special treatments for the tight gas reservoirs.

2.2 Production Technologies of Unconventional Gas Reservoirs

Unconventional gas reservoirs or ultra-low permeability reservoirs called such as coalbed methane, shale gas, and tight gas sands may be called "technology plays" (Warpinski et al, 2009). Application of innovative drilling, completion, and stimulation techniques is required to produce and develop these reservoir systems.

2.2.1 Hydraulic Fracturing

Hydraulic fracturing is been used since 1947s (Charlez, 1997) in the oil industry and it is the most commonly used completion method to obtain economical production from the unconventional gas reservoirs. Recently, the horizontal and multilateral wells with application of multi-stage hydraulic fracturing started to play a key role by providing significantly more contact with the formation, (King, 2010). Hydraulic fracturing operations of unconventional reservoirs differ from conventional ones in terms of type of utilized fluid, volume of fluid, and pumped sand. The high amount of sand and fluid volume is essentially required to increase stimulated reservoir volume (SRV) for the relatively low permeability systems. Figure 2.12 represents the hydraulic fractures in a horizontal and a vertical well.

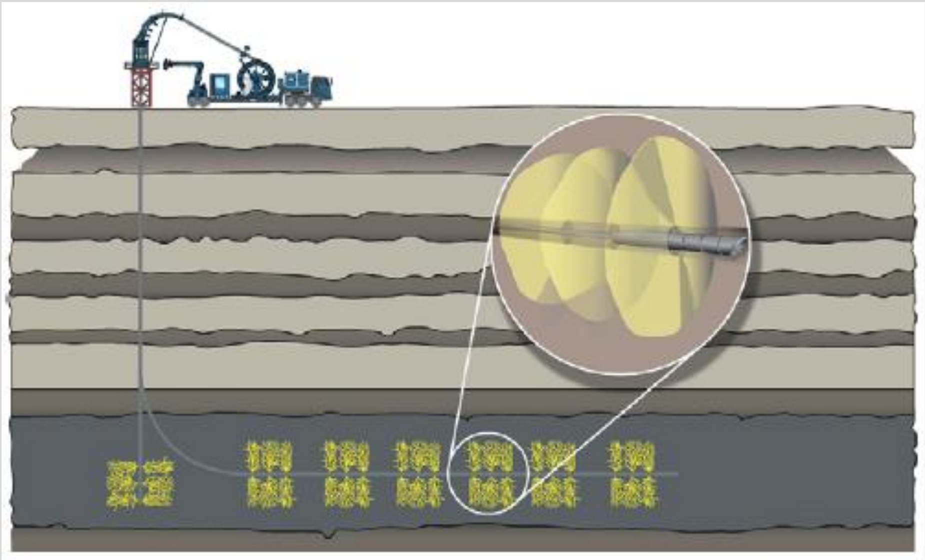

Figure 2.12 Representation of hydraulic fractures in a horizontal and a vertical well (John Perez, 2008)

The hydraulic fracturing is known as man-made or artificially created fractures which allow the opening of a large surface area of the reservoir rock so that the fluid is able to flow into the wellbore. Basically, hydraulic fracturing is processed by pumping the fluid at a high pressure and rate, and then the proppant materials into the fracture in the form of slurry as part of the fracture fluid, (Mattar et al, 2008). After stopping the pumping and following the flowing back to the well to recover the fracture fluids, the proppant pack leaves in the fractures to prevent the total closure due to the natural tectonic stress. That process constitutes a vast and complex fracture network around the wellbore to effectively drain the gas, (Zhang et al, 2009).

Success of the hydraulic fracturing treatment depends on several parameters but the SRV of unconventional gas reservoir are mostly affected from the orientation of fractures as being transverse and longitudinal. If a horizontal well is drilled in the least principal stress direction and as being the greatest principal stress vertical, the transverse fractures orient themself perpendicular to the wellbore. Generally, with low permeability systems SRV can be maximized by transverse fractures providing reduced fracture spacing, (Meyer et al, 2010). Figure 2.13 shows the wellbore placement and transverse hydraulic fractures

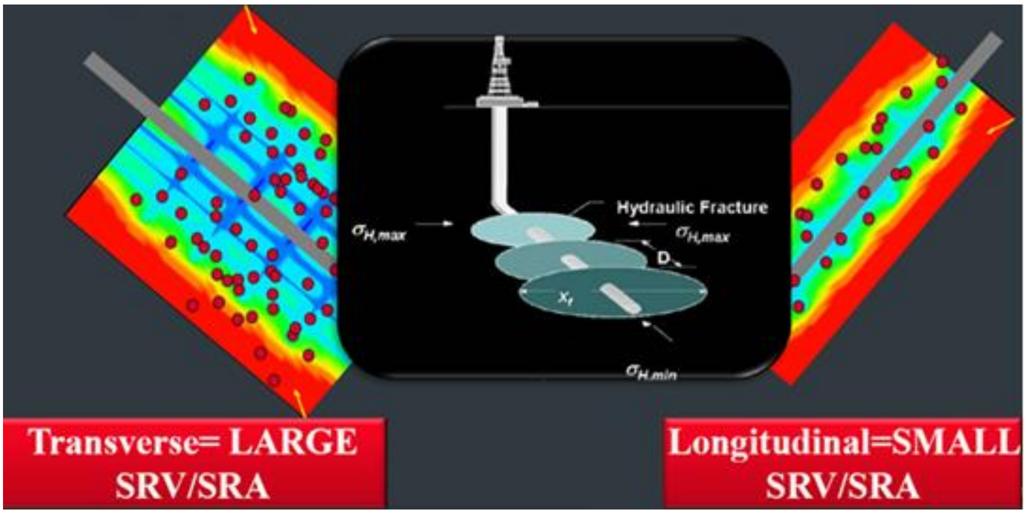

Figure 2.13 Schematic of well bore placement & hydraulic transverse fractures (HB)

Hydraulic fracture system is generally characterized by three variables: fracture permeability, k_{fh}, fracture half-length x_f, and fracture width w_f. These form the following equation to react the dimensionless fracture conductivity. (Cinco-Ley, 1978)

$$F_{CD} = \frac{k_f w_f}{k x_f} \qquad (2.5)$$

Where:
F_{CD} = Dimensionless fracture conductivity
k_f = Fracture permeability, md
w_f = Fracture width, ft
k = Formation permeability, md
x_f = fracture half-length, ft

2.2.2 Horizontal & Multilateral wells

With advances in drilling technology over the past 30 years, horizontal and multilateral wells have become a primary design type to develop reservoirs, especially in unconventional resources. Application of horizontal and multilateral wells provide a large rock surface area that is exposed to flow, more footage of the pay zone contacted by the borehole, more production rate and ultimate reserves recovered, (Lightfoot, 2007). Figure 2.14 (a) & (b) exhibit the horizontal and the multilateral well bore diagrams.

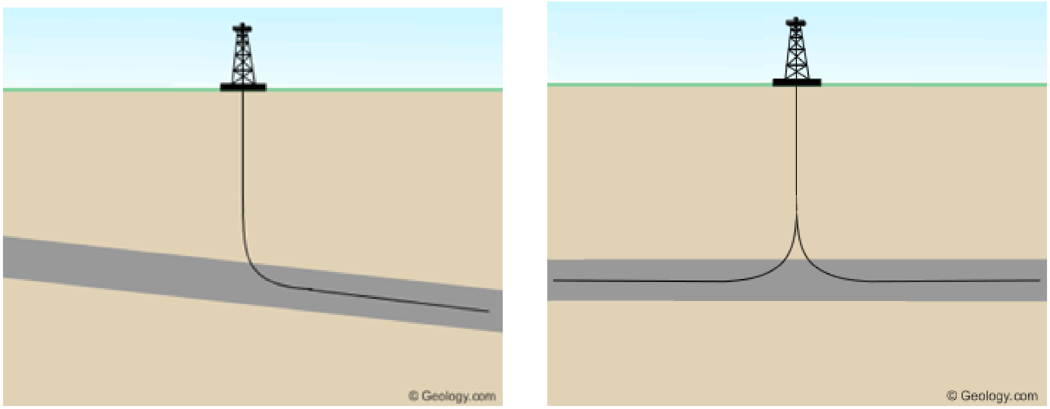

Figure 2.14 (a) Horizontal well (b) Multilateral well (Geology.com)

The horizontal and multilateral wells are drilled through the reservoir bedding plane, the primary objective of both type of wells is to produce more hydrocarbon from the reservoir and reduce the overall cost of production, (Joshi, 1991). In spite of that they are not adequate as a stand-alone stimulation treatment technique and should be exploited with multistage hydraulic fractures to get more effective results for unconventional gas reservoirs.

2.3 Simulation of Unconventional Gas Reservoirs

The growth in reservoir simulation has proceeded parallel to the upsurge in technology over the last 50 years. The engineer has strived at all times to use the best tool available to him to understand the mechanics of hydrocarbon reservoirs and production and to apply these to the efficient operation of reservoirs. Today, the use of simulation has made the computer as much an everyday tool as the slide rule and desk calculator was 40 years ago.

Numerical models utilize computers to solve the mathematical equations which govern the behavior of the fluids in porous media. They provide a generalized approach using a gridded format which can accommodate any reservoir description just by a reordering of the indices of the grids. The numerical models originated in the middle 1950s with the Peaceman and Rachford (1953) and have evolved extremely rapidly to the point where almost every conceivable reservoir behavior pattern can be simulated. The procedure involved consists of discretizing the reservoir into blocks and performing mass and energy balance on all these blocks simultaneously. This gridding of cells allow a more realistic representation of rock and fluid properties which can vary in any manner. Figure 2.15 displays the example of a 3D numerical reservoir simulation model.

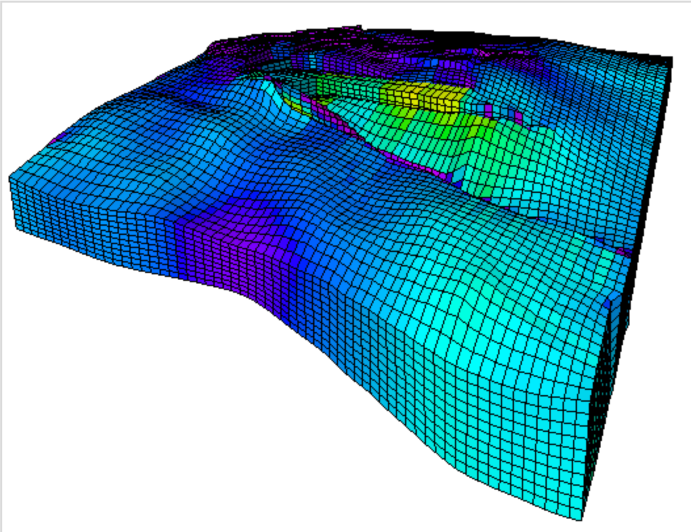

Figure 2.15 An example of a 3D numerical simulation grid (Petrel-2011 Manual)

The engineers know that they have a single opportunity to produce the reservoir; any mistakes made in this process will be around forever. However, the simulation study can be made several times and the alternatives can be examined. When the simulation study is used as a management tool, efficient utilization of available energy within reservoir can lead to greater ultimate production and certainly a more economical operation. In the more complex systems; for example, numerical simulation of unconventional gas reservoirs with horizontal wells that have multistage hydraulic fractures, it is challenging due to the poor understanding of variables such as pressure dependent permeability variation, fluid cleanup, relative permeability effects, non-Darcy flow, adsorption, etc. Most of the time, application of hydraulic fracturing is essential to stimulate the shale and tight gas reservoirs, and such systems are represented accurately with undue difficulty since the hydraulic fractures have quite complex properties in terms of geometry, distribution, and types. In order to characterize these reservoirs and develop a numeric model honouring properly the available data like cores, logs, micro-seismic, it is required to gain understanding and insight into the uncertainties that have the impact on production performance of the unconventional gas reservoirs, (Novlesky, 2011).

2.3.1 Challenges of UGR Simulation

Numerical simulation of unconventional gas reservoirs differs from the conventional gas reservoirs in some aspects. For example, adsorption phenomena, diffusion in the matrix, shrinkage of the matrix, and the effects of pore volume compressibility need to be accounted for in a proper way for most of the unconventional reservoir systems. These variables should be included into models and governed accurately in order to analyze and understand such complicated reservoirs. On the other hand, special stimulation treatment technologies such as hydraulic fractures and complex well paths make them more difficult systems to be modeled and simulated.

CHAPTER 3

STATEMENT OF PROBLEM

Each unconventional gas reservoir is unique and needs special interests to be characterized accurately. Ordinarily, it is very difficult to characterize them and choose the right recovery techniques. Accurate stimulation and determination of the unconventional gas reservoir systems plays an important role to produce natural gas commercially and optimize the recovery properly. At this point, numerical simulation approach that is the most beneficial tool to validate and predict the performance of these kinds of systems provided that adequate and reliable data are available comes into play. Although simulation of the unconventional gas reservoirs are also challenging process due to the several reasons like ultra-low permeability, desorption, complex geological characteristics, it offers remarkable potential for understanding of unconventional gas reservoirs.

The thesis will be performed to analyze the production performance of coalbed methane, shale gas, and tight gas reservoirs with different well trajectories and completion techniques. The objective of the study can be divided into three parts: the first one is to decide which well configurations provide better production performance and how much gas are obtained with improved production from different types of unconventional gas reservoirs; the second is to determine the important factors and limitations for the modeling and simulation of unconventional gas reservoirs and the last goal is to compare the production profile of each unconventional gas reservoir system having the same areal and vertical extent. As a result, each reservoir system will be compared in itself and tried to identify the best production case scenario and the study will also produce some solution techniques that deals with the challenges of the unconventional gas simulation

CHAPTER 4

METHODOLOGY

The starting point in this study was to create a 3D layered model grid and distribute the petrophysical properties by Petrel, and then each case was prepared by modifying the base model for each reservoir system considering their similar and different characteristics. Next, numerical compositional simulator, Eclipse 300, was employed to investigate cases of the vertical, horizontal and multilateral wells with or without multi stage hydraulic fracturing for each unconventional gas reservoir independently.

Three different types of unconventional gas reservoirs, coalbed methane, shale gas, and tight gas, were analyzed in order to evaluate the effects of different well configurations and stimulation treatments on the reservoir depletion. Each reservoir system was handled with vertical, horizontal, and multilateral well paths separately.

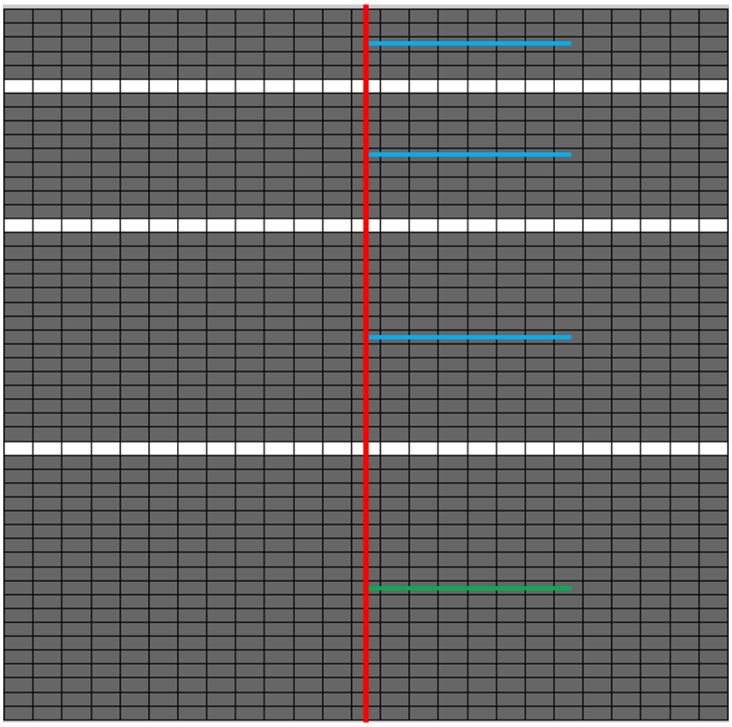

Figure 4.1 Schematic views of well trajectories on the base grid side view

The figure 4.1 shows the side view of simulation grid with four zones, gray cells, separated by impermeable zones, white cells, and all available well trajectories; The red line represents the vertical well path, horizontal well is composed of red and green line, and the last well trajectory is four branches of stacked type of multilateral well consisting of red, green, and three blue lines.

The 3D grid which has 32500 cartesian blocks (N_x=25, N_y=25, N_z=52) constructed with four different zones having thicknesses of 5, 9, 15, 19 meters, and used for all cases as a means of updating the specific properties of each system. Simulation of the cases was conducted using Eclipse 300 compositional reservoir simulation software. Figure 4.2 depicts the 3D grid model of the study.

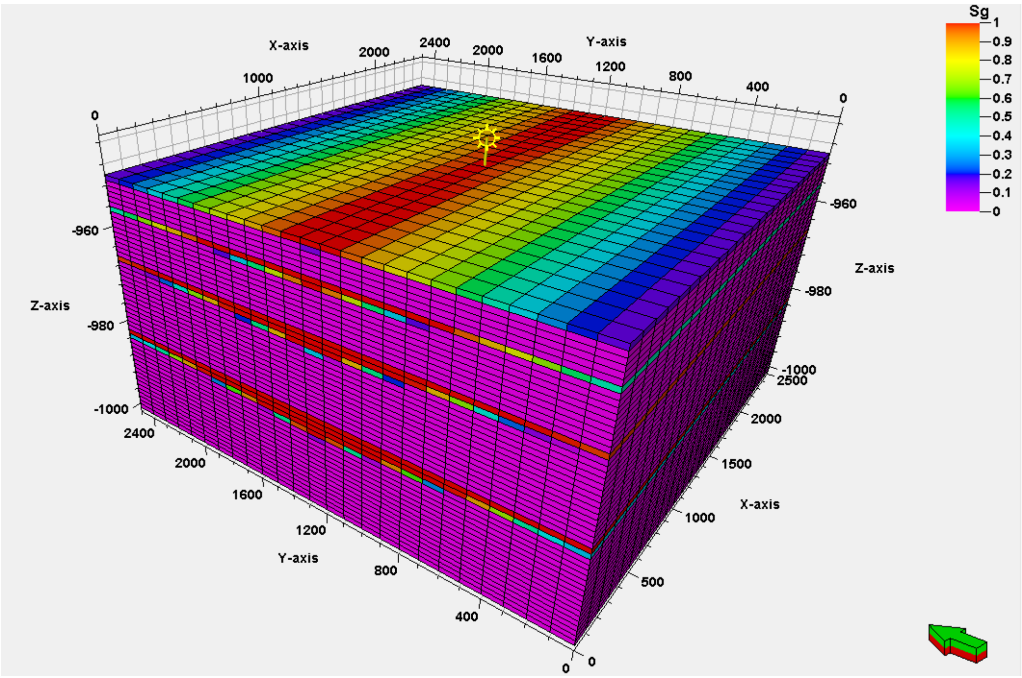

Figure 4.2 The 3D grid of the study

The unconventional gas reservoir systems show some dissimilarity due to their different characteristics. Numeric simulation codes of the cases have to be changed appropriately. In addition to that, a dual porosity system was performed for coalbed and shale gas simulation cases. On the other hand, single porosity system was preferred for the tight gas cases. In the following subsection of this chapter, key parameters for simulating unconventional gas reservoirs were given in detail.

4.1 Characteristics of the Simulation Cases

Different from the conventional gas reservoir simulation, some important points should be considered to model the fluid flow in an unconventional gas reservoir. These differences will be explained in detail as key modeling parameters through the following subsection of the chapter.

4.1.1 Key Modeling Parameter of UGR

Each unconventional reservoir system has special characteristics that should be integrated into the model properly in order to achieve the acceptable and reliable simulation results. Following are some key modeling parameters of studied unconventional gas resources:

CBM

- ✓ Adsorption Isotherm
- ✓ Ash and Moisture Content
- ✓ Orientation of Face/Butt Cleat
- ✓ Cleat Spacing
- ✓ Dual Porosity System
- ✓ Dynamic Permeability

Shale Gas

- ✓ Adsorption Isotherm
- ✓ Hydraulic Fracturing
    - o Fracture Half Length, Height, Width,
    - o Distribution of Hydraulic Fractures
- ✓ Natural Fractures

- Fracture Spacing, Aperture, Length
- Orientation of Natural Fractures

✓ Dual Porosity System

✓ Dynamic Permeability

✓ Geomechanic Consideration

Tight Gas

✓ Permeability

✓ Hydraulic Fracturing

- Fracture Half Length, Height, Width,
- Distribution of Hydraulic Fractures

✓ Single Porosity System

4.2.1 Dual Porosity System

Coalbed methane and shale gas reservoirs are naturally fractured systems and typically modeled as dual porosity system. The key difference between shale gas reservoirs and coalbed methane reservoirs is status of the natural fractures. In shale gas reservoirs, natural fractures are narrow and sealed owing to the pressure of the overburden rock (Gale, et al. 2007) and they must be stimulated to reactivate the natural fracture matrix.

Dual porosity approach was proposed by Warren and Root to separate the flow through the fractures from the flow inside the matrix, (Warren & Root, 1963). The reservoir is represented by two overlapping continua - fracture networks acting as main flow channels and matrix blocks serving as a major storage source. The interaction between the two continua is controlled through a transfer function called shape or coupling factor (σ) that can be evaluated with typical dimensions of the matrix blocks or distances between fractures, (Kazemi, 1976).

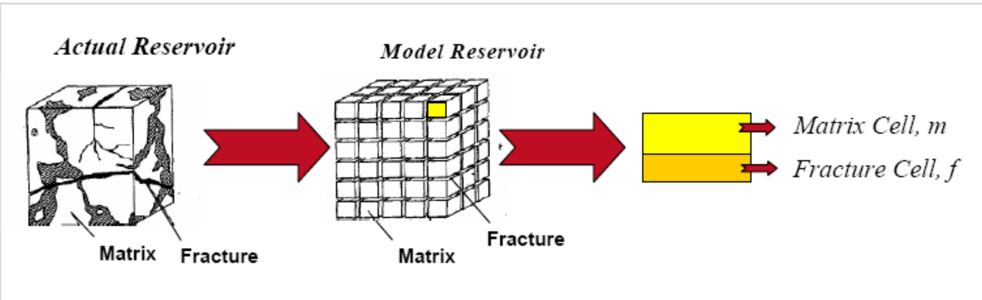

Figure 4.3 Dual Porosity Model (Warren & Root, 1963)

The shape factor may be expressed by analytical derivations, numerical derivations, and time-dependent functions. Several authors proposed shape factor constant but Kazemi and Gilman type of shape factor is mostly utilized in the numerical simulators since it is easy to apply.

The shape factor (σ) accounts for the matrix-fracture interface area per unit bulk volume and Kazemi has proposed the following form for σ:

$$\sigma = 4 \; \frac{1}{L_x^2} + \frac{1}{L_y^2} + \frac{1}{L_z^2} \qquad 4.1$$

Where L_x, L_y, and L_z are typical X, Y and Z dimensions of the blocks of material making up the matrix volume and they refer to fracture spacing in represented directions and also L_x, L_y, and L_z are thus not associated to the simulation grid dimensions.

In the above equation, σ is second order and distance-related parameter which is inversely proportional to the fracture spacing. Consequently, the higher fracture spacing is in the system, the smaller shape factor is calculated.

In a dual porosity reservoir, fluids exist in two interconnected systems:

1. The rock matrix, which usually provides the bulk of the reservoir volume
2. The highly permeable rock fractures.

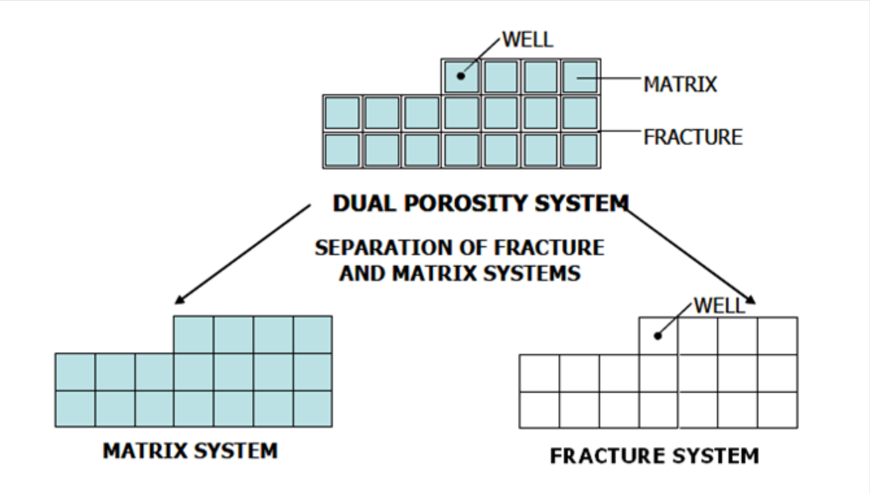

Figure 4.4 Simulation model of a fractured system (Nelson, 2001)

The Dual porosity model consists of two interconnected systems representing the coal matrix and the permeable rock fractures as shown in Figure 4.4. The matrix blocks are linked only through the fracture system regarded as a dual porosity single permeability system, since fluid flow through the reservoir takes place only in the fracture network with the matrix blocks acting as sources and there is no flow between neighboring matrix blocks.

To model such systems, two simulation cells are associated with each block in the geometric grid, representing the matrix and fracture volumes of the cell. In a dual porosity run of Eclipse the number of layers in the Z-direction is doubled and Eclipse automatically assigns the first half of the grid with the matrix blocks, and the second half with the fractures as represented in Figure 4.5. In such case, the number of layers (NDIVIZ) should be even and the dual porosity model be activated with the RUNSPEC keyword DUALPORO.

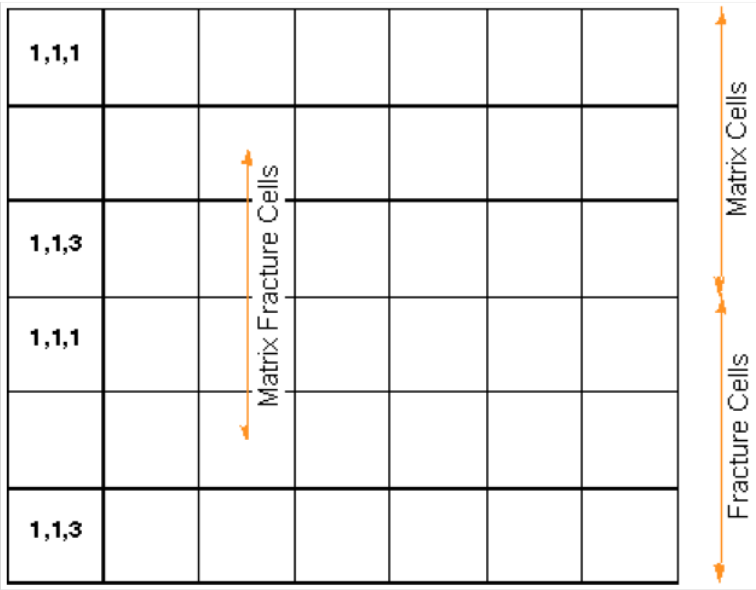

Figure 4.5 View of a simple dual porosity system (Eclipse 2011 Manual)

The following restrictions apply to dual porosity runs in Eclipse:

- ✓ Wells connect only to fracture cells – nor to matrix cells.
- ✓ Non-neighbor connections (NNC) may not be used with matrix cells.
- ✓ Each active matrix cell must connect with an active fracture cell.

4.2.2 Modeling of Adsorption

The simulation of conventional gas reservoirs differ from the unconventional gas reservoirs in many different ways. Adsorbed gas is one of the most important differences. It is defined as gas molecules that are accumulated on the surface of a reservoir rock, (Montgomery et al, 2005). The amount of adsorbed gas is determined in gas volume per unit mass (for example, scf/ton) and is affected by various factors such as nature of the solid sorbent, temperature, pressure etc. In some circumstances, it has a huge impact on the gas production.

The diffusive flow between the matrix and the fracture is given by adsorption or diffusion models. The adsorbed gas concentration on the surface of the rock is assumed to be a function of pressure and only described by a Langmuir Isotherm that is entered into system as a table of pressure versus adsorbed concentration.

At the beginning of the coalbed and the shale gas simulation in Eclipse, the model should be activated by specifying the keyword COAL in the RUNSPEC section and the number of coal regions should be set by means of REGDIMS keyword.

In coalbed methane and shale gas module of Eclipse, the pore volume of the matrix cells has a different interpretation than for an ordinary dual porosity run; it gives the coal volume of the cell, using the time-dependent sorption model. By default the porosity is set to unity minus the porosity of fracture. The cell bulk volume times the porosity then equals the coal volume.

It is possible to choose between two types of adsorption model: instant and time dependent. In our simulation cases, time-dependent sorption model was used.

For the time dependent method, a simulation cell either contains free gas in a pore space or adsorbed gas in the rock. The rock is represented by one simulation cell and the pore volume by a connecting simulation cell. Darcy flow through a rock cell is not permitted. The usual rock volume of a cell now represents the rock volume where the imaginary micro pore space flow is accounted for by a diffusive flow equation. A cell having a non-zero coal region number as set by COALNUM, hence it needs to specify a porosity value that corresponds to a rock fraction value. For cells having a zero coal region number the porosity value correspond to the pore volume fraction as illustrated in Figure 4.6.

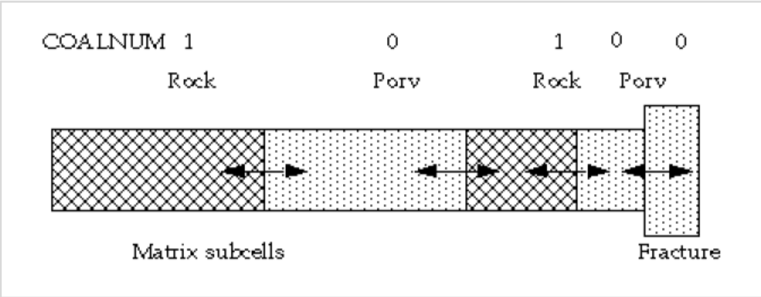

Figure 4.6 Representation of matrix diffusion (Eclipse 2011 Manual)

If pore volume-pore volume connections exists, a permeability value also need to be input in order to compute the transmissibility between the matrix subgrid cells. This is usually done by PERMX.

The diffusive flow between the matrix and the fracture is a function of molar density in the matrix coal/shale, matrix fracture diffusivity, rock density, diffusion coefficient, and gas saturation. In addition, the matrix fracture diffusivity depends on the cell bulk volume and the shape factor that accounts for the matrix-fracture interface area per unit volume. Often sorption time is a quantity that is easier to obtain than the diffusion coefficients. This parameter controls the time lag before the released gas enters the coal fracture system.

4.2.3 Modeling of Multisegment Well

The multisegment well model provides a detailed description of fluid flow in the well bore. Horizontal and multi-lateral wells are specifically designed by means of this utility. A multi-lateral well can be considered as a collection of segments arranged in a gathering tree topology, similar to the node-branch structure of a network in the network option. A single-bore well will, of course, just consist of a series of segments arranged in sequence along the well bore. A multi-lateral well has a series of segments along its main stem, and each lateral branch consists of a series of one or more segments that connects at one end to have sub-branches, (Holmes, 1998).

The segment network for each well may thus have any number of branches and sub-branches, but it must conform to gathering-tree topology. Figure 4.7 demonstrates the schematic view of a multi-segment well in Eclipse.

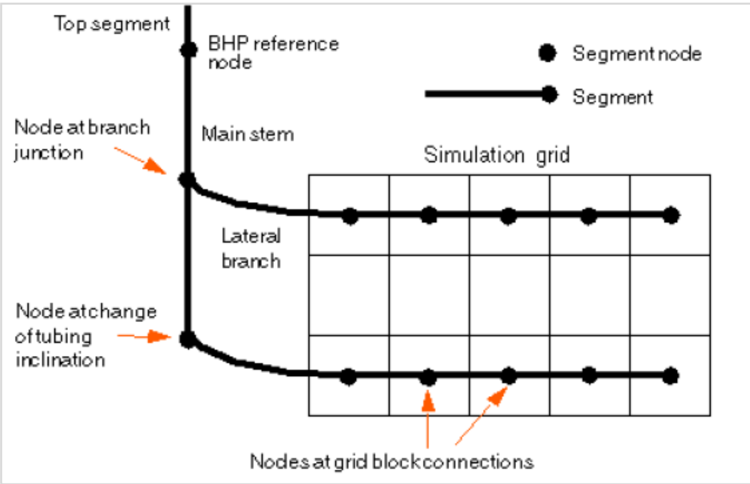

Figure 4.7 Schematic view of a multi-segment well (Eclipse 2011 Manual)

Each segment consists of a node and a flow path to its parent segment's node. A segment's node is positioned at the end that is furthest away from the wellhead. Each node lies at a specified depth, and has a specified length, diameter, roughness, area and volume.

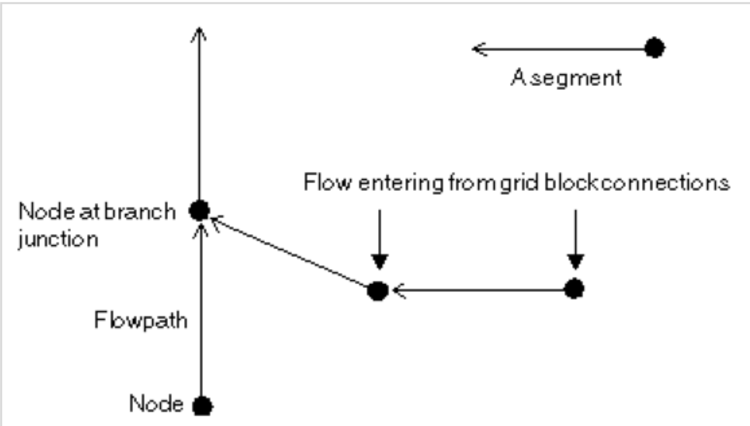

Figure 4.8 Representation flow in a multi-segment well (Eclipse 2011 Manual)

A segment node must be positioned at each branch junction. Flow from the formation through grid block to well connections also enters the well at segment nodes. A segment can accept flow from any number of grid block connections. But it is possible to reduce the number of segments by allocating two or more grid block connections to each segment. Figure 4.8 represents the flow in a multi-segment well.

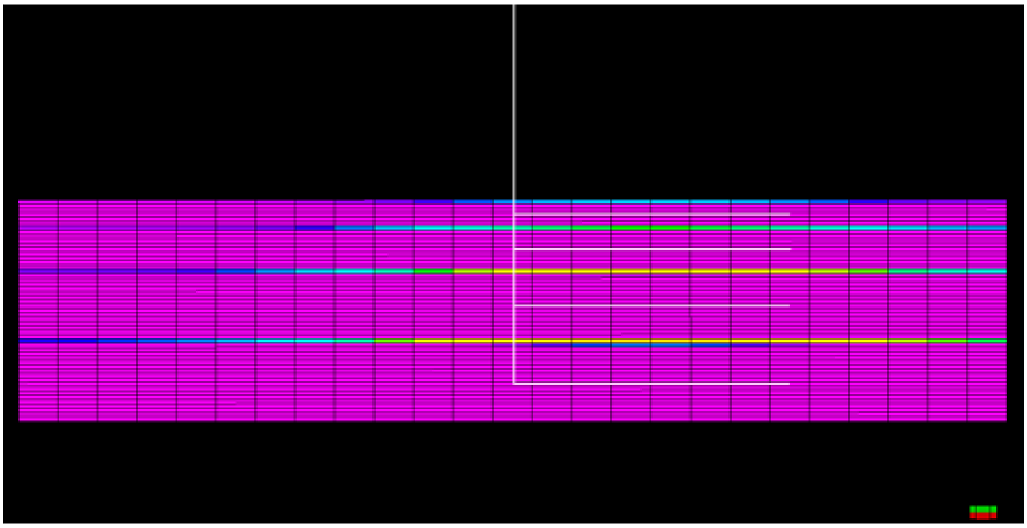

Figure 4.9 Side view of the multilateral well of the study

Figure 4.9 shows the multilateral well configuration of the study. As it is seen, there are four branches for each zone and white lines in the side view of the model represents the lateral segment of the well.

4.2.4 Modeling of Hydraulic Fracturing

For shale and tight gas cases, hydraulic fracturing as stimulation treatment technique was implemented. In this section, it is aimed to give an idea about how to represent the hydraulic fractures and which methods exist to model the hydraulic fractures in a commercial simulator, such as Eclipse 300.

Techniques used to model hydraulic fractures:

- ✓ Using a Local Grid refinement
- ✓ Multiply the permeability
- ✓ Modify the well Productivity Index
- ✓ Use negative skin

From above techniques, the first and second methods were used to be able to model the hydraulic fractures.

It is assumed that the fractures lie in the single plane of local grid cells that best approximates the true geometric orientation of the fracture. The local grid refinement is symmetrically placed within the plane of host cells and the X, Y, and Z transmissibility multipliers for all grid cells intercepted by the fracture are assigned according to the position of the grid cells since the hydraulic fracture conductivity is reduced away from the wellbore and above the perforation landing point. The profile of hydraulic fracture conductivity is represented schematically around the wellbore in the Figure 4.10 and it is given to explain the relation between fracture half-length vs. conductivity.

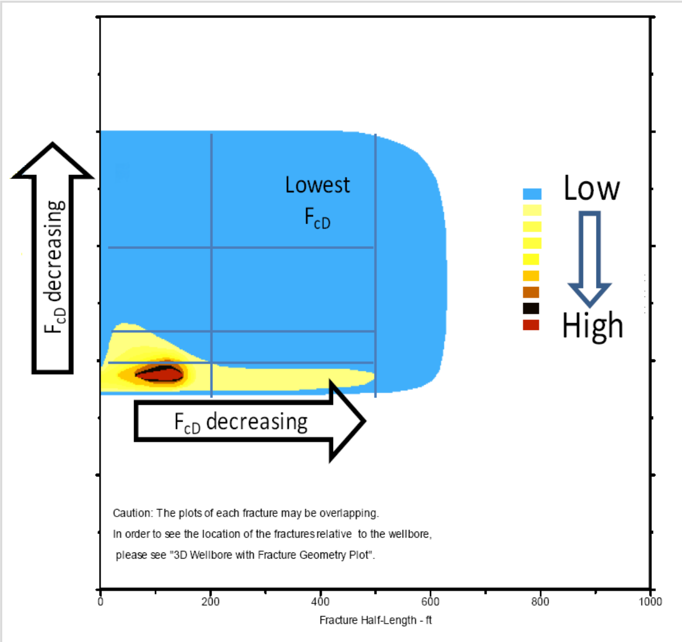

Figure 4.10 Relation between fracture half-length vs. conductivity (Hariharan, 2011)

The local grids were generated distinctly for the vertical and lateral well configurations. For the vertical well of shale gas and tight gas cases, the local grids located in the middle layer of each zone with 5x25 blocks along I and J plane of host cells respectively. For the lateral well of shale gas and tight gas cases, the local grids located in the middle layer of each zone with three stages 25x5 blocks along I and J plane of host cells respectively.

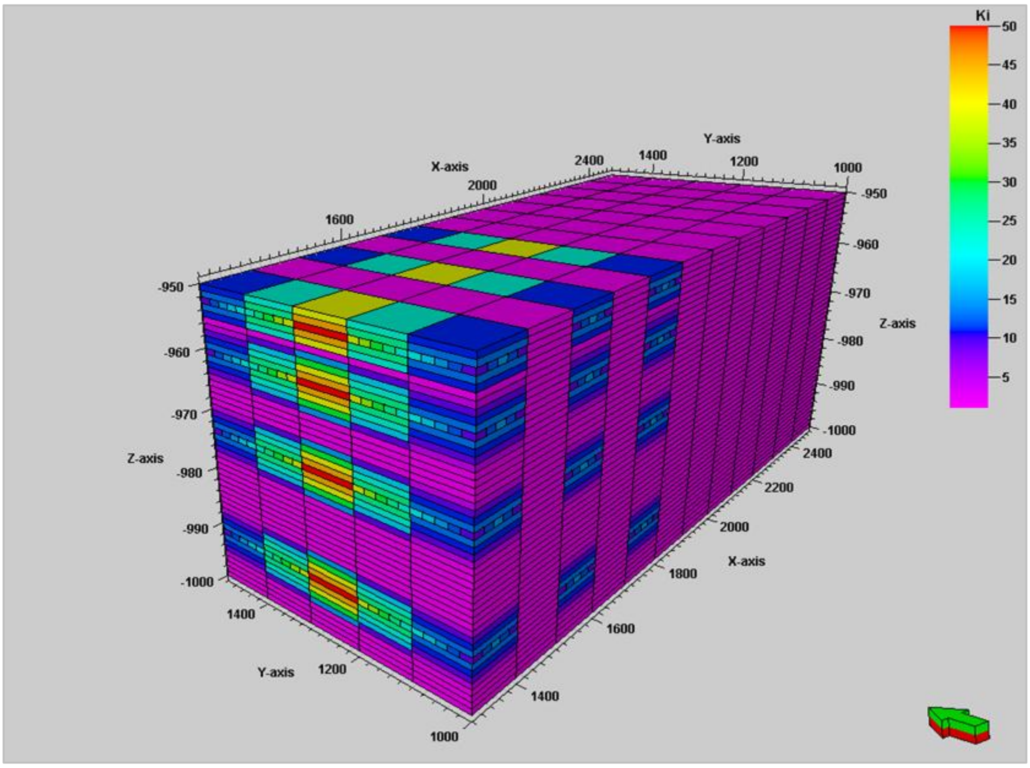

Figure 4.11 Local Grid Refinent of Hydraulic Fractures for Multilateral Well

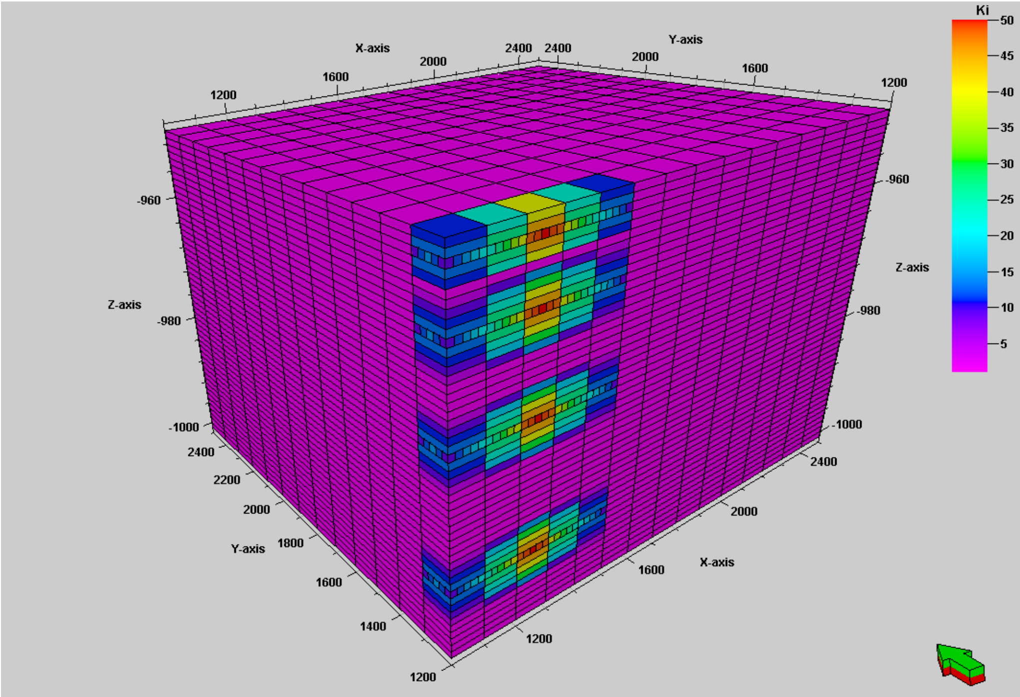

Figure 4.12 Local Grid Refinent of Hydraulic Fractures for Vertical Well

The decreasing conductivity of hydraulic fractures of these two distinct systems in the reservoir was regulated with different permeabilities that have smaller values away from the wellbore in the horizontal and vertical directions. These arrangements are represented in the Figure 4.11 for the multilateral and horizontal well and in the Figure 4.12 for the vertical well. The distribution of that looks like an elliptical shape as it should be.

The conceptual diagram was built to make how the hydraulic fractures are placed in the base grid and to explain the idea of their different stage numbers. The Figure 4.13 indicates the structure of hydraulic fractured cases.

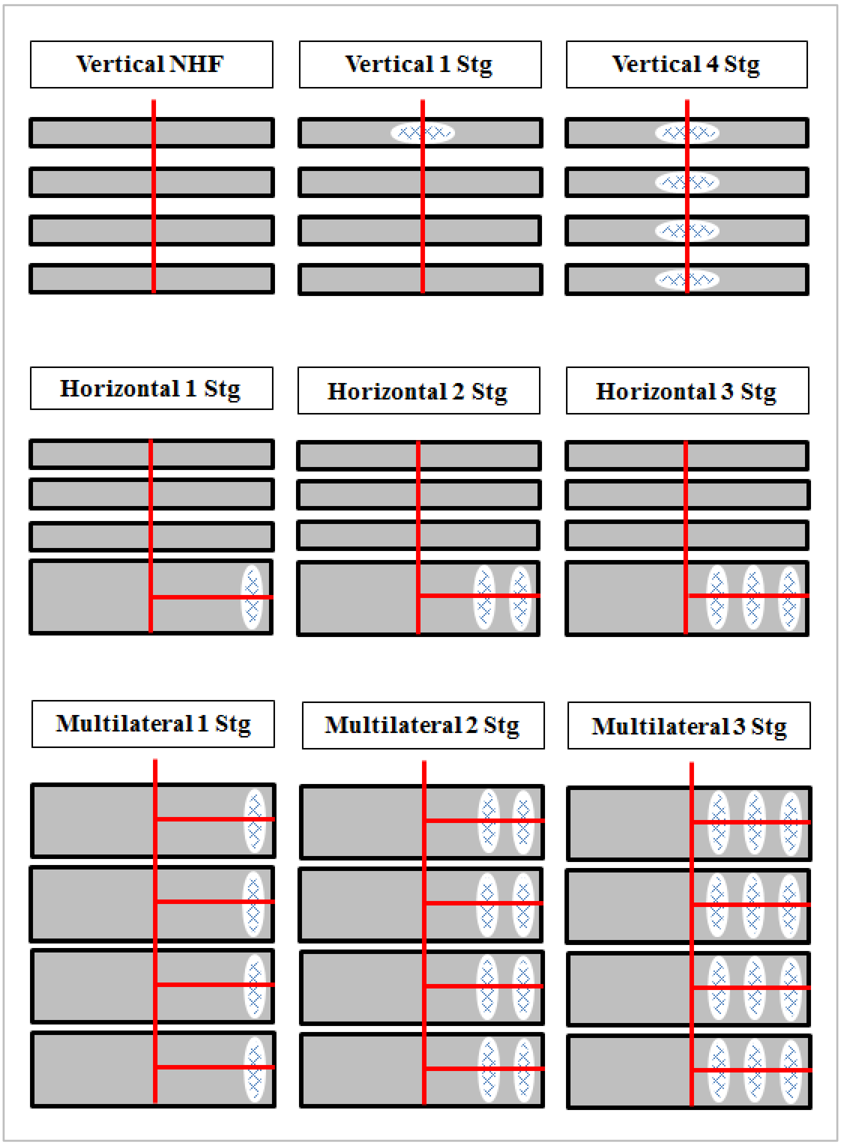

Figure 4.13 Conceptual view of hydraulic fracture stages for the different well types

4.2.5 Compaction Effect

The permeability is critically sensitive to changes in effective stress (pore pressure) during drawdown. For the coalbed methane and shale gas cases, permeability changes as a function of pressure due to matrix shrinkage and compression process of natural fractures. As the pressure reduces during the production, overburden stress increases and permeability decreases, however pressure drop leads to desorption of gas on the surface of coal matrix and that give rises to shrinkage of matrix which enhance the width of cleats. This phenomena has been proposed by Palmer and Mansoori (1996) and illustrated in the Figure 4.14 and 4.15

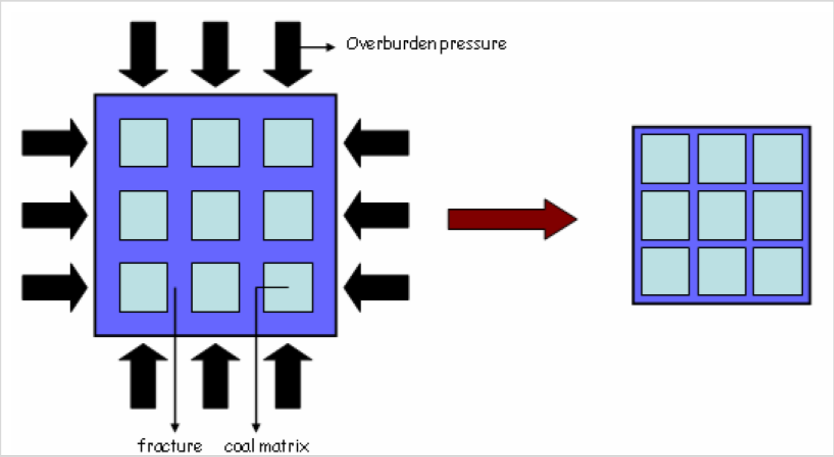

Figure 4.14 Schematic of coal seam before cleats compression and after cleats compression (Palmer, 1996)

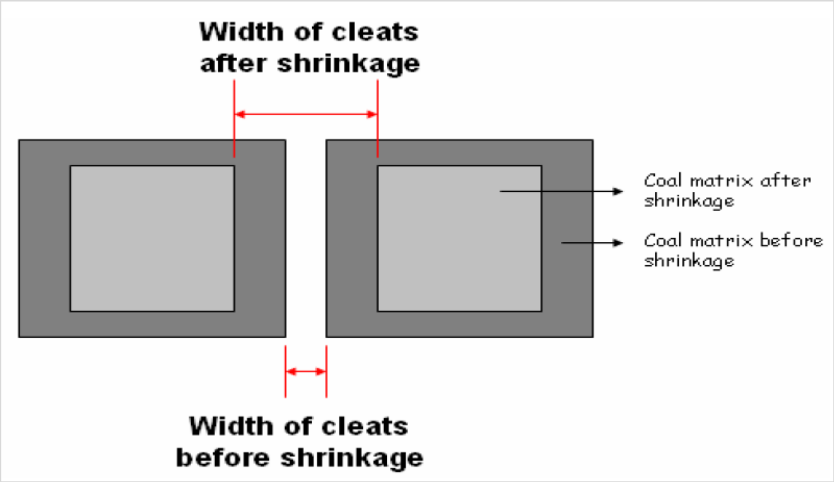

Figure 4.15 Schematic of matrix shrinkage phenomenon (Palmer, 1996)

In Eclipse CBM module, Palmer and Mansoori model includes the rock compaction effect on the production. This model is activated using the ROCKCOMP keyword on the RUNSPEC section. Detailed information about the Palmer–Mansoori rock model is represented in Appendix-A.

4.3 Coalbed Methane Case

In a coalbed methane reservoir, the system is mostly described as a dual porosity system with a low-permeability matrix coupled to a high-permeability fracture network. Matrix part containing the large amount of adsorbed gas has no effective porosity and permeability; and Darcy flow between matrix to fracture is disabled by Eclipse simulator coalbed methane model module therefore that makes the dual porosity system of coalbed methane models different from the conventional dual porosity models. Fractures or coal cleats are the main part of Darcy flow and typically they are filled with water at the early production stage of coalbed methane reservoirs.

In this section, three cases were investigated with the different permeability values since the gas flow mostly depends on the fracture permeability and is a function of this variable. Fracture permeabilities are assigned as the same for x and z directions and one tenth of that for y direction. The reason why the anisotropic system was preferred is that face cleats are generally more conductive than butt cleats and the butt cleats are also discontinuous. Figure 4.16 represents this situation in the coal structure.

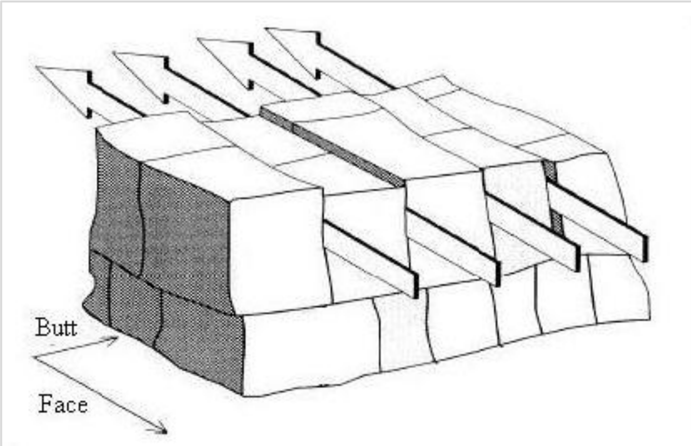

Figure 4.16 Face and Butt Cleats in coal structure (Scott, 1994)

Although there is no flow in matrix and matrix permeability is redundant, the convenient value was defined to run the simulation without problems.

Relative permeability and capillary pressure values were taken from the literature (David et al, 2002), and the other necessary information were obtained using CBM input data file Eclipse 300.

Three different set of permeability values were performed with the vertical, horizontal, and multilateral well configurations.

By making following assumptions regarding the system:

- Temperature remains constant – Isothermal
- Directional change - Anisotropic
- No dissimilarities through the system - Homogenous System

Details of the cases were given in the following tables.

Table 4.1 illustrates the simulation dataset for this section and table 4.2 is given to show the properties of the well trajectories.

Table 4.1 Simulation Dataset for Coalbed Methane Reservoir

	Case-1		Case-2		Case-3	
Parameter	Value					
	Matrix	Fracture	Matrix	Fracture	Matrix	Fracture
Permeability in x direction, md	0.001	0.1	0.001	1	0.001	10
Permeability in y direction, md	0.001	0.01	0.001	0.1	0.001	1
Permeability in z direction, md	0.001	0.1	0.001	1	0.001	10
Porosity	0.3	0.003	0.3	0.003	0.3	0.003
Overall Thickness, m	52		52		52	
Average Reservoir Pressure, bar	93.44		93.44		93.44	
Sw	0.01	0.99	0.01	0.99	0.01	0.99
Average Reservoir Temp., C	92		92		92	
Langmuir Pressure, bar	34.89		34.89		34.89	
Langmuir Volume, sm^3/kg	0.02373		0.02373		0.02373	
Rock Density, kg/m^3	1615		1615		1615	
Rock Compressibility, 1/bars	1.50E-05		1.50E-05		1.50E-05	
Sigma, m^{-2}	1.83		1.83		1.83	

Table 4.2 Data set for well trajectories

	Vertical	Horizontal	Multilateral
Parameter	**Value**		
Measured Depth, m	1001	1695.5	-
True Vertical Depth, m	1001	995.5	-
Branch#1 MD, m	-	-	1652.5
Branch#1 TVD, m	-	-	952.5
Branch#1 Length, m	-	-	700
Branch#2 MD, m	-	-	1660.5
Branch#2 TVD, m	-	-	960.5
Branch#2 Length, m	-	-	700
Branch#3 MD, m	-	-	1673.5
Branch#3 TVD, m	-	-	973.5
Branch#3 Length, m	-	-	700
Branch#4 MD, m	-	-	1691.5
Branch#4 TVD, m	-	-	991.5
Branch#4 Length, m	-	-	700

4.4 Shale Gas Case

Characteristics of the shale gas reservoirs are: nanodarcy matrix permeability, narrow and calcite-sealed natural fractures, complex fracture network, and adsorbed gas on the surface of organic matter. Modeling and simulation of such reservoirs are challenging and all those variables should be integrated into model to represent the system properly. Almost all shale gas reservoirs need special stimulation treatments such as multiple hydraulic fracturing with directional drilling to produce gas at an economical rate and this requirement makes the shale gas modeling and simulation more complicated.

In Eclipse, most of the time, the dual or multi porosity system can be utilized to perform a numeric simulation and “Coal Bed Methane Model” is a starting point because of the similarities with the shale gas reservoirs.

The most significant factor affecting the flow and production capacity of the shale gas reservoirs is both multilateral wells and more importantly hydraulic fractures. In this part of the study, four different subcases were classified according to hydraulic fracture set numbers. No hydraulic fracture and one stage hydraulic fracture cases were analyzed with three different well trajectories: vertical, horizontal, and multilateral, two and three stages hydraulic fracture cases were studied with horizontal and multilateral well paths, only four stages hydraulic fracture case was available for vertical well, in turn totally eleven different cases were generated in order to observe the performance of number of hydraulic fracture sets and effect of well configuration on the stimulation process.

The 3D base grid was used and modified by editing the shale gas reservoir characteristics. Some rock and fluid properties are obtained from the factory default SHALEGAS1.DATA Eclipse 300 input data file. Hydraulic fractures lie on layers including the wellbore were modeled using LGR and rest of them integrated into the model by well multiplier technique owing to the allocating memory error.

Conductivity values of hydraulic fractures were distributed logarithmically in local grids and other blocks with hydraulic fractures. Height and half-length of hydraulic fractures were used similar for all zones except the first zone due to its thickness limitation.

Following assumptions were made for the shale gas system:

- Temperature remains constant – Isothermal
- No directional change - Isotropic
- No dissimilarities through the system - Homogenous System

Details of the used parameters in this section are given in Table 4.3 - 4.5.

Table 4.3 Simulation Dataset for Shale Gas Reservoir

Parameter	**Value**	
	Matrix	Fracture
Permeability in x direction, md	0.0004	0.0004
Permeability in y direction, md	0.0004	0.0004
Permeability in z direction, md	0.0004	0.0004
Porosity	0.04	0.002
Overall Thickness, m	52	
Average Reservoir Pressure, bar	93.44	
Sw	0.1	-
Average Reservoir Temp., C	92	
Langmuir Pressure, bar	46.89	
Langmuir Volume, sm^3/kg	0.0118	
HF Half Length, m	250	
HF Heigth, m	9	
Rock Density, kg/m^3	1434	
Rock Compressibility, 1/bars	7.25E-05	
Sigma, m^{-2}	0.8	

Table 4.4 Well configurations with hydraulic fractures for Shale Gas Reservoir

Well Type	**No HF**	**1 Stg HF**	**2 Stg HF**	**3 Stg HF**	**4 Stg HF**
Vertical	+	+	-	-	+
Horizontal	+	+	+	+	-
Multilateral	+	+	+	+	-

Table 4.4 represents the number of hydraulic fracture stages according to the well type.

Table 4.5 Data set for well trajectories

	Vertical	Horizontal	Multilateral
Parameter	**Value**		
Measured Depth, m	1001	1691.5	-
True Vertical Depth, m	1001	991.5	-
Branch#1 MD, m	-	-	1652.5
Branch#1 TVD, m	-	-	952.5
Branch#1 Length, m	-	-	700
Branch#2 MD, m	-	-	1660.5
Branch#2 TVD, m	-	-	960.5
Branch#2 Length, m	-	-	700
Branch#3 MD, m	-	-	1673.5
Branch#3 TVD, m	-	-	973.5
Branch#3 Length, m	-	-	700
Branch#4 MD, m	-	-	1691.5
Branch#4 TVD, m	-	-	991.5
Branch#4 Length, m	-	-	700

4.5 Tight Gas Case

Typical characteristic of the tight gas reservoirs is low permeability and therefore application of stimulation is necessary for the almost all tight gas reservoirs to improve the permeability and have desirable production rates.

For tight gas case, it was accepted the similar methodology utilized for the previous shale gas section with some important changes. One of them is single porosity model since there is no requirement to make use of additional porosity identification. Properties related to tight gas reservoir were obtained from literature and Eclipse tight gas sample code, and assigned to the base 3D grid making some changes accordingly.

Totally, eleven subcases were studied as the shale gas section. No hydraulic fractures and one stage hydraulic fractures cases were performed for all three different well trajectories, two and three stages hydraulic fractures cases were analyzed for horizontal and multilateral wells, and finally four stages hydraulic fractures case was examined only for the vertical well.

Hydraulic fractures were represented through logarithmic local grid refinement and permeability multiplier methods. Local grids were defined on the layers cutting the wellbores in a logarithmic order and rest of the layers included hydraulic fractures were handled with permeability multiplier in the same manner. By this way, conductivity of hydraulic fractures was determined logarithmically.

Height and half-length of hydraulic fractures were used similar for all zones except the first zone due to its thickness limitation.

Assumptions regarding tight gas the system:

- Temperature remains constant – Isothermal
- Directional change - Anisotropic
- No dissimilarities through the system - Homogenous System

Details of the used parameters for the tight gas case are given in Table 4.6 – 4.8.

Table 4.6 Simulation Dataset for Tight Gas Reservoir

Parameter	Value
Permeability in x direction, md	0.1
Permeability in y direction, md	0.1
Permeability in z direction, md	0.01
Porosity	0.02
Overall Thickness, m	52
Average Reservoir Pressure, bar	93.44
Sw	0.1
Average Reservoir Temp., C	92
HF Half Length, m	250
HF Heigth, m	9
Rock Compressibility, 1/bars	1.00E-05

Table 4.7 Well configurations with hydraulic fractures for Tight Gas Reservoir

Well Type	No HF	1 Stg HF	2 Stg HF	3 Stg HF	4 Stg HF
Vertical	+	+	-	-	+
Horizontal	+	+	+	+	-
Multilateral	+	+	+	+	-

Table 4.7 represents the number of hydraulic fracture stages according to the well type.

Table 4.8 Dataset for well trajectories

	Vertical	Horizontal	Multilateral
Parameter	**Value**		
Measured Depth, m	1001	1691.5	-
True Vertical Depth, m	1001	991.5	-
Branch#1 MD, m	-	-	1652.5
Branch#1 TVD, m	-	-	952.5
Branch#1 Length, m	-	-	700
Branch#2 MD, m	-	-	1660.5
Branch#2 TVD, m	-	-	960.5
Branch#2 Length, m	-	-	700
Branch#3 MD, m	-	-	1673.5
Branch#3 TVD, m	-	-	973.5
Branch#3 Length, m	-	-	700
Branch#4 MD, m	-	-	1691.5
Branch#4 TVD, m	-	-	991.5
Branch#4 Length, m	-	-	700

CHAPTER 5

RESULTS & DISCUSSION

In this part of the thesis, the results of total thirty one cases of simulation runs for three different reservoir systems such as coalbed methane shale gas, and tight gas are analyzed and discussed. Firstly, each reservoir system will be evaluated separately and then three systems will be compared in order to give general overview about representing the twenty years of production characteristics.

5.1 CBM Cases

For CBM, results of three different permeability cases with vertical, horizontal, and multilateral wells will be explained in terms of gas production rate, distribution of gas saturation, cumulative gas production, recovery factors.

As it is seen in Figure 5.1, 5.2, and 5.3, gas production rate trend shows the typical coalbed methane gas reservoir characteristic. At the early time of production, gas rate increases sharply and all gas coming out from the reservoir is free gas in the cleats, next the rate reaches its peak value then it starts decreasing drastically till the water production rate reaches constant value. Stabilization of gas rate is observed in the middle of production profile and the decline of production is almost constant depending on the adsorption capacity of the system.

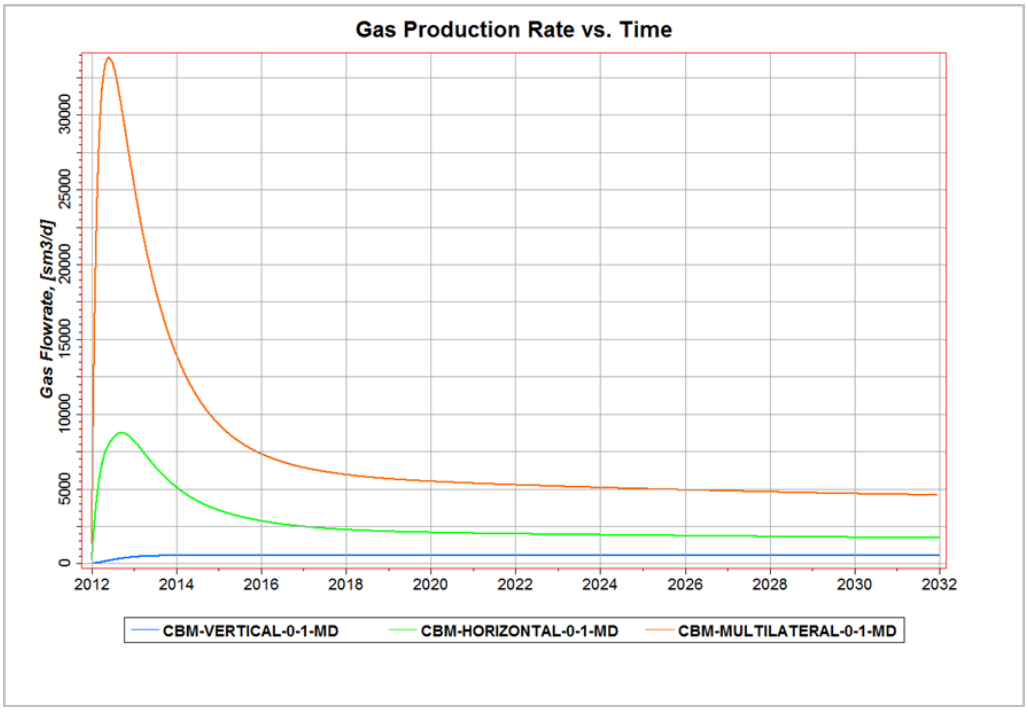

Figure 5.1 CBM 0.1 md Case Production Rates

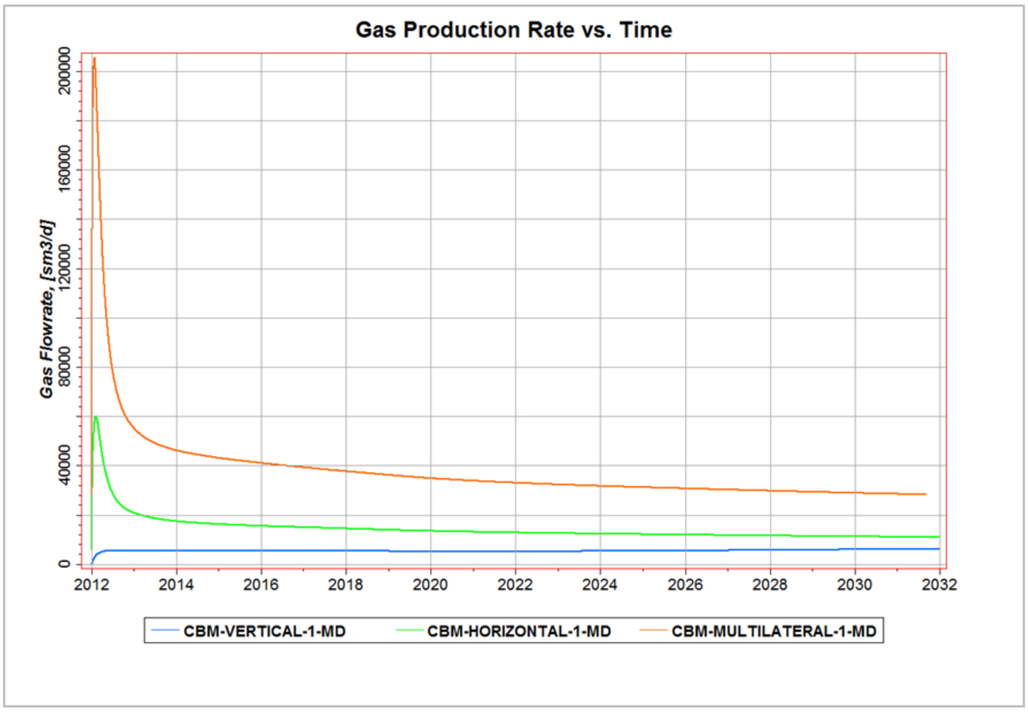

Figure 5.2 CBM 1 md Case Production Rates

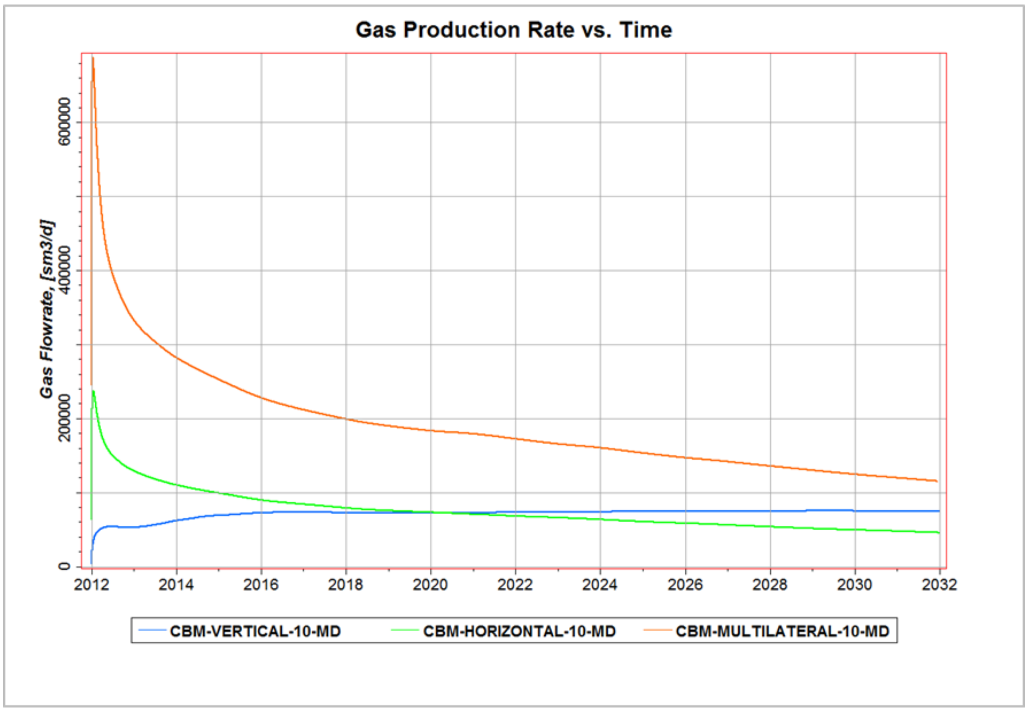

Figure 5.3 CBM 10 md Case Production Rates

In each case, multilateral well provides the most gas production rates as expected. For 0.1 and 1.0 md cases, horizontal well gives better results than vertical one but the production profile of 10 md permeability case makes the conclusion interesting. The gas rate obtained from vertical well catches that of horizontal well approximately in seven years and it produces at higher gas rates in the remaining time of production period. From this point of view, if the coal bed methane reservoir has high permeability like in our case 10 md, vertical well may be drilled instead of horizontal one by considering the reserve amount and economic aspects. In other words, increasing permeability of such systems improves the production performance of vertical wells.

Another observation based on permeability differences is related to behavior of gas production rates at the early time. The production of free gas takes much more time for 0.1 md cases in comparison with 1.0 and 10 md cases and therefore the opening of time curve in that interval is very tight for 1.0 and 10 md cases in a consistent manner.

Decline of production rates show almost similar trend for the multilateral well and the horizontal well but the vertical well has different decline profile due to its limited water production rates.

The 3D view of a half of the base grid in x-axis will be displayed for nine different subcases since the gas saturation is distributed symmetrically in y-axis. The results will be come up for discussion with respect to well type, effect of permeability, and zone thickness. All related figures representing the distribution of gas saturations in the cleats are given in the Appendix-B

Unsurprisingly, the multilateral well supplies more gas for all cases by allowing the high recoveries and more areal extension of produced gas to obtain. For CBM cases, horizontal well is designed with special interest to observe the effect of gravitational segregation between water and gas. Thus, it is realized that placement of the well bore into the zone plays an important role to optimize the gas production rates and water production along the layers connected to the well bore in horizontal direction.

Expectedly, the vertical well gives worse gas distribution than the horizontal well through all simulation runs but if there are multi layers of coal seams available, vertical well can be completed in more than one layer.

The changes of the permeability have high impact on the spread area of gas significantly in y-axis. On the other hand, the amount of gas saturation is influenced highly by permeability in vertical direction. That is, areal extension of gas distribution is affected by not only well trajectories but also permeability values. Consequently, total effect should be considered by permeability and well type since both factors can affect the increase or decrease of the production rates.

In order to analyze the effect of the well bore position in the zone, three different well bore locations such as upper, middle, and lower were simulated for the horizontal well 10 md cases. According to the simulation results, gas distribution in the cleats changes with respect to position of the well bore due to the gravitational effect in between water and gas. If the coal bed methane gas reservoirs with initially water filled in the cleats are aimed to produce, the location of the well bore in the any zone that plays an important role to optimize the water and gas production can be taken into account and determined carefully. This effect is visualized as 3D view figures in Appendix-B

Most of the coal bed methane reservoirs are initially water filled and the aim is to dewater the system during the first phase of production and reduce the pressure to get the adsorbed gas from the coal matrix. Water production amount for twenty years of production is tabulated in the Table… As it is seen, the well type and fracture permeability affect the water production drastically. The huge amount of water can be produced by multilateral well and horizontal well for each case but vertical well does not produce adequate water for this period of production time. Furthermore, increasing cleat permeability brings the much more water production for each well trajectory.

Table 5.1 Cumulative water production of CBM cases

			Cumulative Water Productions, sm^3			
			5-year	**10-year**	**15-year**	**20-year**
CBM	**Vertical**	**0.1 md**	4.36E+03	8.60E+03	1.29E+04	1.72E+04
		1 md	4.31E+04	8.47E+04	1.25E+05	1.62E+05
		10 md	3.61E+05	6.31E+05	8.56E+05	1.04E+06
	Horizontal	**0.1 md**	1.54E+04	2.36E+04	3.06E+04	3.69E+04
		1 md	6.98E+04	1.14E+05	1.51E+05	1.82E+05
		10 md	3.31E+05	4.99E+05	6.09E+05	6.83E+05
	Multilateral	**0.1 md**	3.82E+04	5.86E+04	7.66E+04	9.28E+04
		1 md	1.77E+05	2.89E+05	3.83E+05	4.60E+05
		10 md	8.37E+05	1.26E+06	1.54E+06	1.72E+06

All cumulative production values are drawn as bar chart in the Figure 5.4. At the end of twenty years production, ordinarily, the multilateral well gives the most cumulative gas production for three different permeability cases of multilayered coalbed methane gas system; the horizontal well shows the same trend with less cumulative gas production of the multilateral well. As it is explained in gas production rate, vertical well acts in the similar manner for 0.1 and 1.0 md cases but it exactly behaves improperly for 10 md case and produces gas as much as horizontal well. In such a system having high permeability (greater than 1.0 md), vertical well is able to provide equivalent amount of gas with horizontal well providing there are multi layers of coal seams.

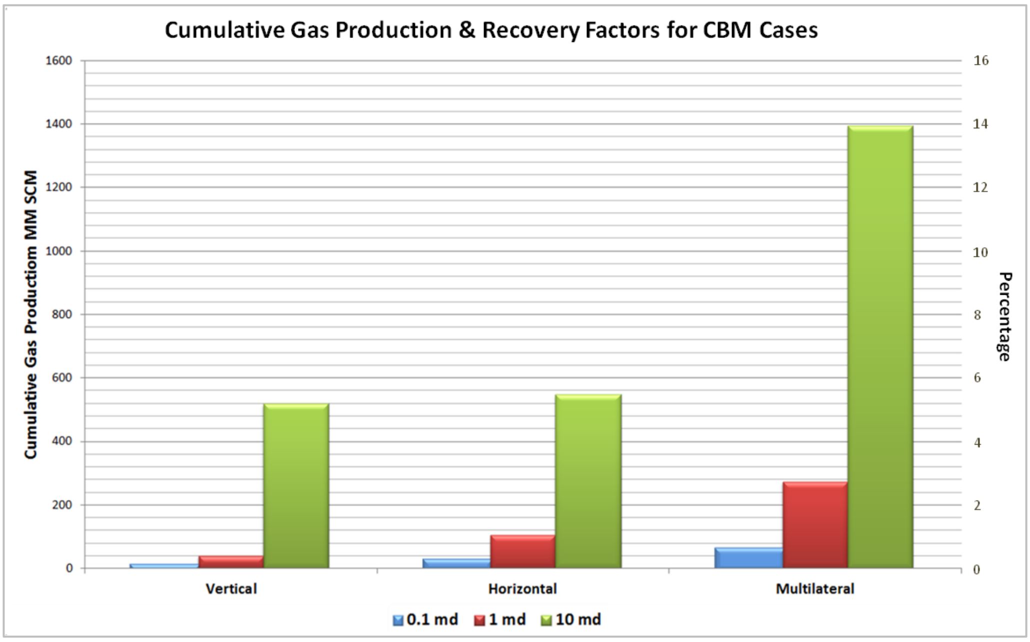

Figure 5.4 CBM Cumulative Gas Production & Recovery Factors for 20 years

The recovery factors of the cases are plotted in the Figure 5.4. It ranges from 0.1 to 12.5 percent. It is useful to remind that, calculated recovery factors does not represent the total field recovery that is, they just give an idea regarding well productivity and exhibit the consistent behavior with amount of cumulative gas productions. The recovery factor of the field depends on the number of production well, if the well number increases; the recovery factor will be affected proportionally. In one well scenario, the multilateral well has the highest value for all three cases. The similar inferences can be made for horizontal and vertical well cases as such in the cumulative gas production part.

5.2 Shale Gas Cases

As it is stated in the previous chapters, shale gas reservoir requires advanced well bore technology applications and special stimulation treatments. Results of the generated eleven subcases of shale gas system indicate that if no hydraulic fracture stimulation is carried out, it is almost impossible to get production from such a system at economical rates. Especially, the vertical well should not be taken into account for production purposes but it may be preferred to define some characteristics of the field by obtaining sample data from the reservoir. Although the horizontal and multilateral well provide better gas production rates than vertical one, they do not supply adequate gas production economically as well.

The gas rates are plotted for no hydraulic fracture case of shale gas in the figure 5.5. Prior to go into detail and discuss the cases, it must be pointed out the logic behind the created cases. The vertical well with one stage hydraulic fracture set will be compared to the horizontal well with three stages hydraulic fracture set since both cases are completed in the same zone and that aims to observe the performance differences of shale gas system having the same zone thickness in terms of well type. In order to consider the effect of zone thickness, the vertical well with four stages hydraulic fracture set will be evaluated comparing with the multilateral well with three stages hydraulic fracture set in a similar way.

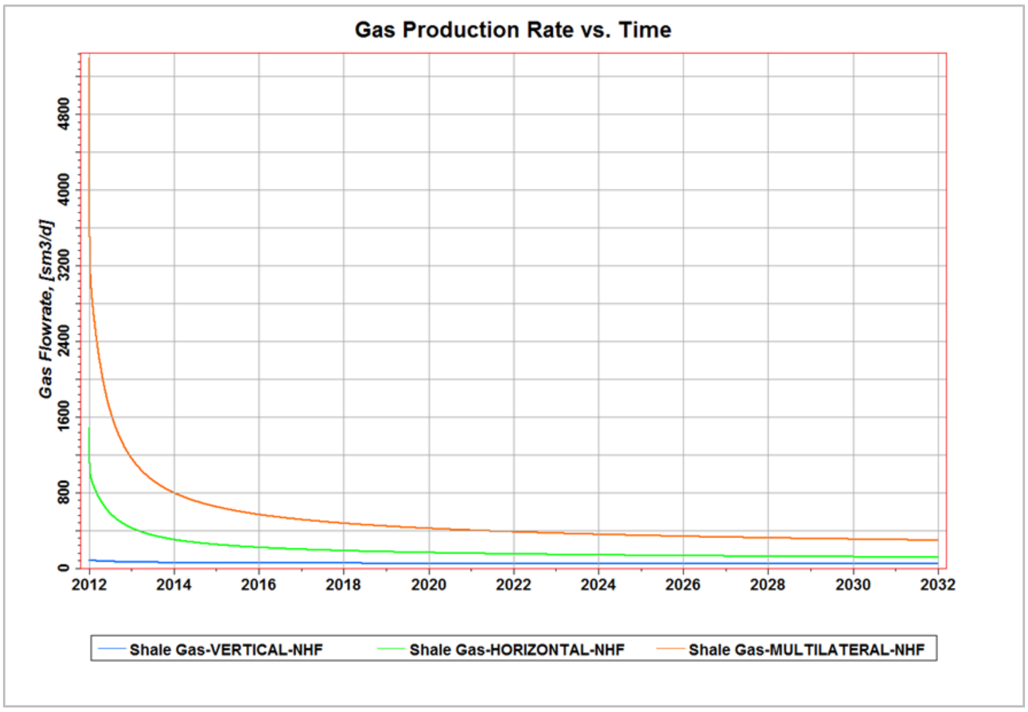

Figure 5.5 Shale Gas - No Hydraulic Fracture Case Production Rates

One stage and two stages hydraulic fracture set for horizontal and multilateral well pretend to show same trend however the big difference occurs at the early time of production period due to free gas in the hydraulic fractures and then they follow almost same decline path. Figure 5.6 and 5.7 illustrate that increasing number of hydraulic fracture stages does not bring the high rates after four years production. It means that higher rates cannot be achieved directly more stages hydraulic fracture set for a long period of production time. To keep the rates at high level, re-fracturing operations and drilling new well or branches are necessary. The inserts in Figure 5.6 and 5.7 show the last ten years of production period in order to make actual rates visible and get rid of the hidden behavior of these two cases.

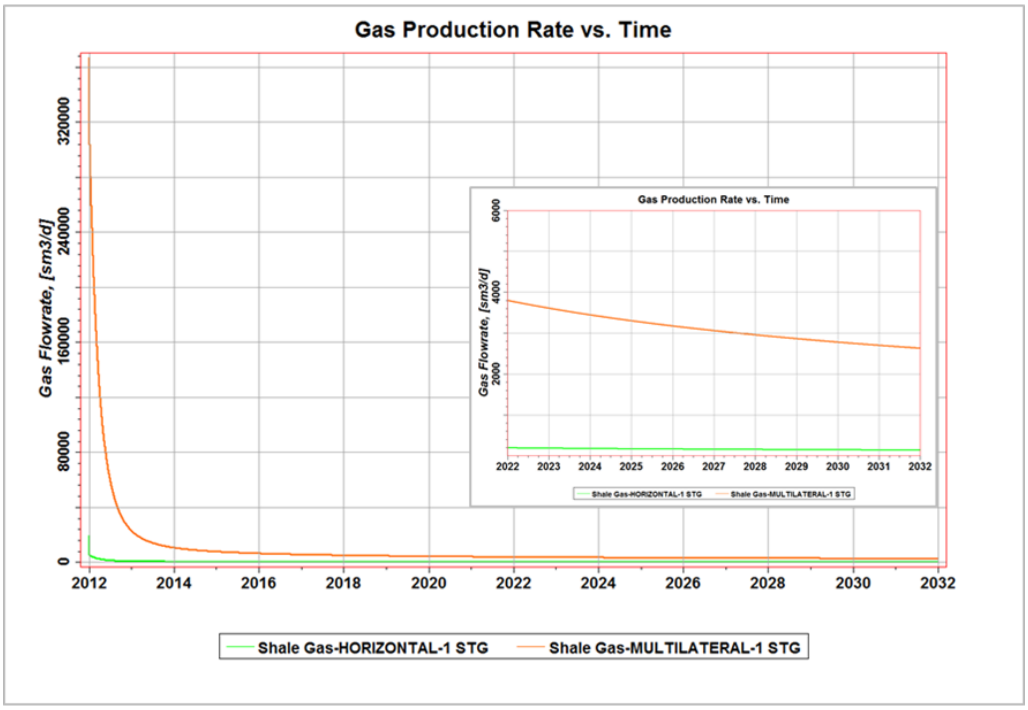

Figure 5.6 Shale Gas-1 Stage Case Production Rates for Horizontal & Multilateral Well

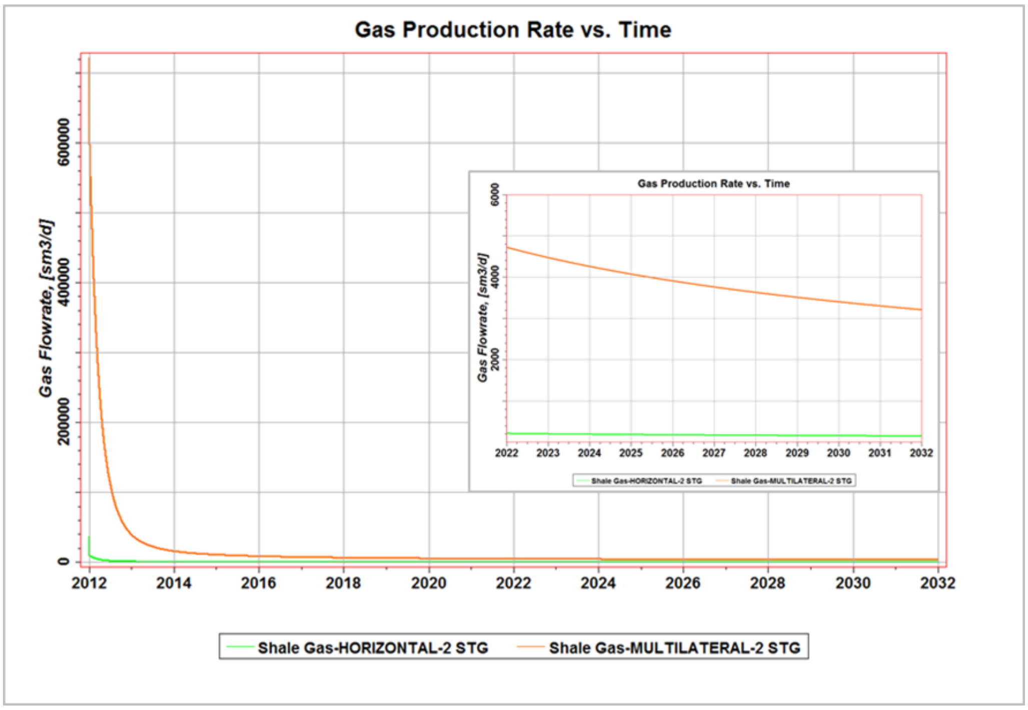

Figure 5.7 Shale Gas-2 Stages Case Production Rates for Horizontal&Multilateral Well

The Figure 5.8 demonstrates the relation between the vertical well with one stage hydraulic fracture set and the horizontal well with three stages hydraulic fracture set. The gas production rates of horizontal well are higher than that of vertical one through the twenty years of production, thus drilling of a horizontal well is more feasible than vertical one for the shale gas system having the same zone thickness.

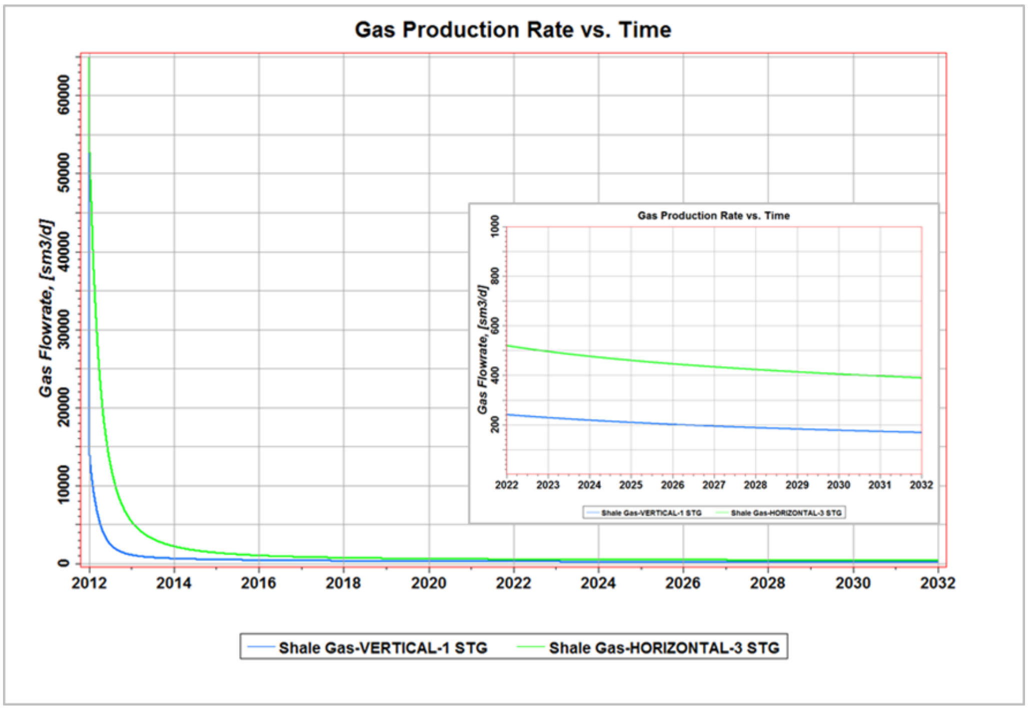

Figure 5.8 Shale Gas Vertical-1 Stage&Horizontal-3 Stages Cases Production Rates

The Figure 5.9 depicts the case created to determine whether the vertical or the multilateral well have a favorable outcome for cumulative production of multilayered fractured zones, and hereby it is confirmed that the multilateral well enables to produce much more gas in comparison to the vertical well.

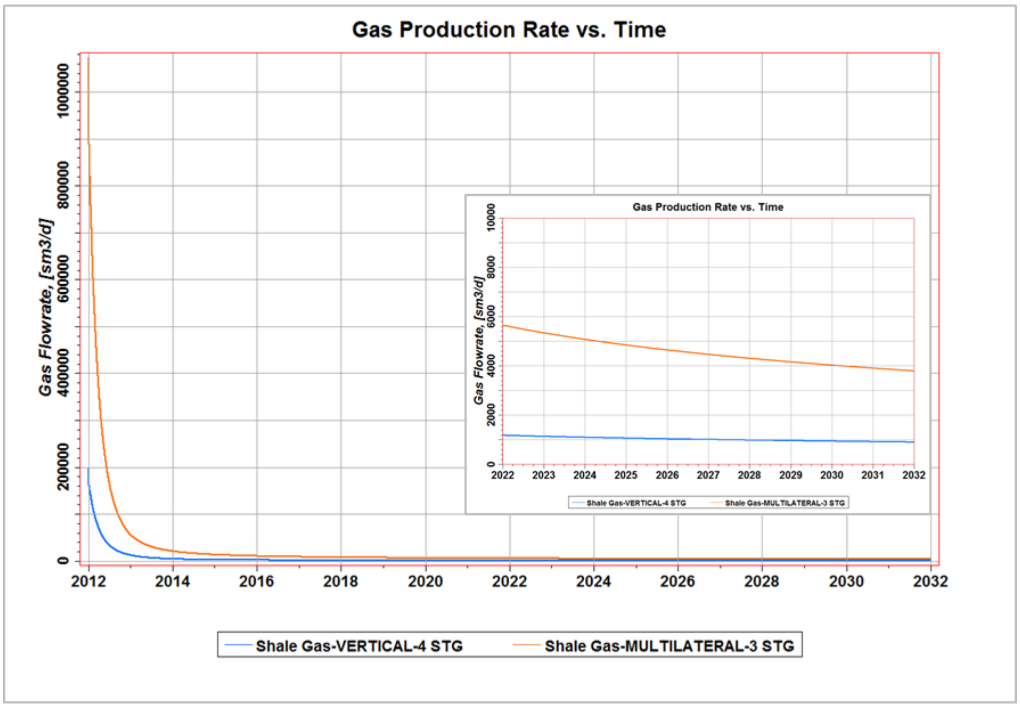

Figure 5.9 Shale Gas Vertical-4 Stages & Multilateral-3 Stage Cases Production Rates

As a general trend, decline of shale gas is very low apart from early years and it varies between 2 and 3 percent per year. Initially, free gas stored in the high permeability fracture network is produced and gas rates decrease sharply because of the limited storage capacity of the fractures. Next, the depletion of free gas in the matrix follows this process. Finally, desorption begins to dominate production. All those phases can be observed from the production gas rates graphs explicitly.

The cumulative gas production of shale gas cases is represented in Figure 5.10. As it is understood from the bar chart graphs, the cumulative gas amount strongly depends on both well type and the number of hydraulic fracture stages. The ideal application for shale gas reservoir is multilateral well with multistage hydraulic fracture cases.

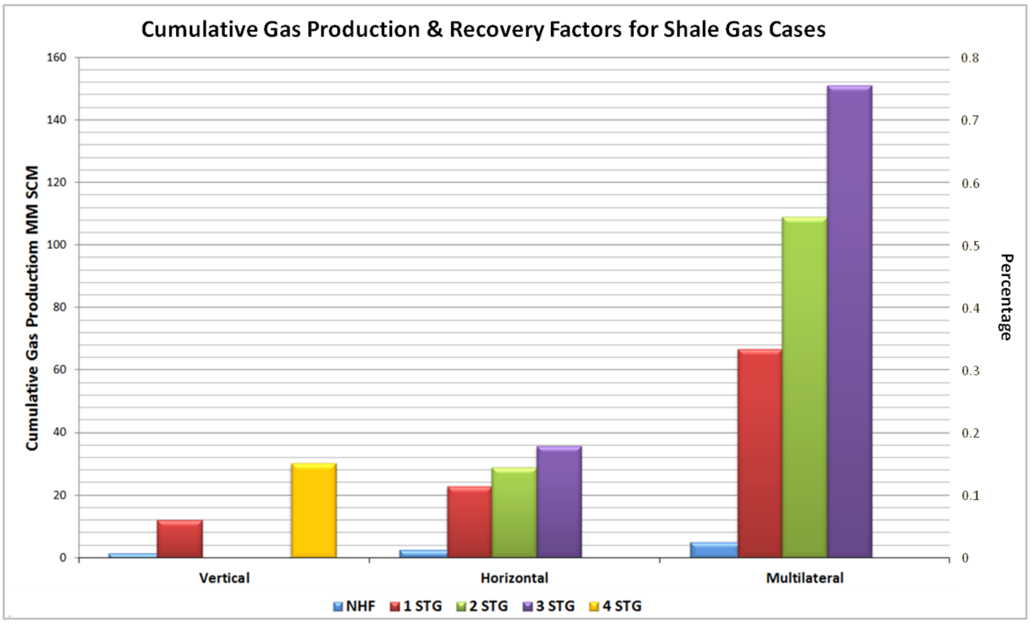

Figure 5.10 Shale Gas Cumulative Gas Production & Recovery Factors for 20 years

By looking at the Figure 5.10, it can be seen that the recovery factors of the shale gas cases stay under one percent and that shows the difficulty of producing gas from this sort of reservoirs. If it is intended to increase the cumulative production and obtain higher gas rates, drilling new directional wells and regular re-fracturing jobs would be essential for shale gas system.

5.3 Tight Gas Cases

The total eleven subcases performed in parallel with shale gas provide valuable results concerning the effect of well configurations and the number of hydraulic fracture stages on the gas production rates and cumulative gas amount.

For no hydraulic fracture case, the multilateral well produces a considerable amount of gas, and performance of the vertical and horizontal well is called as reasonable. The effect of hydraulic fractures is limited for multilateral well. Accordingly, the increasing number of hydraulic fracture stages does not bring along the higher gas rates for the horizontal well specifically after one stage hydraulic fracture application. On the contrary, production of the vertical well remarkably depends on the number of hydraulic fracture stages and it is affected in a positive way.

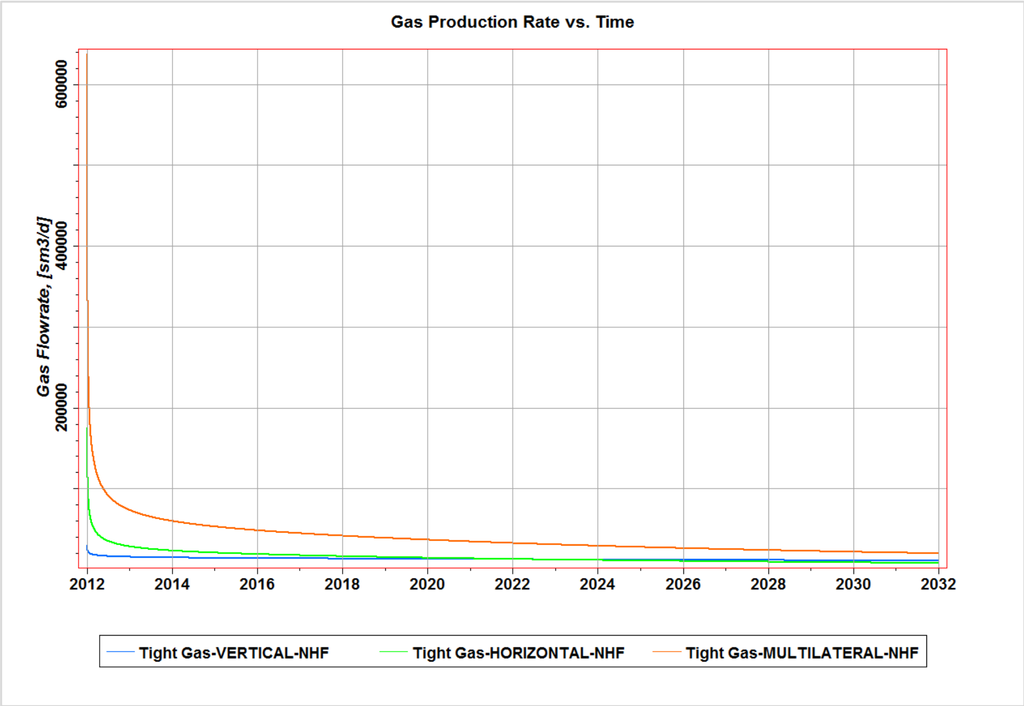

Figure 5.11 Tight Gas No Hydraulic Fracture Case Production Rates

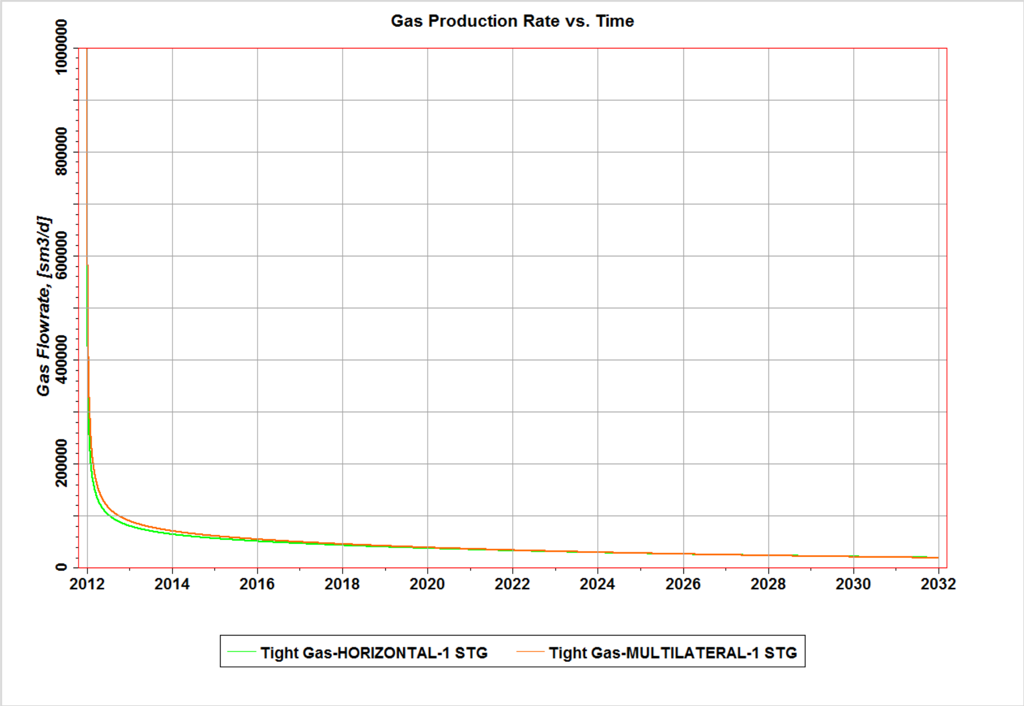

Figure 5.12 Tight Gas-1 Stage Case Production Rates for Horizontal & Multilateral Well

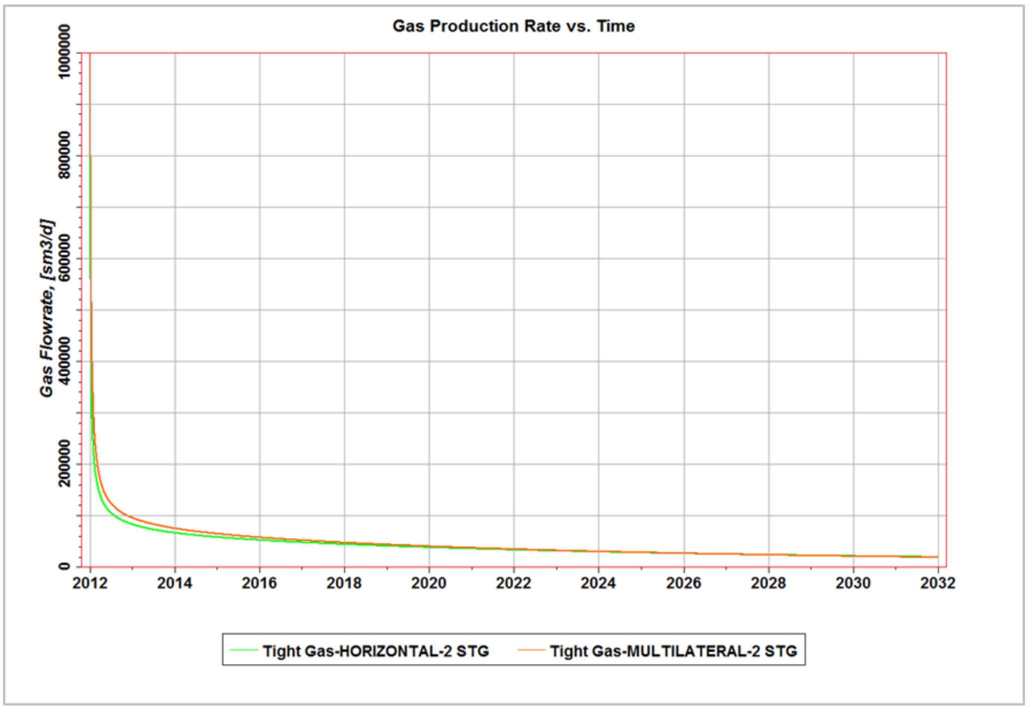

Figure 5.13 Tight Gas-2 Stages Case Production Rates for Horizontal & Multilateral Well

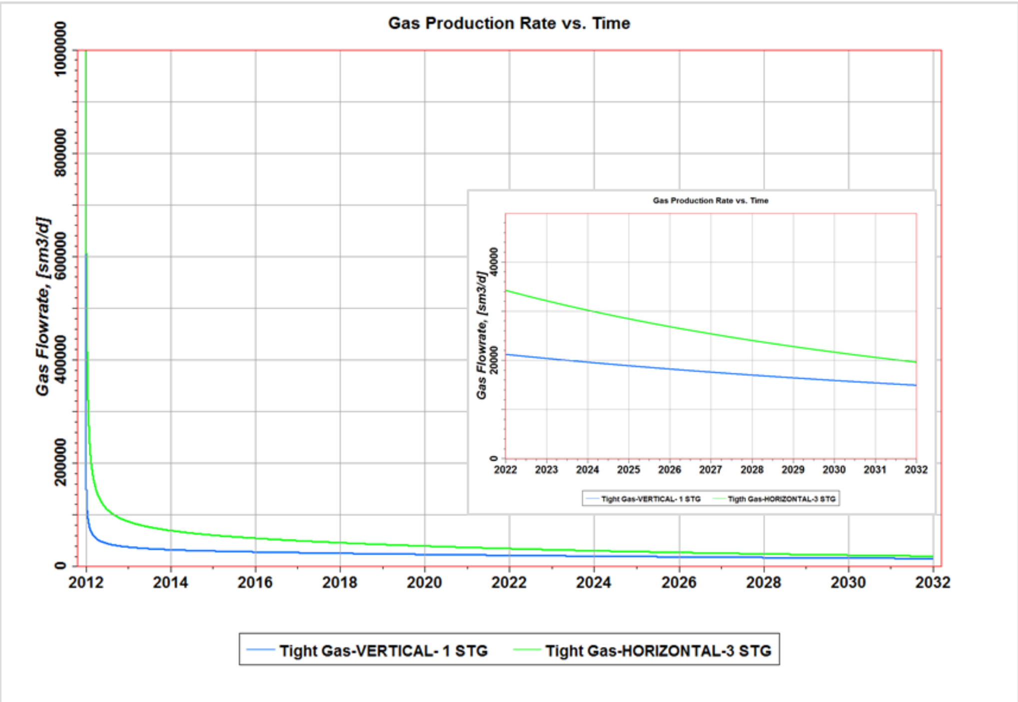

Figure 5.14 Tight Gas-1 Stage Vertical & 3 Stages Horizontal Cases Production Rates

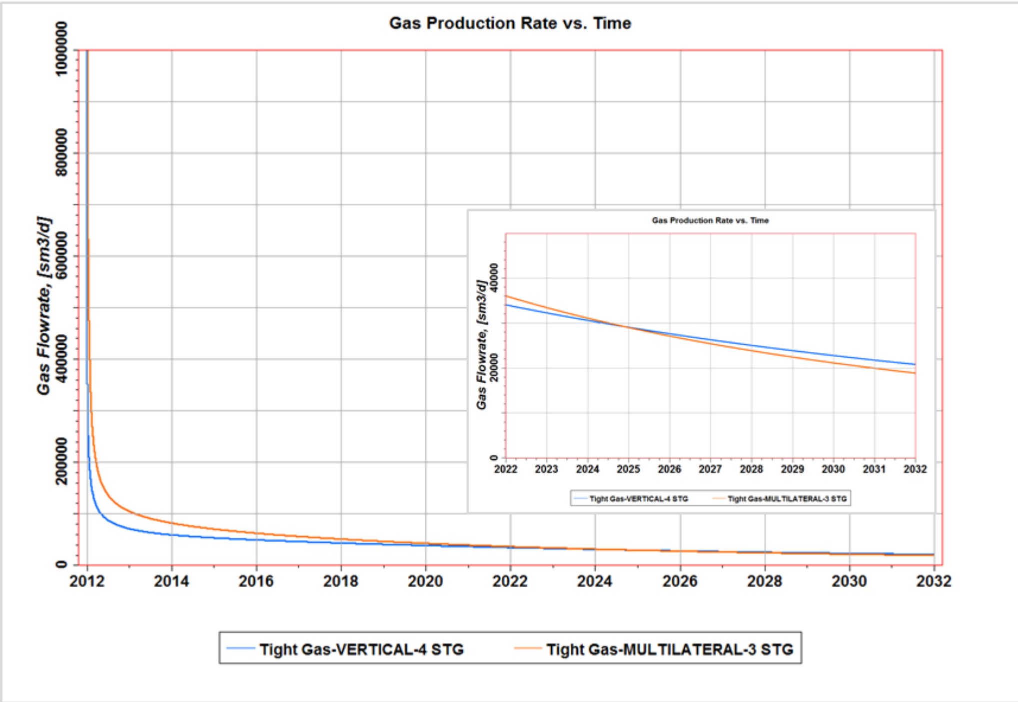

Figure 5.15 Tight Gas-4 Stage Vertical & 3 Stages Multilateral Cases Production Rates

Figure 5.11 to 5.15 show the gas production rate of all conducted cases. The most interesting point is that the gas production rate of the vertical well with 4 stages hydraulic fracture set is equivalent to that of the multilateral well with 3 stages hydraulic fracture set approximately thirteen years later and it starts producing more gas after that point.

The cumulative gas production graph, Figure 5.16, presents that particularly the multilateral or horizontal well having a large surface area of the reservoir rock does not require massive hydraulic fracturing stimulation treatments to achieve the large amount of gas production for the tight gas system. On the other hand, the performance of the vertical well is increased gradually by the number of hydraulic fracture stage and the vertical well should be stimulated to give more economical volumes of gas.

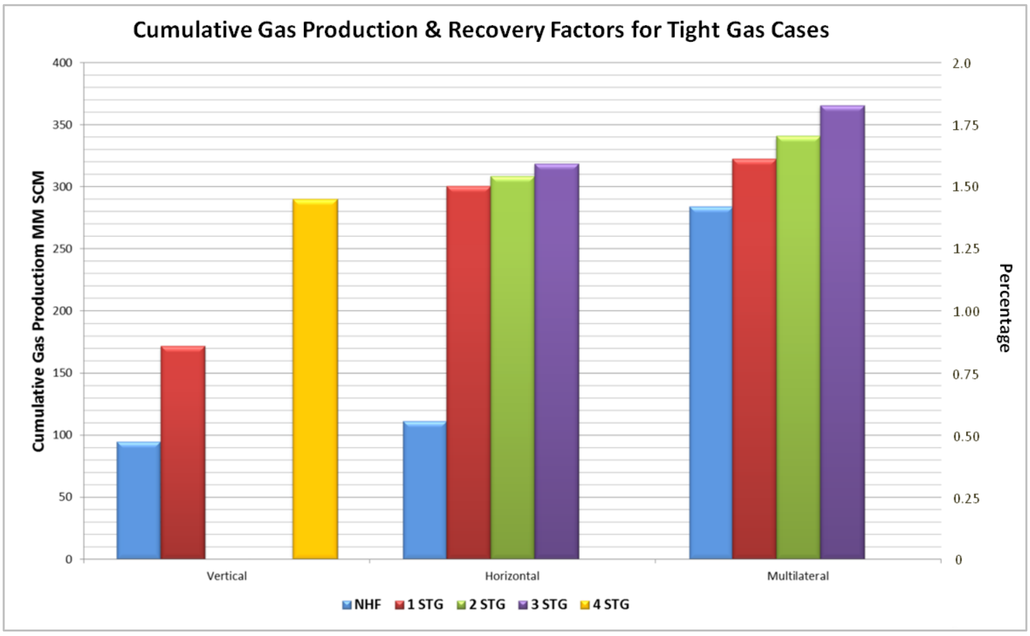

Figure 5.16 Tight Gas Cumulative Gas Production & Recovery Factors for 20 years

The recovery factor values of tight gas cases are illustrated in Figure 5.16 and they change between 0.5 and 1.9 percent according to the results of one well simulation. Actually, the similar approach with the cumulative gas production part can be accepted for the discussion of recovery factors since they have the same trend with different values.

5.4 Run Time of Simulations

Execution time of the cases is tabulated in the table 5.1. Utilized computer for the study has an Intel® Core™2 Duo CPU 2.53 GHz processor and 2.96 GB RAM. Total computer time for running thirty one cases is 468419 seconds about 130 hours.

Table 5.2 Elapsed time for all cases

		Elapsed Time, sec		
		Vertical	***Horizontal***	***Multilateral***
CBM	**0.1 md**	12756	13364	13810
	1.0 md	14357	16076	14032
	10 md	14498	14416	15307
Shale Gas	**NHF**	13506	13839	13957
	1 STG HF	18887	17316	24255
	2 STG HF	-	21041	29977
	3 STG HF	-	23572	31613
	4 STG HF	47175	-	-
Tight Gas	**NHF**	4675	4646	4667
	1 STG HF	6671	6468	9612
	2 STG HF	-	6914	10400
	3 STG HF	-	8470	11985
	4 STG HF	12157	-	-

The tabulated elapse time ranges between 4675 and 47175 seconds. The lowest value is for the single porosity system of tight gas case with no hydraulic fracture stage and the highest value is for the dual porosity system of shale gas case with four stages of hydraulic fracture. For all runs, the elapsed time of coalbed methane and shale gas cases is higher than that of the tight gas cases because the simulation of the dual porosity system takes much more time than the single porosity system. In addition to that the influence of the locally refined grids while defining the hydraulic fractures in shale gas and tight gas reservoirs is observed and the values indicate that implementation of local grid refinement make the situation worse for the dual porosity system. Based on these data, it is understood that not only the preference of the porosity system but also application of LGR play an important role on the performance of simulation time. As a result, the dual porosity system and the increasing number of hydraulic fracture stages affect the run time of simulation in a negative way.

5.5 Comparison of Production Profiles

The coalbed methane, shale gas, and tight gas reservoirs are combined into the same graph, figure 5.17, in an attempt to explain the general characteristics of production profiles.

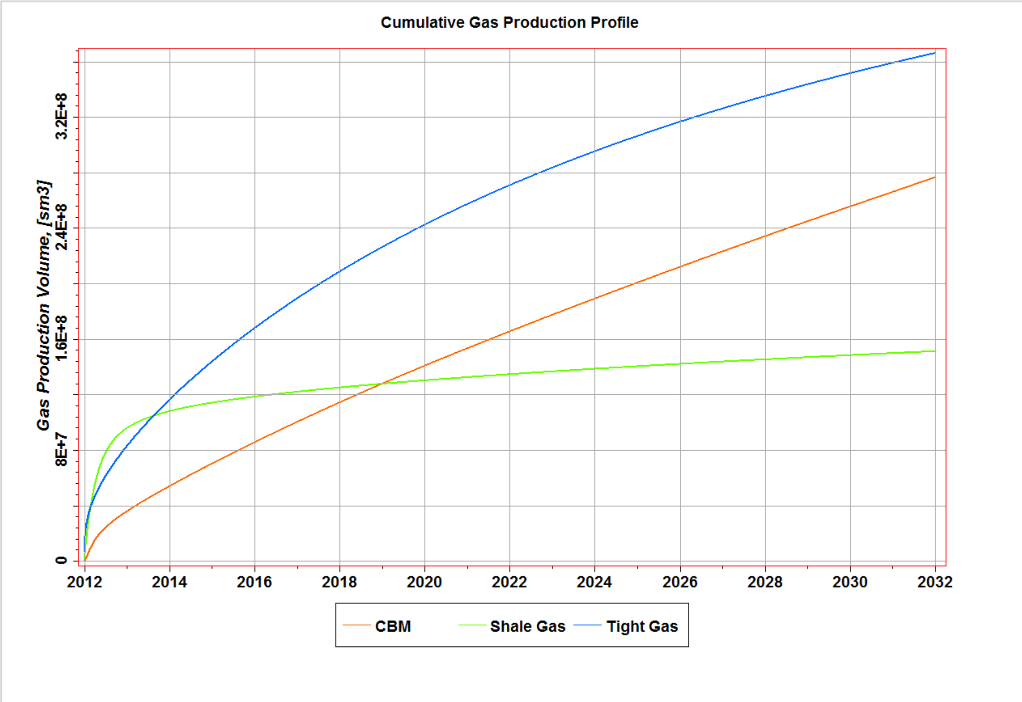

Figure 5.17 cumulative gas production of CBM, Shale gas, and Tight Gas Systems

The orange line representing the production trend of the CBM reservoir consists of two phases; rapid increase in gas production is seen due to free gas in the cleats through the first phase lasting approximately two years and it is followed by the second phase having nearly constant slope of production amount. From the green line displaying the shale gas system, the effect of the hydraulic fractures on the gas production is observed during about three years and that results in a sharp increase with a high inclination. Towards the middle of production period, the desorption starts contributing to the gas production and dominates the behavior of system. For the tight gas, the blue line is like a curve shape with regularly declining gas production. The hydraulic fractures act similar to the shale gas system but the impact of that is less at early years and exists extended period of time.

The shale gas and the tight gas systems show some similarity in terms of hydraulic fracturing effect at the beginning of production years; however adsorption as a distinguishing property in between shifts their style of gas production later. The production profile for the coalbed methane system differs from the shale gas and tight gas reservoirs due to its natural fractured structure and desorption process depending on pressure drop because of the water production. Eventually, each unconventional gas system has its own particular characteristic and production profile.

In order to avoid the misleading, it should be emphasised that above figure just shows the result of the most productive case of each system with the same areal and vertical extent and it is only valid under this circumstance. Expectedly, shale gas reservoir is larger volume in size than that of coal bed methane and tight gas reservoirs thus the volume of the each reservoir system in nature is very important factor to make an inference.

Figure 5.18 is plotted to give a general idea about the cumulative gas production under the performed conditions of three different systems. The figure may be used helpful during the development of these kinds of reservoirs providing the similar properties and treatments are applied.

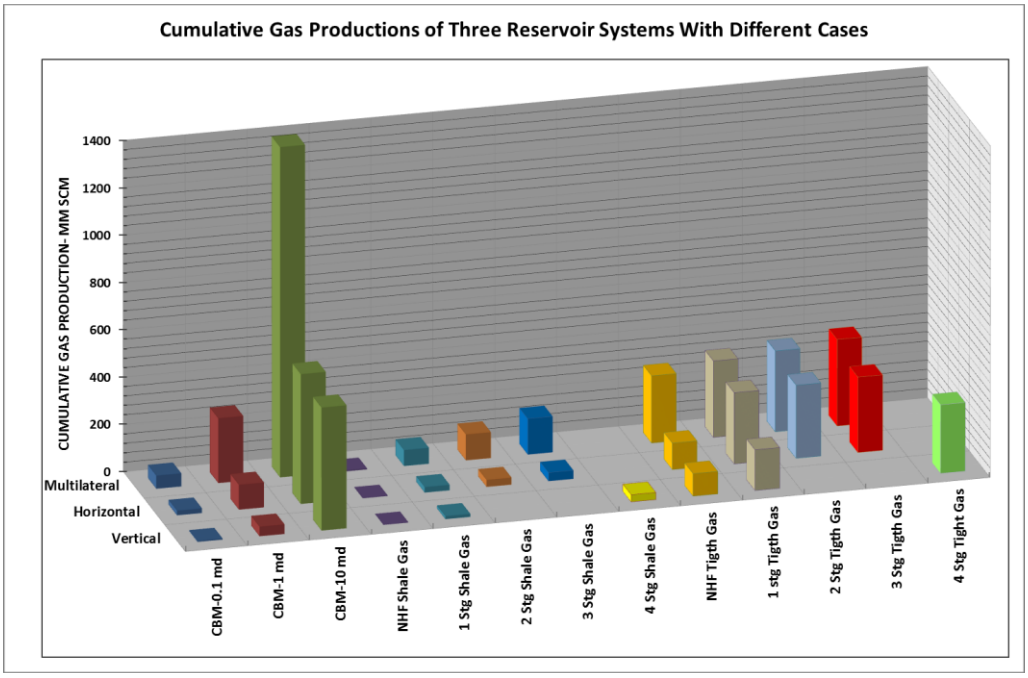

Figure 5.18 The 3D bar chart graph of cumulative gas production for all cases.

Furthermore, the table 5.2 is created to point out the gas in place and the cumulative gas production of each studied case with the period of five years. “quinquennium”

Table 5.3 Gas production amount of all cases with the periods of 5 years

			GIP	Cumulative Gas Productions, SCM			
				5-year	**10-year**	**15-year**	**20-year**
CBM	**Vertical**	**0.1 md**	**1.12E+10**	0.9E+06	1.94E+06	2.92E+06	3.88E+06
		1 md		9.82E+06	19.48E+06	29.29E+06	39.92E+06
		10 md		116.07E+06	248.95E+06	384.17E+06	518.8E+06
	Horizontal	**0.1 md**		8.74E+06	12.68E+06	16.18E+06	19.38E+06
		1 md		36.59E+06	61.76E+06	84.17E+06	104.57E+06
		10 md		206.48E+06	343.22E+06	456.65E+06	547.7E+06
	Multilateral	**0.1 md**		26.94E+06	37.28E+06	46.51E+06	54.98E+06
		1 md		100.49E+06	165.73E+06	223.3E+06	273.15E+06
		10 md		534.42E+06	878.93E+06	1164.93E+06	1394.5E+06
Shale Gas	**Vertical**	**NHF**	**2.58E+10**	0.11E+06	0.2E+06	0.29E+06	0.38E+06
		1 STG HF		9.21E+06	10.37E+06	11.23E+06	11.96E+06
		4 STG HF		23.87E+06	26.39E+06	28.38E+06	30.11E+06
	Horizontal	**NHF**		0.62E+06	0.93E+06	1.19E+06	1.41E+06
		1 STG HF		12.49E+06	16.71E+06	19.99E+06	22.76E+06
		2 STG HF		17.74E+06	22.42E+06	25.96E+06	28.91E+06
		3 STG HF		23.1E+06	28.37E+06	32.31E+06	35.57E+06
	Multilateral	**NHF**		1.71E+06	2.5E+06	3.15E+06	3.71E+06
		1 STG HF		47.22E+06	55.48E+06	61.68E+06	66.76E+06
		2 STG HF		84.61E+06	95.05E+06	102.7E+06	108.93E+06
		3 STG HF		122.01E+06	134.63E+06	143.74E+06	151.13E+06
Tight Gas	**Vertical**	**NHF**	**1.95E+10**	27.65E+06	51.99E+06	74.53E+06	95.13E+06
		1 STG HF		64.21E+06	107.36E+06	142.62E+06	171.75E+06
		4 STG HF		121.56E+06	193.5E+06	248.11E+06	290.14E+06
	Horizontal	**NHF**		46.92E+06	74.63E+06	95.6E+06	111.86E+06
		1 STG HF		134.91E+06	207.25E+06	260.39E+06	300.77E+06
		2 STG HF		141.42E+06	214.83E+06	268.23E+06	308.5E+06
		3 STG HF		149.74E+06	224.75E+06	278.56E+06	318.7E+06
	Multilateral	**NHF**		121.29E+06	191.14E+06	243.63E+06	284.12E+06
		1 STG HF		153.78E+06	229.13E+06	282.87E+06	322.89E+06
		2 STG HF		169.35E+06	247.12E+06	301.38E+06	341.09E+06
		3 STG HF		189.58E+06	271.14E+06	326.34E+06	365.7E+06

CHAPTER 6

CONCLUSION

For CBM:

- The productivities of the wells in the increasing order are like: vertical, horizontal, and multilateral. The well configuration plays a major role on the productivity of the system.
- Production rates are highly dependent on permeability of the system. Increasing permeability affects the gas production rate in a positive way for three different well paths. The most favorable impact is observed for vertical well.
- The placement of the well bore into the zone plays an important role to optimize the gas production rates and water production along the layers connected to the well bore in horizontal direction.
- Dual porosity model is able to represent properly the characteristics of the coalbed methane reservoir by requiring much more simulation time.

For Shale Gas:

- Without hydraulic fracturing, it is almost impossible to produce gas from the vertical well. The produced gas amount is limited and economical rates cannot be achieved by horizontal and multilateral wells as well.
- With the increasing number of hydraulic fracturing stages, it is possible to obtain more gas rate especially during the early time of production period.
- The increasing number of hydraulic fracture stages does not bring along the higher gas rates for horizontal well specifically after one stage hydraulic fracture application.
- The multilateral well with multistage hydraulic fractures is the most ideal application
- Re-fracturing operations and drilling new well or branches are necessary to keep the gas production rates at high level.
- Dual porosity system is a valid approach to model the shale gas reservoir.

For Tight Gas:

- Without hydraulic fracturing, the limited amount of gas may be produced by vertical and horizontal well and satisfactory gas rates can be reached with multilateral well.
- The effect of the increasing number of hydraulic fracture stages does not alter the production rate as much as shale gas.
- Vertical well with the high number of hydraulic fracture stage can be preferred to multilateral well having high stages of hydraulic fracture.
- Single porosity system is a valid approach to model the tight gas reservoir.

For Production Profile of Each System:

- CBM
    - Rapid increase in gas production due to the free gas in the cleats during the early period of production
    - Nearly constant slope of gas production amount for the following years
- Shale Gas
    - Sharp increase with a high inclination in gas production due to the effect of hydraulic fractures during about three years
    - Desorption starts contributing to the gas production and dominates the behavior of system towards the middle of production period.
- Tight Gas
    - Regularly declining production rates during the drawdown period

- Hydraulic fractures act similar to the shale gas but the impact of that is less at early years and exists extended period of time.

For Run Time:

- Dual porosity system requires much more simulation time than the single porosity system.
- Local grid refinement facility using for hydraulic fracturing model has a negative influence on the run time and it also make the convergence of the system difficult.
- The modeling of hydraulic fractures by local grid refinement increases the simulation time drastically.
- Implementation of LGR makes the situation worse for the dual porosity system.
- High number of hydraulic fracture stage increases the simulation time definitely.
- Complex well geometry such as multi segment wells does not affect the execution time of simulation too much.
- Allocating memory error is highly related to the number of grid cell in the model.

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APPENDIX A

Palmer - Mansoori rock model

The palmer-Mansoori rock model adjust the preo columes V(P), at the current pressure, P, using

$$v\ P\ \ = V\ P_0\ \ \ 1 + \frac{c_m}{\varnothing_0}\ P - P_0\ \ + \frac{\varepsilon_l}{\varnothing_0}\ \frac{K}{M} - 1\ \ \ \frac{\beta P}{1 + \beta P} - \frac{\beta P_0}{1 + \beta P_0}$$

Where:
$\varnothing_0$ is the initial porosity
P_0 is the initial pressure
$V(P_0)$ is the pore volume at the initial pressure
K is the bulk modulus
M is the constrained axial modulus
γ is the grain compressibility
β, ε_l are parameters of the match between the Langmuir curve and the change in volumetriz strain due to matriz shrinkage
f is a fraction between 0 and 1
and

$$c_{m = \frac{1}{M} - \frac{K}{M} + f - 1\ \gamma}$$

Following Palmer-Mansoori, assuming that permeability varies with porosity as

$$\frac{k}{k_0} = \ \ \frac{\varnothing}{\varnothing_0}^{\ n}$$

Where the exponent n is typically 3, then the transmissibility multiplier is taken as

$$1 + \frac{c_m}{\varnothing_0}\ P - P_0\ \ + \frac{\varepsilon_l}{\varnothing_0}\ \frac{K}{M} - 1\ \ \ \frac{\beta P}{1 + \beta P} - \frac{\beta P_0}{1 + \beta P_0}^{\ n}$$

APPENDIX B

CBM cases 3D gas distribution in the cleats

CBM Cases: 3D view of gas saturation in the cleats for vertical, horizontal, and multilateral well well after 20 years of production

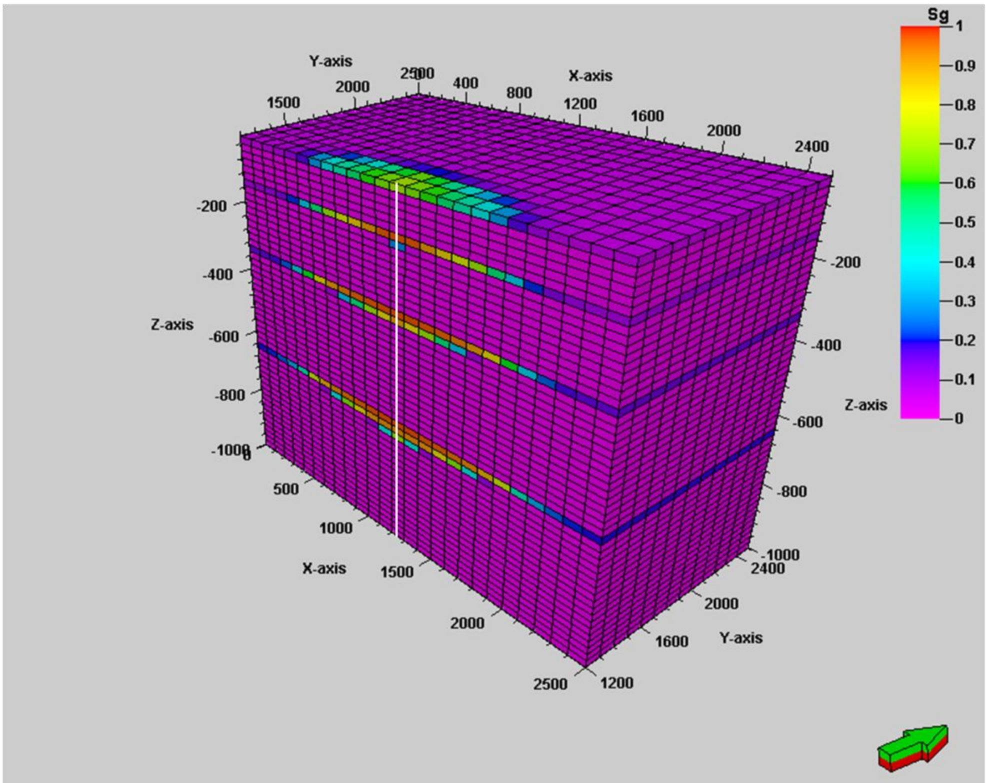

Figure B.1 CBM 0.1 md Case 3D view of Gas Saturation in the cleats for vertical well after 20 years of production

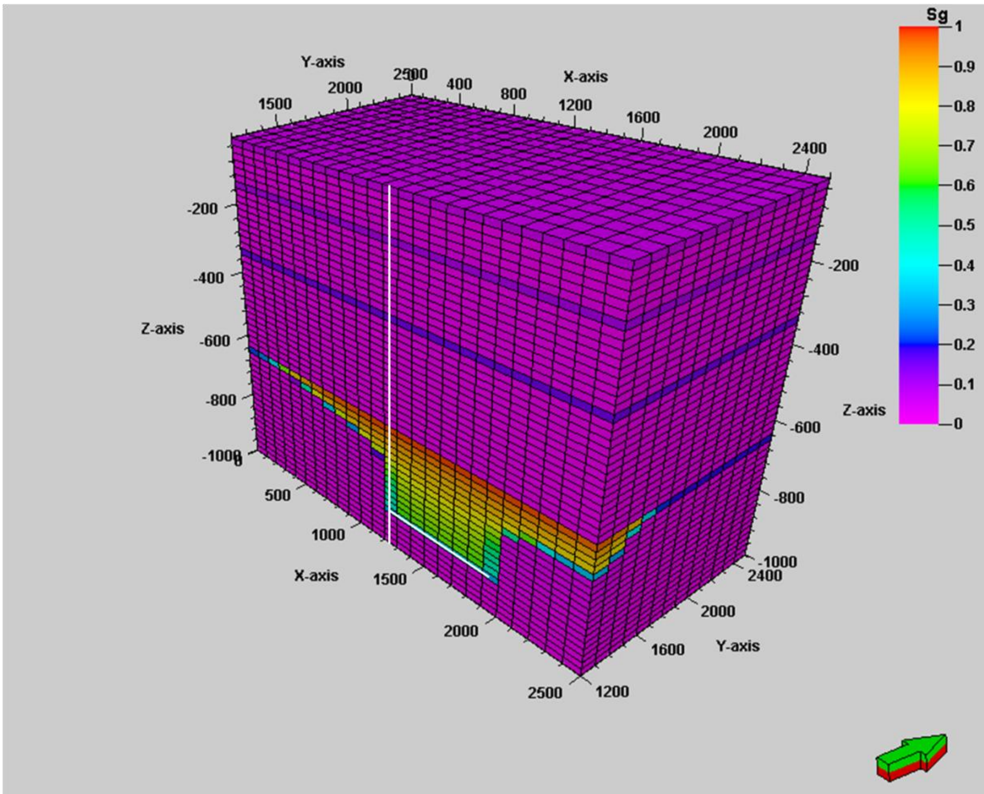

Figure B.2 CBM 0.1 md Case 3D view of Gas Saturation in the cleats for horizontal well after 20 years of production

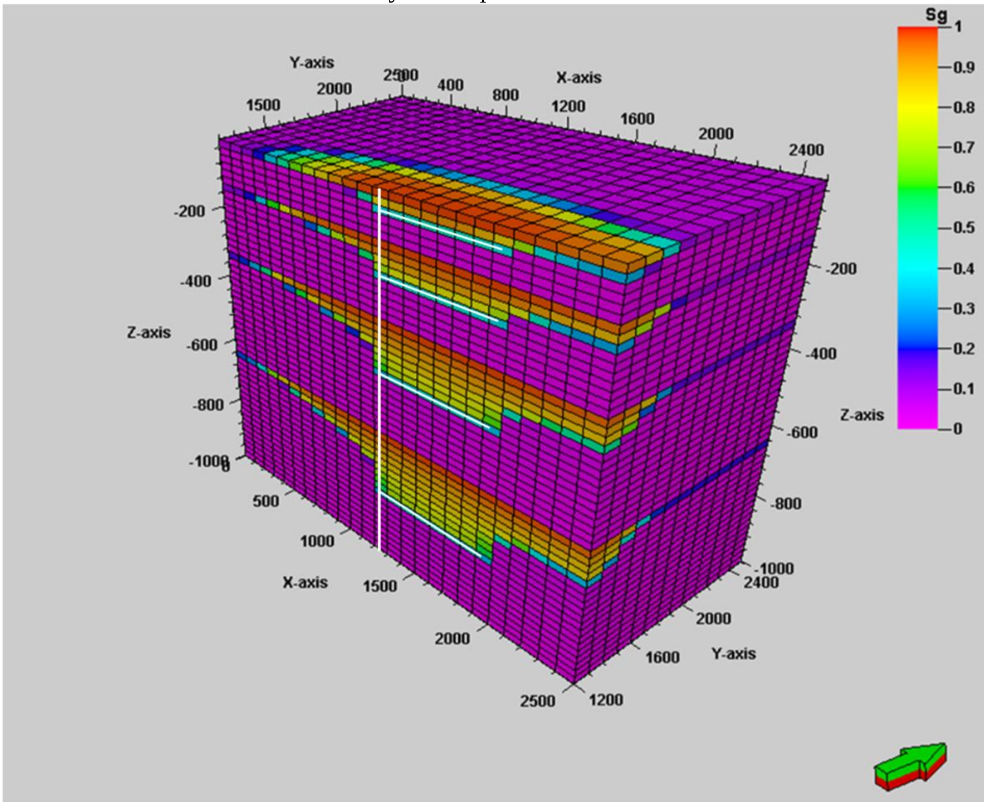

Figure B.3 CBM 0.1 md Case 3D view of Gas Saturation in the cleats for multilateral well after 20 years of production

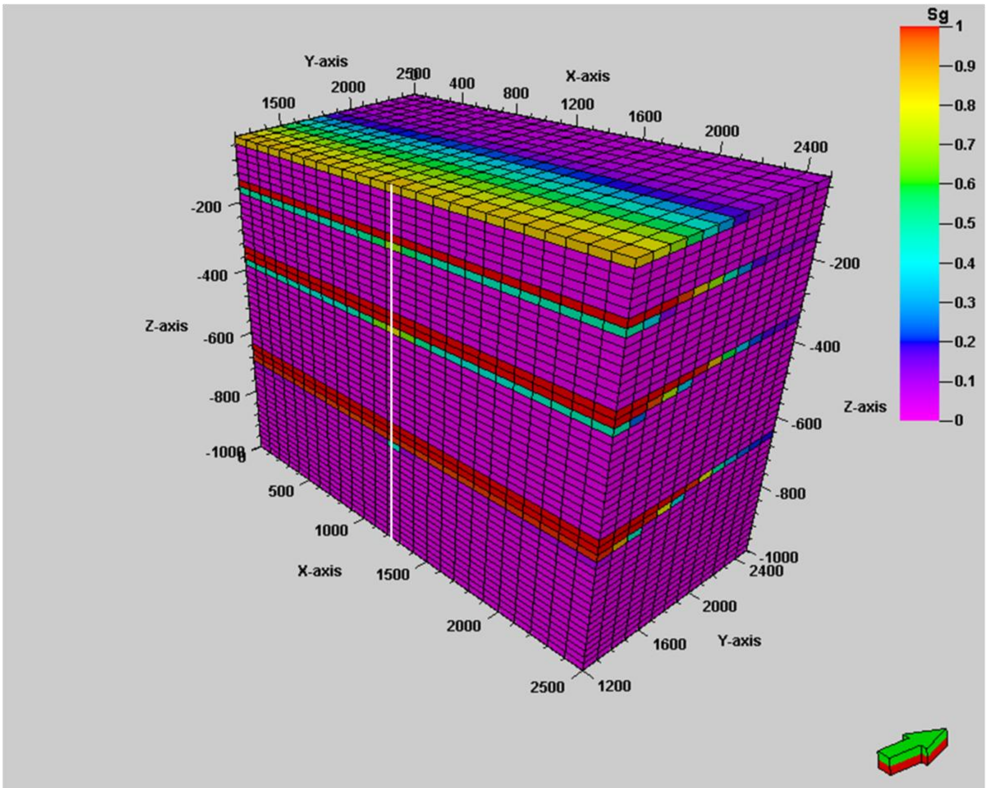

Figure B.4 CBM 1 md Case 3D view of Gas Saturation in the cleats for vertical well after 20 years of production

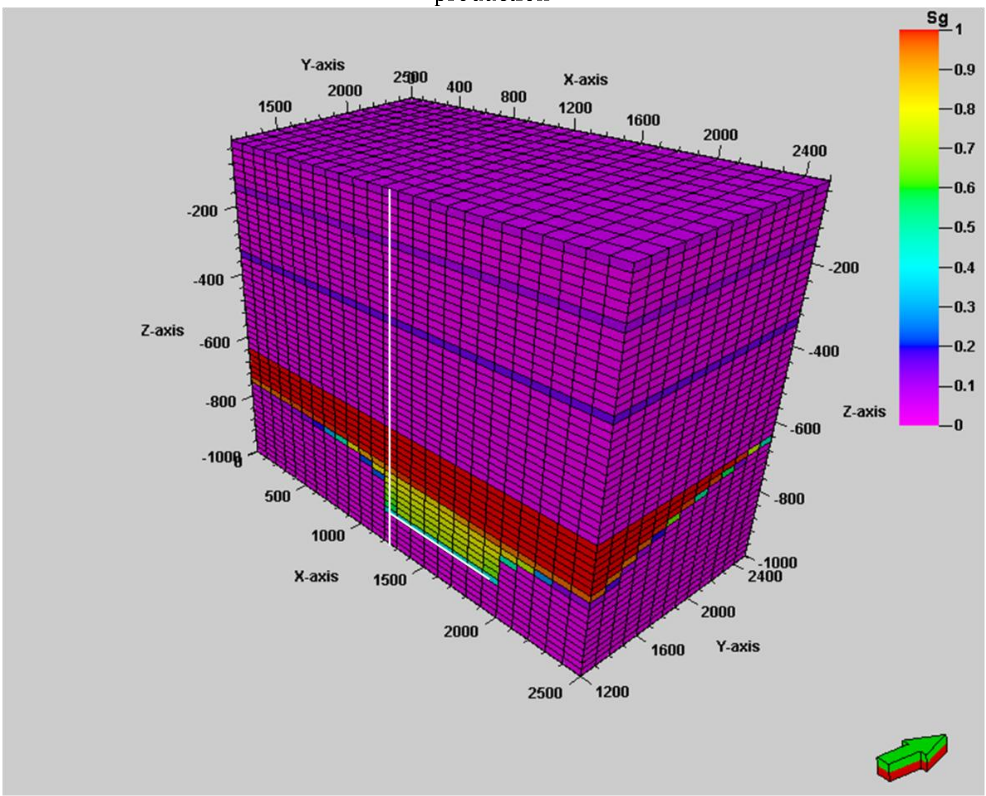

Figure B.5 CBM 1 md Case 3D view of Gas Saturation in the cleats for horizontal well after 20 years of production

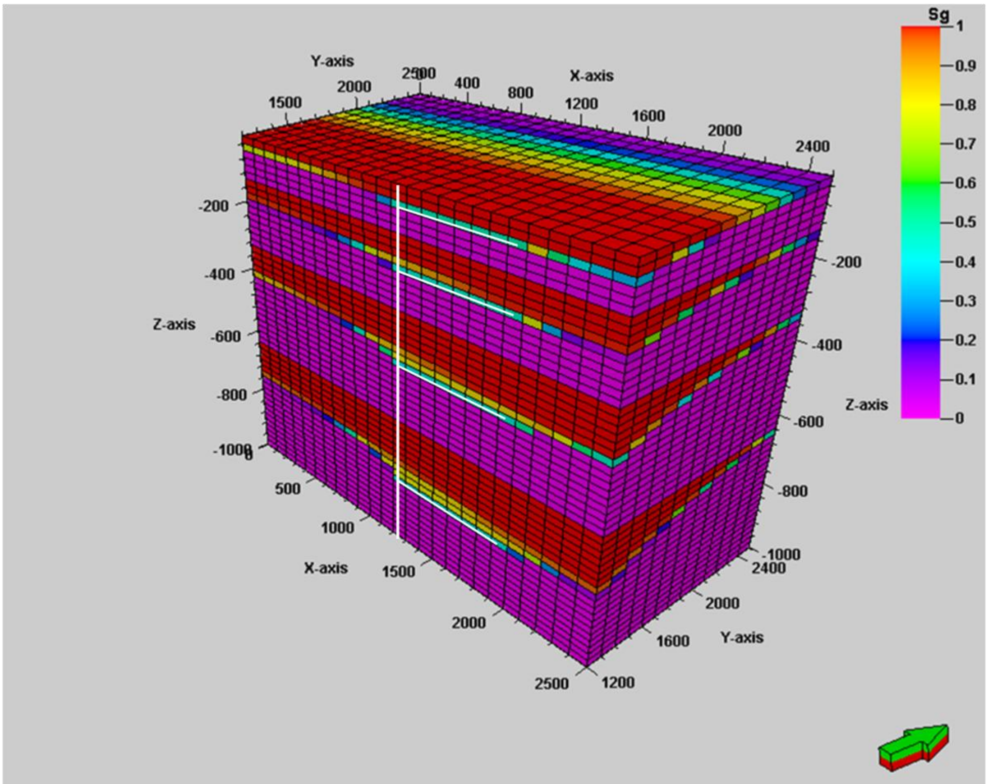

Figure B.6 CBM 1 md Case 3D view of Gas Saturation in the cleats for multilateral well after 20 years of production

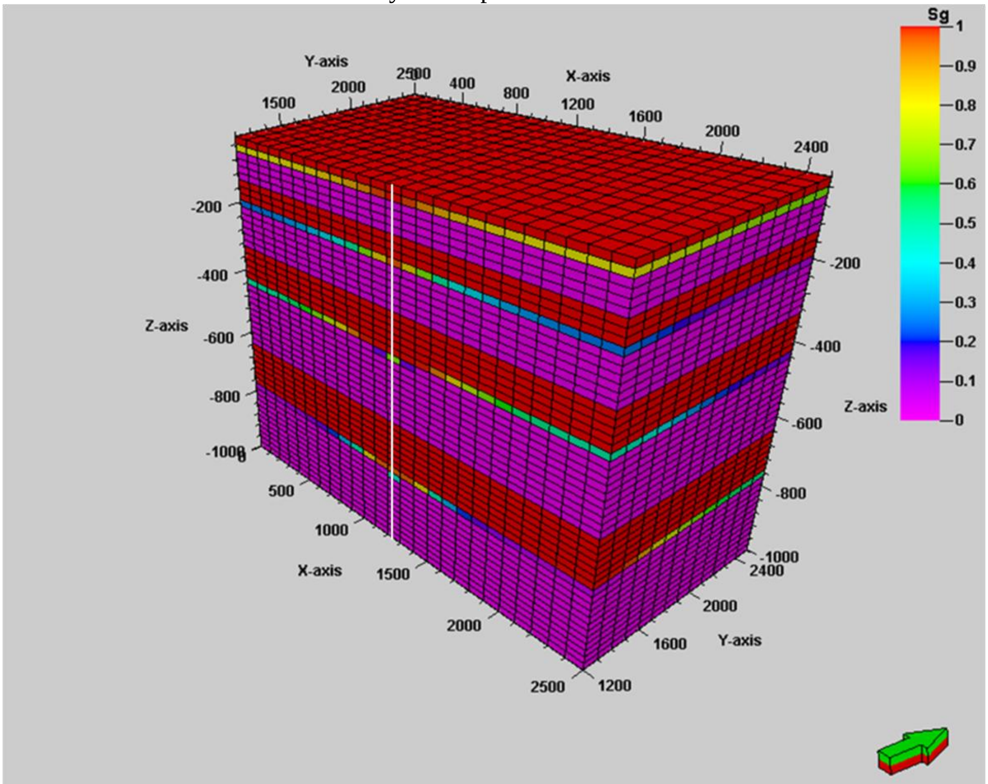

Figure B.7 CBM 10 md Case 3D view of Gas Saturation in the cleats for vertical well after 20 years of production

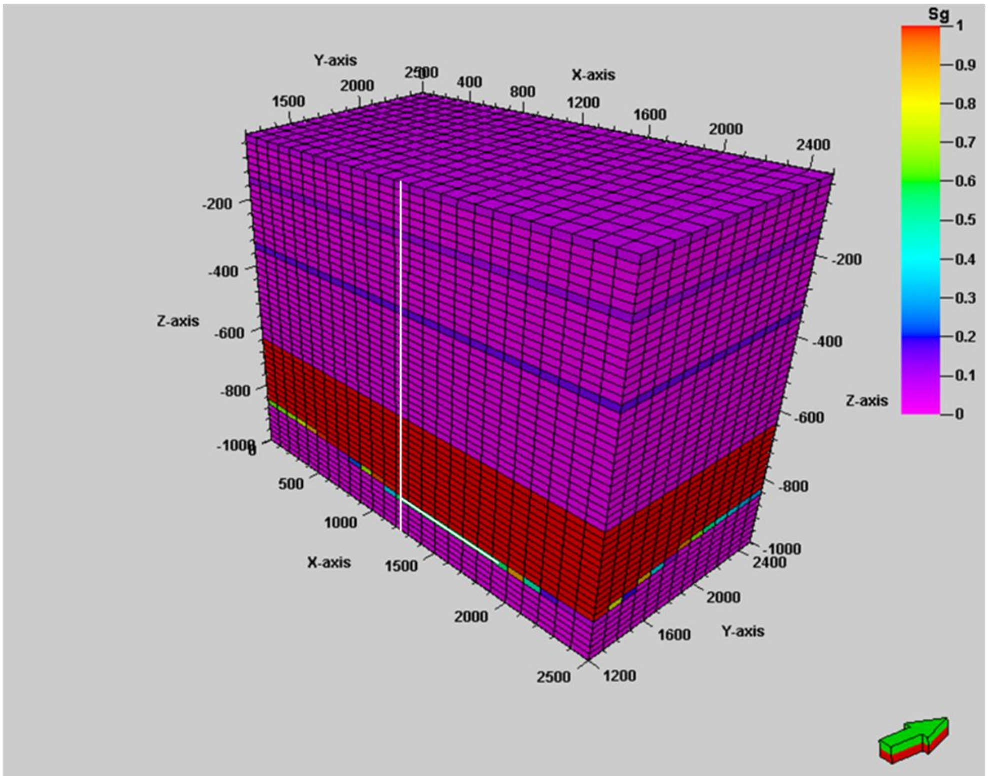

Figure B.8 CBM 10 md Case 3D view of Gas Saturation in the cleats for horizontal well (Lower) after 20 years of production

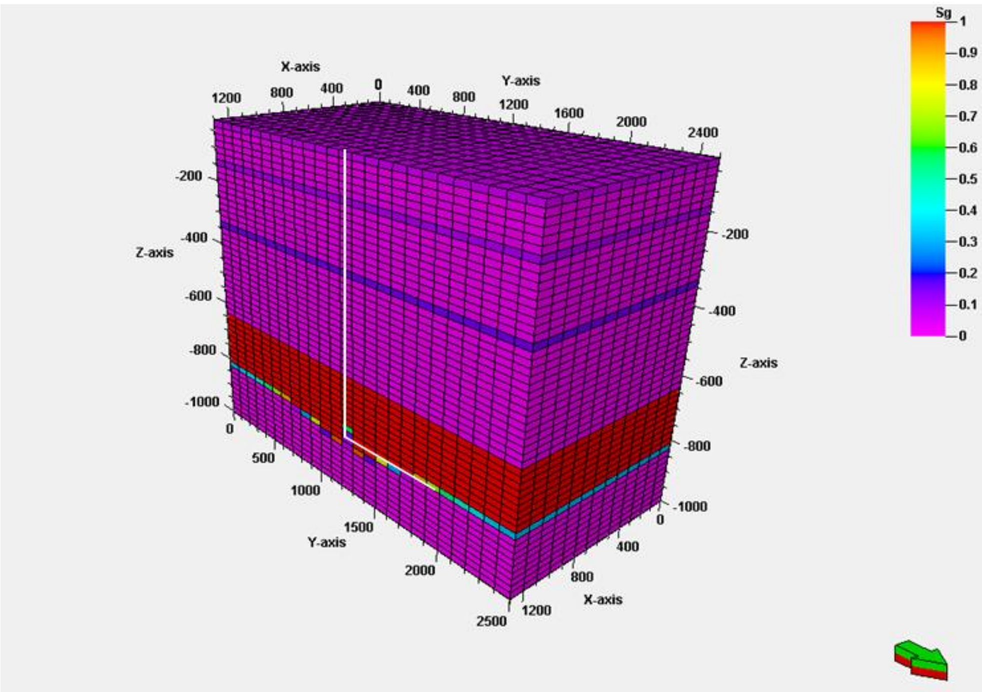

Figure B. 9 CBM 10 md Case 3D view of Gas Saturation in the cleats for horizontal well(Middle) after 20 years of production

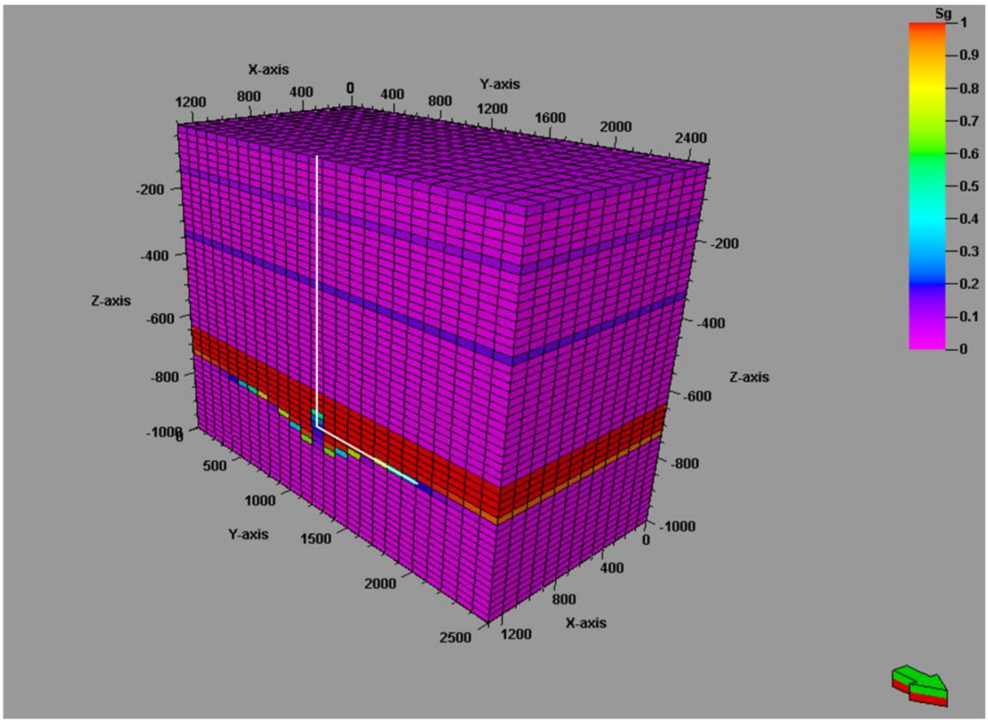

Figure B.10 Figure B.11 CBM 10 md Case 3D view of Gas Saturation in the cleats for horizontal well (Middle) after 20 years of production

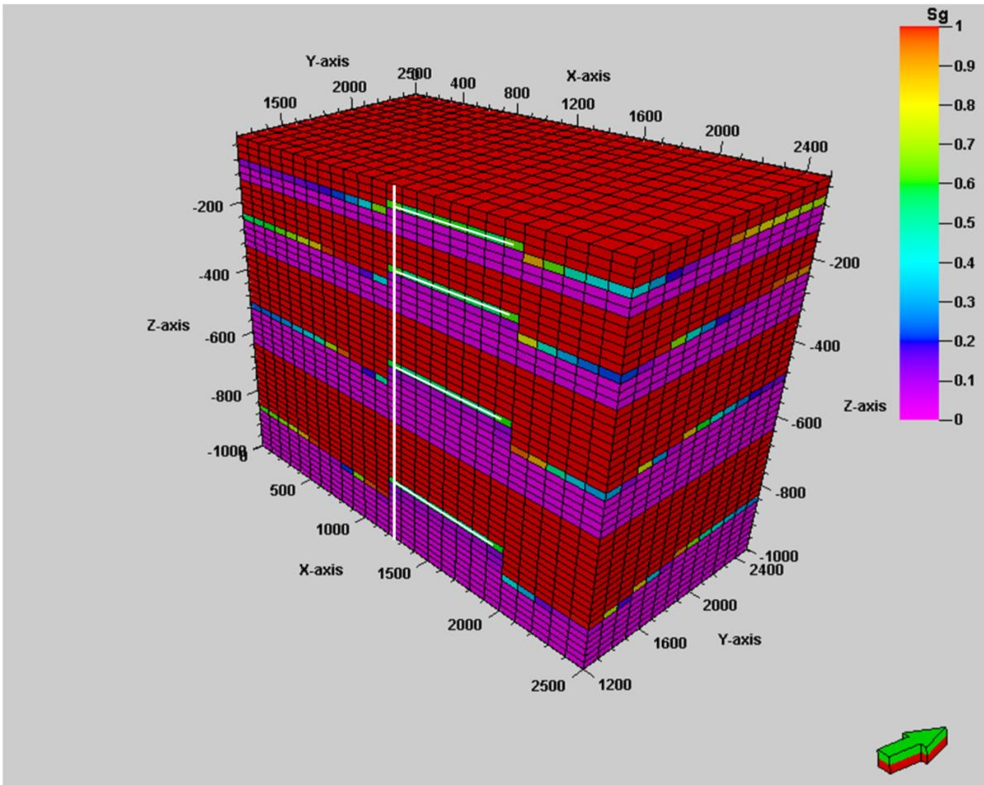

Figure B.12 CBM 10 md Case 3D view of Gas Saturation in the cleats for multilateral well after 20 years of production

APPENDIX C

Simulation Codes

CBM 1 md Case Multilateral Well Data File:

```
-- *******************
-- * Runspec Section *
-- *******************
RUNSPEC
TITLE
CBM 1 md ML
WATER
GAS
NODPPM
METRIC
FULLIMP
DUALPORO
COAL
CBMOPTS
TIMEDEP YES/
COMPS 1 /
EOS
PR3 /
DIMENS
-- NDIVIX NDIVIY NDIVIZ
   25     25     104 /
START
-- DAY MONTH YEAR
   01  JAN   2012 /
TABDIMS 4* 9 /
EQLDIMS 1 /
REGDIMS 5* 4 /
WELLDIMS 9 200 /
WSEGDIMS 1 100 5 /
HWELLS
UNIFOUT
UNIFIN
SOF3 keyword
FORMOPTS
HCSCAL /
-- ****************
-- * GRID Section *
-- ****************
GRID
GRIDFILE 2 /
INIT
INCLUDE
'..\mce_grid' /
INCLUDE
'..\mce_props' /
SIGMA 1.83 /
COALNUM
625*0
3125*1
625*0
```

```
5625*2
625*0
9375*3
625*0
11875*4 /
BOX 1 25    1 25   1 1 /
ROCKDEN 625*0 /
BOX  1 25    1 25   2 6 /
ROCKDEN 3125*1615 /
BOX  1 25    1 25   7 7 /
ROCKDEN 625*0 /
BOX  1 25    1 25   8 16 /
ROCKDEN 5625*1615 /
BOX 1 25    1 25   17 17 /
ROCKDEN 625*0 /
BOX  1 25    1 25   18 32 /
ROCKDEN 9375*1615 /
BOX  1 25    1 25   33 33 /
ROCKDEN 625*0 /
BOX  1 25    1 25   34 52 /
ROCKDN 11875*1615 /
NOECHO
-- ******************
-- * EDIT Section *
-- ******************
EDIT
-- ******************
-- * PROPS Section *
-- ******************
PROPS
FACTLI 0.8 /
CNAMES CH4 /
SGFN
--      Sg          Krg         Pcgw
        0.000       0.0000 0.0
        0.025       0.0035 0.0
        0.050       0.0070 0.0
        0.100       0.0180 0.0
        0.150       0.0330 0.0
        0.200       0.0510 0.0
        0.250       0.0700 0.0
        0.300       0.0900 0.0
        0.350       0.1180 0.0
        0.400       0.1470 0.0
        0.450       0.1800 0.0
        0.500       0.2160 0.0
        0.550       0.2530 0.0
        0.600       0.2950 0.0
        0.650       0.3420 0.0
        0.700       0.4010 0.0
        0.750       0.4660 0.0
        0.800       0.5370 0.0
        0.850       0.6270 0.0
        0.900       0.7200 0.0
        0.950       0.8350 0.0
        1.000       1.0000 0.0     /
SWFN
--      Sw          Krw
```

```
        0.000       0.0000 0.0
        0.050       0.0006 0.0
        0.100       0.0013 0.0
        0.150       0.0020 0.0
        0.200       0.0070 0.0
        0.250       0.0150 0.0
        0.300       0.0240 0.0
        0.350       0.0350 0.0
        0.400       0.0490 0.0
        0.450       0.0670 0.0
        0.500       0.0880 0.0
        0.550       0.1160 0.0
        0.600       0.1540 0.0
        0.650       0.2000 0.0
        0.700       0.2510 0.0
        0.750       0.3120 0.0
        0.800       0.3920 0.0
        0.850       0.4900 0.0
        0.900       0.6010 0.0
        0.950       0.7310 0.0
        0.975       0.8140 0.0
        1.000       1.0000 0.0    /
SOF3
        0       0       0
        1       0       0/
ROCK 1.01325  1.45E-05 /
-- Unit m2/day
DIFFCBM
0.0186 0.0372 0.0186 /
0.0186 0.0372 0.0186 /
0.0186 0.0372 0.0186 /
0.0186 0.0372 0.0186 //
LANGMEXT
34.89  0.02373 4.999      0.03081 53.99 0.01773 /
34.89  0.02373 4.999      0.03081 53.99 0.01773 /
34.89  0.02373 4.999      0.03081 53.99 0.01773 /
34.89  0.02373 4.999      0.03081 53.99 0.01773 / /
BOX 1 25 1 25 2 6 /
LANGMULT   3125*0.575/
ENDBOX
BOX 1 25 1 25 8 16 /
LANGMULT
5625*0.575/
ENDBOX
BOX
1 25 1 25 18 32 /
LANGMULT   9375*0.575/
ENDBOX
BOX 1 25 1 25 34 52 /
LANGMULT   11875*0.575/
ENDBOX
TEMPVD
250 18.91
500 22.82
718 26.22
935 32.30
1100 34.88 /
TCRIT
```

```
-- Unit is K
190.6
304.7
126.15 /
PCRIT
-- Unit is Barsa
46.04208
73.865925
33.999 /
ZCRIT
0.284729476628582
0.274077797373227
0.292047393612482/
ACF 0.013 0.225 0.040 /
MW 16.043 /
OMEGAA 0.457235529 0.457235529 0.457235529 /
OMEGAB 0.077796074 0.077796074 0.077796074 /
SSHIFT
-0.144265618878948
BIC 0.1 0.1 -0.012 /
PARACHOR 77 78 41 /
RPTPROPS
LANGMEXT DIFFCBM /
--********************
-- * REGIONS Section *
-- ********************
REGIONS
EQUALS
FIPNUM 1 1 25 1 25 1 1 /
FIPNUM 2 1 25 1 25 2 6 /
FIPNUM 1 1 25 1 25 7 7 /
FIPNUM 3 1 25 1 25 8 16 /
FIPNUM 1 1 25 1 25 17 17 /
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FIPNUM 7 1 25 1 25 60 68 /
FIPNUM 1 1 25 1 25 69 69 /
FIPNUM 8 1 25 1 25 70 84 /
FIPNUM 1 1 25 1 25 85 85 /
FIPNUM 9 1 25 1 25 86 104 //
-- ********************
-- * SOLUTION Section *
-- ********************
SOLUTION
INCLUDE
'..\mce_pressure' /
SWAT
625*0.0 3125*0.0 625*0.0 5625*0.0 625*0.0 9375*0.0 625*0.0 11875*0.0
625*0.99 3125*0.99 625*0.99 5625*0.99 625*0.99 9375*0.99 625*0.99
11875*0.99 /
SGAS 625*1.0 3125*1.0 625*1.0 5625*1.0 625*1.0 9375*1.0 625*1.0 11875*1.0 625*0.01
3125*0.01 625*0.01 5625*0.01 625*0.01 9375*0.01
625*0.01 11875*0.01 /
XMF
```

-- CH4 Component
625*0.0 3125*0.0 625*0.0 5625*0.0 625*0.0 9375*0.0 625*0.0 11875*0.0
625*0.0 3125*0.0 625*0.0 5625*0.0 625*0.0 9375*0.0 625*0.0 11875*0.0
625*0.0 11875*0.0 /
YMF
-- CH4 component
625*1.0 3125*1.0 625*1.0 5625*1.0 625*1.0 9375*1.0 625*1.0 11875*1.0
625*1.0 3125*1.0 625*1.0 5625*1.0 625*1.0 9375*1.0 625*1.0 11875*1.0 /
-- *******************
-- * SUMMARY Section *
-- *******************
SUMMARY
ELAPSED
EXCEL
FGIP
FGPP
FGPR
FGPT
FRPV
FHPV
FGSAT
FWPR
FWPT
FPR
FPPG
WGIR /
WGIT /
WGPT /
WGPR /
WGPRH /
WGPTH /
WGPP /
WWPR /
WWPT /
WBHP /
WTHP /
WTHPH /
GPR /
WWGR /
WCMPR MCE-1 1 / /
FCMPR 1 /
WCMPT MCE-1 1 / /
FCMPT 1 /
WCHMR MCE-1 1 / /
FCHMR 1 /
WCHMT MCE-1 1 //
FCHMT 1 /
WXMF MCE-1 1 / /
FXMF 1 /
WYMF MCE-1 1 / /
FYMF 1 /
WZMF MCE-1 1 / /
FZMF 1 /
WCWGPR MCE-1 1 / /
FCWGPR 1 /
WCWGPT MCE-1 1 / /
FCWGPT 1 /
-- Methan production rate

```
FCWGPR 1 /
-- ********************
-- * SCHEDULE Section *
-- ********************
SCHEDULE
TUNING / /
2* 400 /
NSTACK 200 /
RPTRST
BASIC=2 BGAS DENG DENW PGAS PRESSURE PSAT SGAS SWAT XMF YMF ZMF /
RPTSCHED
FIP=2 /
RPTPRINT
5* 1 1 /
SAVEEND
WELSPECS
'MCE-1' 1* 13 13 950 WATER / /
COMPORD
'MCE-1' INPUT / /
COMPDAT
'MCE-1' 13 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 95 95 OPEN 0 0 0.1524 3* X/ /
WELSEGS
-- Name      Depth 1    Tlen 1 Type of dep information
'MCE-1'     950.00 0.0        1*    'ABS' /
-- First Last  Branch     Outlet Length Depth      Diam       Ruff   Area   Vol
-- Seg  Seg    Num        Seg
-- Main Stem
```

```
    2    2    1    1     2.5     952.5    0.15243E-04  1*  1* /
    3    3    1    2     10.5    960.5    0.15243E-04  1*  1* /
    4    4    1    3     23.5    973.5    0.15243E-04  1*  1* /
    5    5    1    4     41.5    991.5    0.15243E-04  1*  1* /
-- First Zone
    6    6    2    2     102.5   952.5    0.15243E-04  1*  1* /
    7    7    2    6     202.5   952.5    0.15243E-04  1*  1* /
    8    8    2    7     302.5   952.5    0.15243E-04  1*  1* /
    9    9    2    8     402.5   952.5    0.15243E-04  1*  1* /
    10   10   2    9     502.5   952.5    0.15243E-04  1*  1* /
    11   11   2    10    602.5   952.5    0.15243E-04  1*  1* /
    12   12   2    11    702.5   952.5    0.15243E-04  1*  1* /
-- Second Zone
    13   13   3    3     110.5   960.5    0.15243E-04  1*  1* /
    14   14   3    13    210.5   960.5    0.15243E-04  1*  1* /
    15   15   3    14    310.5   960.5    0.15243E-04  1*  1* /
    16   16   3    15    410.5   960.5    0.15243E-04  1*  1* /
    17   17   3    16    510.5   960.5    0.15243E-04  1*  1* /
    18   18   3    17    610.5   960.5    0.15243E-04  1*  1* /
    19   19   3    18    710.5   960.5    0.15243E-04  1*  1* /
-- Third zone
    20   20   4    4     123.5   973.5    0.15243E-04  1*  1* /
    21   21   4    20    223.5   973.5    0.15243E-04  1*  1* /
    22   22   4    21    323.5   973.5    0.15243E-04  1*  1* /
    23   23   4    22    423.5   973.5    0.15243E-04  1*  1* /
    24   24   4    23    523.5   973.5    0.15243E-04  1*  1* /
    25   25   4    24    623.5   973.5    0.15243E-04  1*  1* /
    26   26   4    25    723.5   973.5    0.15243E-04  1*  1* /
-- Fourth Zone
    27   27   5    5     141.5   991.5    0.15243E-04  1*  1* /
    28   28   5    27    241.5   991.5    0.15243E-04  1*  1* /
```

```
        29      29      5               28              341.5           991.5           0.15243E-04  1*       1*
/
        30      30      5               29              441.5           991.5           0.15243E-04  1*       1*
/
        31      31      5               30              541.5           991.5           0.15243E-04  1*       1*
/
        32      32      5               31              641.5           991.5           0.15243E-04  1*       1*
/
        33      33      5               32              741.5           991.5           0.15243E-04  1*       1*
/ /
COMPSEGS
-- Name
'MCE-1' /
--      I       J       K       Brn  Start     End           Dirn    End
--                      No   Length   LengthPenet  Range
-- First Zone
        13      13      56      2       2.5             102.5           'X'     13 /
        14      13      56      2       102.5           202.5           'X'     14 /
        15      13      56      2       202.5           302.5           'X'     15 /
        16      13      56      2       302.5           402.5           'X'     16 /
        17      13      56      2       402.5           502.5           'X'     17 /
        18      13      56      2       502.5           602.5           'X'     18 /
        19      13      56      2       602.5           702.5           'X'     19 /
        20      13      56      2       702.5           802.5           'X'     20 /
-- Second Zone
        13      13      64      3       10.5            110.5           'X'     13 /
        14      13      64      3       110.5           210.5           'X'     14 /
        15      13      64      3       210.5           310.5           'X'     15 /
        16      13      64      3       310.5           410.5           'X'     16 /
        17      13      64      3       410.5           510.5           'X'     17 /
        18      13      64      3       510.5           610.5           'X'     18 /
        19      13      64      3       610.5           710.5           'X'     19 /
        20      13      64      3       710.5           810.5           'X'     20 /
-- Third Zone
        13      13      77      4       23.5            123.5           'X'     13 /
        14      13      77      4       123.5           223.5           'X'     14 /
        15      13      77      4       223.5           323.5           'X'     15 /
        16      13      77      4       323.5           423.5           'X'     16 /
        17      13      77      4       423.5           523.5           'X'     17 /
        18      13      77      4       523.5           623.5           'X'     18 /
        19      13      77      4       623.5           723.5           'X'     19 /
        20      13      77      4       723.5           823.5           'X'     20 /
-- Fourth Zone
        13      13      95      5        41.5           141.5           'X'     13 /
        14      13      95      5       141.5           241.5           'X'     14 /
        15      13      95      5       241.5           341.5           'X'     15 /
        16      13      95      5       341.5           441.5           'X'     16 /
        17      13      95      5       441.5           541.5           'X'     17 /
        18      13      95      5       541.5           641.5           'X'     18 /
        19      13      95      5       641.5           741.5           'X'     19 /
        20      13      95      5       741.5           841.5           'X'     20 / /
TSCRIT 2* 1 /
WCONPROD
'MCE-1' OPEN BHP 5* 6.9 / /
TSTEP
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
```

```
31 28 31 30 31 30 31 31 30 31 30 31
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31/
END
```

Shale Gas Data File, Multilateral Well With Three Stages of Hydraulic Fracture:

```
-- *******************
-- * Runspec Section *
-- *******************
RUNSPEC
TITLE
SG ML 3 STG
WATER
GAS
NODPPM
METRIC
FULLIMP
DUALPORO
COAL
CBMOPTS
TIMEDEP YES/
COMPS 1 /
EOS
PR3 /
DIMENS
-- NDIVIX NDIVIY NDIVIZ
   25    25    104 /
START
-- DAY MONTH YEAR
   01  JAN   2012 /
TABDIMS 4* 9 /
EQLDIMS 1 /
REGDIMS 5* 4 /
WELLDIMS 9 200 /
WSEGDIMS 1 100 5 /
HWELLS
UNIFOUT
UNIFIN
FORMOPTS
HCSCAL /
-- ****************
-- * GRID Section *
-- ****************
```

```
GRID
GRIDFILE 2 /
INIT
INCLUDE
'..\mce_grid' /
INCLUDE
'..\mce_props' /
BOX 14 14 11 11 54 54 / PERMX  11/ PERMY  11/ PERMZ  11/ ENDBOX
BOX 14 14 11 11 55 55 / PERMX  13/ PERMY  13/ PERMZ  13/ ENDBOX
BOX 14 14 11 11 57 57 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 58 58 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 12 12 54 54 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 55 55 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 57 57 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 58 58 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 13 13 54 54 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 55 55 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 56 56 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 14 14 13 13 57 57 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 58 58 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 14 14 54 54 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 55 55 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 57 57 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 58 58 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 15 15 54 54 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 55 55 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 57 57 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 58 58 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 60 60 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 61 61 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 62 62 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 63 63 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 65 65 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 66 66 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 67 67 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 68 68 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 12 12 60 60 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 12 12 61 61 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 62 62 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 63 63 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 65 65 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 66 66 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 67 67 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 68 68 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 13 13 60 60 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 13 13 61 61 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 62 62 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 63 63 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 64 64 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 14 14 13 13 65 65 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 66 66 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 67 67 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 68 68 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 14 14 60 60 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 14 14 61 61 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 62 62 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 63 63 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 65 65 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
```

BOX 14 14 14 14 66 66 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 67 67 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 68 68 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 60 60 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 15 15 61 61 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 62 62 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 63 63 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 65 65 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 66 66 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 67 67 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 68 68 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 73 73 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 74 74 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 75 75 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 76 76 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 78 78 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 79 79 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 80 80 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 81 81 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 12 12 73 73 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 12 12 74 74 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 75 75 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 76 76 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 78 78 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 79 79 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 80 80 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 81 81 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 13 13 73 73 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 13 13 74 74 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 75 75 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 76 76 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 77 77 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 14 14 13 13 78 78 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 79 79 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 80 80 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 81 81 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 14 14 73 73 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 14 14 74 74 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 75 75 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 76 76 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 78 78 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 79 79 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 80 80 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 81 81 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 73 73 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 15 15 74 74 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 75 75 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 76 76 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 78 78 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 79 79 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 80 80 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 81 81 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 91 91 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 92 92 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 93 93 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 94 94 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 96 96 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 97 97 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX

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BOX 14 14 11 11 98 98 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 99 99 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 12 12 91 91 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 12 12 92 92 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 93 93 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 94 94 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 96 96 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 97 97 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 98 98 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 99 99 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 13 13 91 91 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 13 13 92 92 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 93 93 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 94 94 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 95 95 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 14 14 13 13 96 96 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 97 97 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 98 98 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 99 99 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 14 14 91 91 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 14 14 92 92 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 93 93 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 94 94 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 96 96 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 97 97 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 98 98 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 99 99 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 91 91 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 15 15 92 92 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 93 93 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 94 94 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 96 96 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 97 97 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 98 98 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 99 99 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR17' 14 14 14 15 4 4 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
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'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 //
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR18' 14 14 11 12 4 4 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
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'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR19' 14 14 14 15 12 12 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
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'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR20' 14 14 11 12 12 12 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
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'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR21' 14 14 14 15 25 25 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
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'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR22' 14 14 11 12 25 25 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
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'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR23' 14 14 14 15 43 43 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
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'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR24' 14 14 11 12 43 43 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
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'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
BOX 16 16 11 11 60 60 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 61 61 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 62 62 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 63 63 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 65 65 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 66 66 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 67 67 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 68 68 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 12 12 60 60 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 12 12 61 61 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 62 62 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 63 63 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 65 65 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 66 66 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 67 67 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 68 68 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 13 13 60 60 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 13 13 61 61 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 62 62 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 63 63 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 64 64 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 16 16 13 13 65 65 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 66 66 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
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BOX 16 16 13 13 67 67 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 68 68 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 16 16 60 60 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 16 16 61 61 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 62 62 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 63 63 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 65 65 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 66 66 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 67 67 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 68 68 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 60 60 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 15 15 61 61 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 62 62 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 63 63 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 65 65 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 66 66 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 67 67 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 68 68 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 73 73 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 74 74 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 75 75 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 76 76 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 78 78 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 79 79 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 80 80 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 81 81 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 12 12 73 73 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 12 12 74 74 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 75 75 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 76 76 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 78 78 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 79 79 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 80 80 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 81 81 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 13 13 73 73 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 13 13 74 74 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 75 75 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 76 76 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 77 77 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 16 16 13 13 78 78 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 79 79 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 80 80 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 81 81 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 16 16 73 73 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 16 16 74 74 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 75 75 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 76 76 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 78 78 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 79 79 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 80 80 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 81 81 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 73 73 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 15 15 74 74 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 75 75 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 76 76 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 78 78 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 79 79 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 80 80 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX

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BOX 16 16 15 15 81 81 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 91 91 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 92 92 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 93 93 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 94 94 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 96 96 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 97 97 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 98 98 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 99 99 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 12 12 91 91 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 12 12 92 92 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 93 93 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 94 94 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 96 96 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 97 97 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 98 98 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 99 99 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 13 13 91 91 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 13 13 92 92 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 93 93 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 94 94 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 95 95 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 16 16 13 13 96 96 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 97 97 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 98 98 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 99 99 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 16 16 91 91 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 16 16 92 92 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 93 93 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 94 94 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 96 96 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 97 97 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 98 98 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 99 99 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 91 91 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 15 15 92 92 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 93 93 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 94 94 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 96 96 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 97 97 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 98 98 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 99 99 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR1' 16 16 14 15 4 4 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
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'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR2' 16 16 11 12 4 4 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
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'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR3' 16 16 14 15 12 12 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
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'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR4' 16 16 11 12 12 12 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
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'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR5' 16 16 14 15 25 25 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
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'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 //
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR6' 16 16 11 12 25 25 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
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'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR7' 16 16 14 15 43 43 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
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'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR8' 16 16 11 12 43 43 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
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'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
BOX 18 18 11 11 60 60 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 61 61 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 62 62 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 63 63 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 65 65 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 66 66 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 67 67 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 68 68 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 12 12 60 60 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 12 12 61 61 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 62 62 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 63 63 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 65 65 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 66 66 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 67 67 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 68 68 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
```

BOX 18 18 13 13 60 60 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 13 13 61 61 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 62 62 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 63 63 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 64 64 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 18 18 13 13 65 65 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 66 66 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 67 67 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 68 68 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 18 18 60 60 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 18 18 61 61 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 62 62 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 63 63 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 65 65 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 66 66 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 67 67 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 68 68 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 60 60 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 15 15 61 61 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 62 62 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 63 63 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 65 65 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 66 66 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 67 67 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 68 68 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 73 73 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 74 74 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 75 75 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 76 76 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 78 78 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 79 79 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 80 80 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 81 81 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 12 12 73 73 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 12 12 74 74 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 75 75 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 76 76 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 78 78 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 79 79 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 80 80 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 81 81 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 13 13 73 73 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 13 13 74 74 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 75 75 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 76 76 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 77 77 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 18 18 13 13 78 78 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 79 79 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 80 80 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 81 81 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 18 18 73 73 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 18 18 74 74 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 75 75 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 76 76 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 78 78 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 79 79 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 80 80 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 81 81 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX

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BOX 18 18 15 15 73 73 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 15 15 74 74 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 75 75 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 76 76 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 78 78 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 79 79 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 80 80 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 81 81 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 91 91 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 92 92 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 93 93 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 94 94 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 96 96 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 97 97 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 98 98 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 99 99 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 12 12 91 91 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 12 12 92 92 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 93 93 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 94 94 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 96 96 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 97 97 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 98 98 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 99 99 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 13 13 91 91 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 13 13 92 92 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 93 93 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 94 94 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 95 95 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 18 18 13 13 96 96 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 97 97 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 98 98 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 99 99 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 18 18 91 91 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 18 18 92 92 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 93 93 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 94 94 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 96 96 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 97 97 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 98 98 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 99 99 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 91 91 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 15 15 92 92 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 93 93 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 94 94 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 96 96 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 97 97 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 98 98 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 99 99 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR9' 18 18 14 15 4 4 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
```

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'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR10' 18 18 11 12 4 4 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
```

```
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 //
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR11' 18 18 14 15 12 12 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
```

```
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR12' 18 18 11 12 12 12 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
```

```
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR13' 18 18 14 15 25 25 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
```

```
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR14' 18 18 11 12 25 25 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
```

```
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR15' 18 18 14 15 43 43 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 2 /
'PERMX'  42 2 2 1 1 1 2 /
'PERMX'  45 3 3 1 1 1 2 /
```

```
'PERMX'  42 4 4 1 1 1 2 /
'PERMX'  38 5 5 1 1 1 2 /
'PERMX'  34 1 1 2 2 1 2 /
'PERMX'  38 2 2 2 2 1 2 /
'PERMX'  42 3 3 2 2 1 2 /
'PERMX'  38 4 4 2 2 1 2 /
'PERMX'  34 5 5 2 2 1 2 /
'PERMX'  30 1 1 3 3 1 2 /
'PERMX'  34 2 2 3 3 1 2 /
'PERMX'  38 3 3 3 3 1 2 /
'PERMX'  34 4 4 3 3 1 2 /
'PERMX'  30 5 5 3 3 1 2 /
'PERMX'  27 1 1 4 4 1 2 /
'PERMX'  30 2 2 4 4 1 2 /
'PERMX'  34 3 3 4 4 1 2 /
'PERMX'  30 4 4 4 4 1 2 /
'PERMX'  27 5 5 4 4 1 2 /
'PERMX'  23 1 1 5 5 1 2 /
'PERMX'  27 2 2 5 5 1 2 /
'PERMX'  30 3 3 5 5 1 2 /
'PERMX'  27 4 4 5 5 1 2 /
'PERMX'  23 5 5 5 5 1 2 /
'PERMX'  21 1 1 6 6 1 2 /
'PERMX'  23 2 2 6 6 1 2 /
'PERMX'  27 3 3 6 6 1 2 /
'PERMX'  23 4 4 6 6 1 2 /
'PERMX'  21 5 5 6 6 1 2 /
'PERMX'  18 1 1 7 7 1 2 /
'PERMX'  21 2 2 7 7 1 2 /
'PERMX'  23 3 3 7 7 1 2 /
'PERMX'  21 4 4 7 7 1 2 /
'PERMX'  18 5 5 7 7 1 2 /
'PERMX'  15 1 1 8 8 1 2 /
'PERMX'  18 2 2 8 8 1 2 /
'PERMX'  21 3 3 8 8 1 2 /
'PERMX'  18 4 4 8 8 1 2 /
'PERMX'  15 5 5 8 8 1 2 /
'PERMX'  12 1 1 9 9 1 2 /
'PERMX'  15 2 2 9 9 1 2 /
'PERMX'  18 3 3 9 9 1 2 /
'PERMX'  15 4 4 9 9 1 2 /
'PERMX'  12 5 5 9 9 1 2 /
'PERMX'  9 1 1 10 10 1 2 /
'PERMX'  12 2 2 10 10 1 2 /
'PERMX'  15 3 3 10 10 1 2 /
'PERMX'  12 4 4 10 10 1 2 /
'PERMX'  9 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR16' 18 18 11 12 43 43 5 10 2 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 2 /
'PERMX'  12 2 2 1 1 1 2 /
'PERMX'  15 3 3 1 1 1 2 /
```

```
'PERMX'  12 4 4 1 1 1 2 /
'PERMX'  9 5 5 1 1 1 2 /
'PERMX'  12 1 1 2 2 1 2 /
'PERMX'  15 2 2 2 2 1 2 /
'PERMX'  18 3 3 2 2 1 2 /
'PERMX'  15 4 4 2 2 1 2 /
'PERMX'  12 5 5 2 2 1 2 /
'PERMX'  15 1 1 3 3 1 2 /
'PERMX'  18 2 2 3 3 1 2 /
'PERMX'  21 3 3 3 3 1 2 /
'PERMX'  18 4 4 3 3 1 2 /
'PERMX'  15 5 5 3 3 1 2 /
'PERMX'  18 1 1 4 4 1 2 /
'PERMX'  21 2 2 4 4 1 2 /
'PERMX'  23 3 3 4 4 1 2 /
'PERMX'  21 4 4 4 4 1 2 /
'PERMX'  18 5 5 4 4 1 2 /
'PERMX'  21 1 1 5 5 1 2 /
'PERMX'  23 2 2 5 5 1 2 /
'PERMX'  27 3 3 5 5 1 2 /
'PERMX'  23 4 4 5 5 1 2 /
'PERMX'  21 5 5 5 5 1 2 /
'PERMX'  23 1 1 6 6 1 2 /
'PERMX'  27 2 2 6 6 1 2 /
'PERMX'  30 3 3 6 6 1 2 /
'PERMX'  27 4 4 6 6 1 2 /
'PERMX'  23 5 5 6 6 1 2 /
'PERMX'  27 1 1 7 7 1 2 /
'PERMX'  30 2 2 7 7 1 2 /
'PERMX'  34 3 3 7 7 1 2 /
'PERMX'  30 4 4 7 7 1 2 /
'PERMX'  27 5 5 7 7 1 2 /
'PERMX'  30 1 1 8 8 1 2 /
'PERMX'  34 2 2 8 8 1 2 /
'PERMX'  38 3 3 8 8 1 2 /
'PERMX'  34 4 4 8 8 1 2 /
'PERMX'  30 5 5 8 8 1 2 /
'PERMX'  34 1 1 9 9 1 2 /
'PERMX'  38 2 2 9 9 1 2 /
'PERMX'  42 3 3 9 9 1 2 /
'PERMX'  38 4 4 9 9 1 2 /
'PERMX'  34 5 5 9 9 1 2 /
'PERMX'  38 1 1 10 10 1 2 /
'PERMX'  42 2 2 10 10 1 2 /
'PERMX'  45 3 3 10 10 1 2 /
'PERMX'  42 4 4 10 10 1 2 /
'PERMX'  38 5 5 10 10 1 2 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
SIGMA 0.8 /
COALNUM 625*0 3125*1 625*0 5625*2 625*0 9375*3 625*0 11875*4 /
BOX   1 25    1 25   1 1 /
ROCKDEN 625*0 /
BOX   1 25    1 25   2 6 /
ROCKDEN 3125*2400 /
BOX   1 25    1 25   7 7 /
ROCKDEN 625*0 /
BOX   1 25    1 25   8 16 /
```

```
ROCKDEN 5625*2400 /
BOX   1 25    1 25   17 17 /
ROCKDEN 625*0 /
BOX   1 25    1 25   18 32 /
ROCKDEN 9375*2400 /
BOX   1 25    1 25   33 33 /
ROCKDEN 625*0 /
BOX   1 25    1 25   34 52 /
ROCKDEN 11875*2400 /
NOECHO
-- *****************
-- * EDIT Section *
-- *****************
EDIT
-- *****************
-- * PROPS Section *
-- *****************
PROPS
FACTLI 0.8 /
CNAMES
CH4
SGFN
--      Sg          Krg         Pcgw
        0.000       0.0000 0.0
        0.025       0.0035 0.0
        0.050       0.0070 0.0
        0.100       0.0180 0.0
        0.150       0.0330 0.0
        0.200       0.0510 0.0
        0.250       0.0700 0.0
        0.300       0.0900 0.0
        0.350       0.1180 0.0
        0.400       0.1470 0.0
        0.450       0.1800 0.0
        0.500       0.2160 0.0
        0.550       0.2530 0.0
        0.600       0.2950 0.0
        0.650       0.3420 0.0
        0.700       0.4010 0.0
        0.750       0.4660 0.0
        0.800       0.5370 0.0
        0.850       0.6270 0.0
        0.900       0.7200 0.0
        0.950       0.8350 0.0
        1.000       1.0000 0.0     /
SWFN
--      Sw          Krw
        0.000       0.0000 0.0
        0.050       0.0006 0.0
        0.100       0.0013 0.0
        0.150       0.0020 0.0
        0.200       0.0070 0.0
        0.250       0.0150 0.0
        0.300       0.0240 0.0
        0.350       0.0350 0.0
        0.400       0.0490 0.0
        0.450       0.0670 0.0
        0.500       0.0880 0.0
```

```
	0.550		0.1160	0.0
	0.600		0.1540	0.0
	0.650		0.2000	0.0
	0.700		0.2510	0.0
	0.750		0.3120	0.0
	0.800		0.3920	0.0
	0.850		0.4900	0.0
	0.900		0.6010	0.0
	0.950		0.7310	0.0
	0.975		0.8140	0.0
	1.000		1.0000	0.0	/
SOF3
	0	0	0
	1	0	0 /
ROCK 1.01325  7.25E-05 /
-- Unit m2/day
DIFFCBM
0.0186 /
0.0186 /
0.0186 /
0.0186 / /
LANGMEXT
46.8885	0.01180736 4.999	0.00616 53.99 0.00355 /
46.8885	0.01180736 4.999	0.00616 53.99 0.00355 /
46.8885	0.01180736 4.999	0.00616 53.99 0.00355 /
46.8885	0.01180736 4.999	0.00616 53.99 0.00355 / /
TEMPVD
250 18.91
500 22.82
718 26.22
935 32.30
1100 34.88 /
TCRIT
-- Unit is K
190.6
304.7
126.15 /
PCRIT
-- Unit is Barsa
46.04208
73.865925
33.999 /
ZCRIT
0.284729476628582
0.274077797373227
0.292047393612482 /
ACF 0.013 0.225 0.040 /
MW 16.043 /
OMEGAA 0.457235529 0.457235529 0.457235529 /
OMEGAB 0.077796074 0.077796074 0.077796074 /
SSHIFT
-0.144265618878948
BIC 0.1 0.1 -0.012 /
PARACHOR 77 /
RPTPROPS
 LANGMEXT DIFFCBM /
-- *******************
-- * REGIONS Section *
```

```
-- ********************
REGIONS
EQUALS
FIPNUM 1 1 25 1 25 1 1 /
FIPNUM 2 1 25 1 25 2 6 /
FIPNUM 1 1 25 1 25 7 7 /
FIPNUM 3 1 25 1 25 8 16 /
FIPNUM 1 1 25 1 25 17 17 /
FIPNUM 4 1 25 1 25 18 32 /
FIPNUM 1 1 25 1 25 33 33 /
FIPNUM 5 1 25 1 25 34 52 /
FIPNUM 1 1 25 1 25 53 53 /
FIPNUM 6 1 25 1 25 54 58 /
FIPNUM 1 1 25 1 25 59 59 /
FIPNUM 7 1 25 1 25 60 68 /
FIPNUM 1 1 25 1 25 69 69 /
FIPNUM 8 1 25 1 25 70 84 /
FIPNUM 1 1 25 1 25 85 85 /
FIPNUM 9 1 25 1 25 86 104 / /
-- ********************
-- * SOLUTION Section *
-- ********************
SOLUTION
INCLUDE
'..\mce_pressure' /
SWAT 625*0.0 3125*0.0 625*0.0 5625*0.0 625*0.0 9375*0.0 625*0.0 11875*0.0 625*0.01
3125*0.01 625*0.01 5625*0.01 625*0.01 9375*0.01 625*0.01 11875*0.01 /
SGAS 625*1.0 3125*1.0 625*1.0 5625*1.0 625*1.0 9375*1.0 625*1.0 11875*1.0 625*0.99
3125*0.99 625*0.99 5625*0.99 625*0.99 9375*0.99 625*0.99 11875*0.99 /
XMF
-- CH4 Component
625*0.0 3125*0.0 625*0.0 5625*0.0 625*0.0 9375*0.0 625*0.0 11875*0.0 625*0.0 3125*0.0
625*0.0 5625*0.0 625*0.0 9375*0.0 625*0.0 11875*0.0
YMF
-- CH4 component
625*1.0 3125*1.0 625*1.0 5625*1.0 625*1.0 9375*1.0 625*1.0 11875*1.0 625*1.0 3125*1.0
625*1.0 5625*1.0 625*1.0 9375*1.0 625*1.0 11875*1.0 -- *******************
-- * SUMMARY Section *
-- *******************
SUMMARY
ELAPSED
EXCEL
FGIP
FGPP
FGPR
FGPT
FRPV
FHPV
FGSAT
FWPR
FWPT
FPR
FPPG
WGIR /
WGIT /
WGPT /
WGPR /
WGPRH /
```

```
WGPTH /
WGPP /
WWPR /
WWPT /
WBHP /
WTHP /
WTHPH /
GPR /
WWGR /
WCMPR MCE-1 1 / /
FCMPR 1 /
WCMPT MCE-1 1 //
FCMPT 1 /
WCHMR MCE-1 1 / /
FCHMR 1 /
WCHMT MCE-1 1 / /
FCHMT 1 /
WXMF MCE-1 1 / /
FXMF 1 /
WYMF MCE-1 1 / /
FYMF 1 /
WZMF MCE-1 1 / /
FZMF 1 /
WCWGPR
MCE-1 1 / /
FCWGPR 1 /
WCWGPT MCE-1 1 / /
FCWGPT 1 /
FCWGPR 1 /
-- ********************
-- * SCHEDULE Section *
-- ********************
SCHEDULE
TUNING / /
2* 500 /
NSTACK 200 /
RPTRST
BASIC=2 BGAS DENG DENW PGAS PRESSURE PSAT SGAS SWAT XMF YMF ZMF /
RPTSCHED
FIP=2 /
RPTPRINT
5* 1 1 /
SAVEEND
WELSPECS
'MCE-1' 1* 13 13 950 WATER / /
COMPORD
'MCE-1' INPUT / /
COMPDAT
'MCE-1' 13 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 56 56 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 64 64 OPEN 0 0 0.1524 3* X/
```

```
'MCE-1' 15 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 64 64 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 77 77 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 95 95 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 95 95 OPEN 0 0 0.1524 3* X/ /
WELSEGS
-- Name     Depth 1    Tlen 1  Type of dep information
'MCE-1'     950.00 0.0         1*     'ABS' /
-- First Last  Branch    Outlet  Length Depth    Diam    Ruff   Area   Vol
-- Seg  Seg    Num       Seg
-- Main Stem
     2     2     1        1      2.5     952.5   0.1524 3E-04  1*   1*
/
     3     3     1        2      10.5    960.5   0.1524 3E-04  1*   1*
/
     4     4     1        3      23.5    973.5   0.1524 3E-04  1*   1*
/
     5     5     1        4      41.5    991.5   0.1524 3E-04  1*   1*
/
-- First Zone
     6     6     2        2      102.5   952.5   0.1524 3E-04  1*   1*
/
     7     7     2        6      202.5   952.5   0.1524 3E-04  1*   1*
/
     8     8     2        7      302.5   952.5   0.1524 3E-04  1*   1*
/
     9     9     2        8      402.5   952.5   0.1524 3E-04  1*   1*
/
     10    10    2        9      502.5   952.5   0.1524 3E-04  1*   1*
/
     11    11    2        10     602.5   952.5   0.1524 3E-04  1*   1*
/
     12    12    2        11     702.5   952.5   0.1524 3E-04  1*   1*
/
-- Second Zone
     13    13    3        3      110.5   960.5   0.1524 3E-04  1*   1*
/
     14    14    3        13     210.5   960.5   0.1524 3E-04  1*   1*
/
     15    15    3        14     310.5   960.5   0.1524 3E-04  1*   1*
/
```

```
        16      16      3               15              410.5           960.5           0.15243E-04  1*       1*
/
        17      17      3               16              510.5           960.5           0.15243E-04  1*       1*
/
        18      18      3               17              610.5           960.5           0.15243E-04  1*       1*
/
        19      19      3               18              710.5           960.5           0.15243E-04  1*       1*
/
-- Third zone
        20      20      4               4               123.5           973.5           0.15243E-04  1*       1*
/
        21      21      4               20              223.5           973.5           0.15243E-04  1*       1*
/
        22      22      4               21              323.5           973.5           0.15243E-04  1*       1*
/
        23      23      4               22              423.5           973.5           0.15243E-04  1*       1*
/
        24      24      4               23              523.5           973.5           0.15243E-04  1*       1*
/
        25      25      4               24              623.5           973.5           0.15243E-04  1*       1*
/
        26      26      4               25              723.5           973.5           0.15243E-04  1*       1*
/
-- Fourth Zone
        27      27      5               5               141.5           991.5           0.15243E-04  1*       1*
/
        28      28      5               27              241.5           991.5           0.15243E-04  1*       1*
/
        29      29      5               28              341.5           991.5           0.15243E-04  1*       1*
/
        30      30      5               29              441.5           991.5           0.15243E-04  1*       1*
/
        31      31      5               30              541.5           991.5           0.15243E-04  1*       1*
/
        32      32      5               31              641.5           991.5           0.15243E-04  1*       1*
/
        33      33      5               32              741.5           991.5           0.15243E-04  1*       1*
/ /
COMPSEGS
-- Name
'MCE-1' /
--      I       J       K       Brn  Start      End             Dirn    End
--                      No   Length    LengthPenet  Range
-- First Zone
        13      13      56      2       2.5             102.5           'X'     13 /
        14      13      56      2       102.5           202.5           'X'     14 /
        15      13      56      2       202.5           302.5           'X'     15 /
        16      13      56      2       302.5           402.5           'X'     16 /
        17      13      56      2       402.5           502.5           'X'     17 /
        18      13      56      2       502.5           602.5           'X'     18 /
        19      13      56      2       602.5           702.5           'X'     19 /
        20      13      56      2       702.5           802.5           'X'     20 /
-- Second Zone
        13      13      64      3       10.5            110.5           'X'     13 /
        14      13      64      3       110.5           210.5           'X'     14 /
        15      13      64      3       210.5           310.5           'X'     15 /
        16      13      64      3       310.5           410.5           'X'     16 /
        17      13      64      3       410.5           510.5           'X'     17 /
```

```
        18      13      64      3       510.5           610.5           'X'     18 /
        19      13      64      3       610.5           710.5           'X'     19 /
        20      13      64      3       710.5           810.5           'X'     20 /
-- Third Zone
        13      13      77      4       23.5            123.5           'X'     13 /
        14      13      77      4       123.5           223.5           'X'     14 /
        15      13      77      4       223.5           323.5           'X'     15 /
        16      13      77      4       323.5           423.5           'X'     16 /
        17      13      77      4       423.5           523.5           'X'     17 /
        18      13      77      4       523.5           623.5           'X'     18 /
        19      13      77      4       623.5           723.5           'X'     19 /
        20      13      77      4       723.5           823.5           'X'     20 /
-- Fourth Zone
        13      13      95      5        41.5           141.5           'X'     13 /
        14      13      95      5       141.5           241.5           'X'     14 /
        15      13      95      5       241.5           341.5           'X'     15 /
        16      13      95      5       341.5           441.5           'X'     16 /
        17      13      95      5       441.5           541.5           'X'     17 /
        18      13      95      5       541.5           641.5           'X'     18 /
        19      13      95      5       641.5           741.5           'X'     19 /
        20      13      95      5       741.5           841.5           'X'     20 / /
TSCRIT 2* 1 /
WCONPROD
'MCE-1' OPEN BHP 5* 6.9 / /
TSTEP
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 29 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31
31 28 31 30 31 30 31 31 30 31 30 31/
END
```

Tight Gas Data File, Multilateral Well With Three Stages of Hydraulic Fracture:

```
-- *******************
-- * Runspec Section *
-- *******************
RUNSPEC
TITLE
TG ML 3 STG
WATER
GAS
METRIC
```

```
FULLIMP
COMPS 1 /
DIMENS
-- NDIVIX NDIVIY NDIVIZ
   25     25     52 /
START
-- DAY MONTH YEAR
   01  JAN   2012 /
TABDIMS 4* 9 /
EQLDIMS 1 /
REGDIMS 5* 4 /
WELLDIMS9 200 /
WSEGDIMS 1 100 5 /
HWELLS
UNIFOUT
UNIFIN
FORMOPTS
HCSCAL /
-- ****************
-- * GRID Section *
-- ****************
GRID
GRIDFILE 2 /
INIT
INCLUDE
'..\mce_grid' /
INCLUDE
'..\mce_props' /
BOX 14 14 11 11 2 2 / PERMX  11/ PERMY  11/ PERMZ  11/ ENDBOX
BOX 14 14 11 11 3 3 / PERMX  13/ PERMY  13/ PERMZ  13/ ENDBOX
BOX 14 14 11 11 5 5 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 6 6 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 12 12 2 2 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 3 3 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 5 5 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 6 6 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 13 13 2 2 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 3 3 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 4 4 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 14 14 13 13 5 5 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 6 6 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 14 14 2 2 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 3 3 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 5 5 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 6 6 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 15 15 2 2 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 3 3 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 5 5 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 6 6 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 8 8 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 9 9 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 10 10 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 11 11 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 13 13 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 14 14 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 15 15 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 16 16 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 12 12 8 8 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
```

BOX 14 14 12 12 9 9 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 10 10 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 11 11 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 13 13 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 14 14 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 15 15 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 16 16 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 13 13 8 8 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 13 13 9 9 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 10 10 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 11 11 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 12 12 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 14 14 13 13 13 13 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 14 14 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 15 15 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 16 16 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 14 14 8 8 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 14 14 9 9 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 10 10 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 11 11 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 13 13 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 14 14 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 15 15 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 16 16 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 8 8 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 15 15 9 9 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 10 10 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 11 11 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 13 13 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 14 14 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 15 15 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 16 16 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 21 21 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 22 22 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 23 23 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 24 24 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 26 26 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 27 27 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 28 28 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 29 29 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 12 12 21 21 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 12 12 22 22 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 23 23 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 24 24 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 26 26 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 27 27 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 28 28 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 29 29 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 13 13 21 21 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 13 13 22 22 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 23 23 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 24 24 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 25 25 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 14 14 13 13 26 26 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 27 27 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 28 28 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 29 29 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 14 14 21 21 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX

BOX 14 14 14 14 22 22 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 23 23 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 24 24 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 26 26 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 27 27 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 28 28 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 29 29 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 21 21 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 15 15 22 22 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 23 23 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 24 24 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 26 26 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 27 27 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 28 28 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 29 29 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 39 39 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 11 11 40 40 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 41 41 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 42 42 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 44 44 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 11 11 45 45 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 11 11 46 46 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 11 11 47 47 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 12 12 39 39 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 12 12 40 40 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 41 41 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 42 42 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 44 44 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 12 12 45 45 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 12 12 46 46 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 12 12 47 47 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 13 13 39 39 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 13 13 40 40 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 41 41 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 42 42 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 43 43 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 14 14 13 13 44 44 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 14 14 13 13 45 45 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 14 14 13 13 46 46 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 14 14 13 13 47 47 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 14 14 14 14 39 39 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 14 14 40 40 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 41 41 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 42 42 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 44 44 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 14 14 14 14 45 45 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 14 14 14 14 46 46 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 14 14 14 14 47 47 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 39 39 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 14 14 15 15 40 40 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 41 41 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 42 42 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 44 44 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 14 14 15 15 45 45 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 14 14 15 15 46 46 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 14 14 15 15 47 47 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT

```
'LGR17' 14 14 14 15 4 4 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
```

```
'LGR18' 14 14 11 12 4 4 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
```

```
'LGR19' 14 14 14 15 12 12 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
```

```
'LGR20' 14 14 11 12 12 12 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
```

```
'LGR21' 14 14 14 15 25 25 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
```

```
'LGR22' 14 14 11 12 25 25 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
```

```
'LGR23' 14 14 14 15 43 43 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
```

```
'LGR24' 14 14 11 12 43 43 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
BOX 16 16 11 11 8 8 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 9 9 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
```

BOX 16 16 11 11 10 10 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 11 11 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 13 13 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 16 16 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 15 15 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 16 16 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 12 12 8 8 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 12 12 9 9 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 10 10 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 11 11 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 13 13 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 16 16 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 15 15 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 16 16 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 13 13 8 8 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 13 13 9 9 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 10 10 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 11 11 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 12 12 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 16 16 13 13 13 13 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 16 16 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 15 15 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 16 16 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 16 16 8 8 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 16 16 9 9 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 10 10 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 11 11 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 13 13 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 16 16 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 15 15 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 16 16 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 8 8 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 15 15 9 9 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 10 10 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 11 11 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 13 13 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 16 16 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 15 15 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 16 16 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 21 21 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 22 22 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 23 23 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 24 24 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 26 26 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 27 27 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 28 28 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 29 29 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 12 12 21 21 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 12 12 22 22 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 23 23 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 24 24 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 26 26 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 27 27 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 28 28 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 29 29 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 13 13 21 21 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 13 13 22 22 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 23 23 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX

BOX 16 16 13 13 24 24 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 25 25 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 16 16 13 13 26 26 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 27 27 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 28 28 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 29 29 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 16 16 21 21 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 16 16 22 22 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 23 23 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 24 24 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 26 26 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 27 27 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 28 28 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 29 29 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 21 21 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 15 15 22 22 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 23 23 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 24 24 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 26 26 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 27 27 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 28 28 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 29 29 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 39 39 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 11 11 40 40 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 41 41 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 42 42 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 44 44 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 11 11 45 45 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 11 11 46 46 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 11 11 47 47 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 12 12 39 39 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 12 12 40 40 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 41 41 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 42 42 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 44 44 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 12 12 45 45 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 12 12 46 46 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 12 12 47 47 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 13 13 39 39 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 13 13 40 40 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 41 41 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 42 42 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 43 43 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 16 16 13 13 44 44 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 16 16 13 13 45 45 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 16 16 13 13 46 46 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 16 16 13 13 47 47 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 16 16 16 16 39 39 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 16 16 40 40 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 41 41 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 42 42 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 44 44 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 16 16 16 16 45 45 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 16 16 16 16 46 46 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 16 16 16 16 47 47 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 39 39 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 16 16 15 15 40 40 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 41 41 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX

```
BOX 16 16 15 15 42 42 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 44 44 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 16 16 15 15 45 45 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 16 16 15 15 46 46 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 16 16 15 15 47 47 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR9' 16 16 14 15 4 4 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
```

```
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR10' 16 16 11 12 4 4 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
```

```
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR11' 16 16 14 15 12 12 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
```

```
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR12' 16 16 11 12 12 12 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
```

```
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR13' 16 16 14 15 25 25 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
```

```
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR14' 16 16 11 12 25 25 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
```

```
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR15' 16 16 14 15 43 43 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
```

```
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR16' 16 16 11 12 43 43 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
```

```
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
BOX 18 18 11 11 8 8 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 9 9 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 10 10 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 11 11 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 13 13 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 14 14 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 15 15 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 16 16 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 12 12 8 8 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 12 12 9 9 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 10 10 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 11 11 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 13 13 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 14 14 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 15 15 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 16 16 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 13 13 8 8 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 13 13 9 9 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 10 10 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 11 11 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 12 12 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 18 18 13 13 13 13 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 14 14 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 15 15 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 16 16 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 18 18 8 8 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 18 18 9 9 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 10 10 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 11 11 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 13 13 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 14 14 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 15 15 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 16 16 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 8 8 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 15 15 9 9 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 10 10 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 11 11 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 13 13 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 14 14 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 15 15 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 16 16 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 21 21 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 22 22 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 23 23 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 24 24 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 26 26 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 27 27 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 28 28 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 29 29 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 12 12 21 21 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 12 12 22 22 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 23 23 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 24 24 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
```

BOX 18 18 12 12 26 26 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 27 27 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 28 28 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 29 29 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 13 13 21 21 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 13 13 22 22 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 23 23 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 24 24 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 25 25 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 18 18 13 13 26 26 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 27 27 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 28 28 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 29 29 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 18 18 21 21 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 18 18 22 22 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 23 23 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 24 24 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 26 26 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 27 27 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 28 28 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 29 29 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 21 21 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 15 15 22 22 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 23 23 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 24 24 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 26 26 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 27 27 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 28 28 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 29 29 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 39 39 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 11 11 40 40 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 41 41 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 42 42 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 44 44 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 11 11 45 45 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 11 11 46 46 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 11 11 47 47 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 12 12 39 39 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 12 12 40 40 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 41 41 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 42 42 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 44 44 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 12 12 45 45 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 12 12 46 46 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 12 12 47 47 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 13 13 39 39 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 13 13 40 40 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 41 41 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 42 42 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 43 43 / PERMX 50/ PERMY 50/ PERMZ 50/ ENDBOX
BOX 18 18 13 13 44 44 / PERMX 45/ PERMY 45/ PERMZ 45/ ENDBOX
BOX 18 18 13 13 45 45 / PERMX 39/ PERMY 39/ PERMZ 39/ ENDBOX
BOX 18 18 13 13 46 46 / PERMX 30/ PERMY 30/ PERMZ 30/ ENDBOX
BOX 18 18 13 13 47 47 / PERMX 15/ PERMY 15/ PERMZ 15/ ENDBOX
BOX 18 18 18 18 39 39 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 18 18 40 40 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 41 41 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 42 42 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX

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BOX 18 18 18 18 44 44 / PERMX 27/ PERMY 27/ PERMZ 27/ ENDBOX
BOX 18 18 18 18 45 45 / PERMX 23/ PERMY 23/ PERMZ 23/ ENDBOX
BOX 18 18 18 18 46 46 / PERMX 18/ PERMY 18/ PERMZ 18/ ENDBOX
BOX 18 18 18 18 47 47 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 39 39 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
BOX 18 18 15 15 40 40 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 41 41 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 42 42 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 44 44 / PERMX 13/ PERMY 13/ PERMZ 13/ ENDBOX
BOX 18 18 15 15 45 45 / PERMX 11/ PERMY 11/ PERMZ 11/ ENDBOX
BOX 18 18 15 15 46 46 / PERMX 9/ PERMY 9/ PERMZ 9/ ENDBOX
BOX 18 18 15 15 47 47 / PERMX 4/ PERMY 4/ PERMZ 4/ ENDBOX
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR1' 18 18 14 15 4 4 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
```

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'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR2' 18 18 11 12 4 4 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
```

```
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 //
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR3' 18 18 14 15 12 12 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
```

```
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR4' 18 18 11 12 12 12 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
```

```
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR5' 18 18 14 15 25 25 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
```

```
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR6' 18 18 11 12 25 25 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
```

```
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR7' 18 18 14 15 43 43 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  38 1 1 1 1 1 1 /
'PERMX'  42 2 2 1 1 1 1 /
'PERMX'  45 3 3 1 1 1 1 /
'PERMX'  42 4 4 1 1 1 1 /
'PERMX'  38 5 5 1 1 1 1 /
'PERMX'  34 1 1 2 2 1 1 /
'PERMX'  38 2 2 2 2 1 1 /
'PERMX'  42 3 3 2 2 1 1 /
'PERMX'  38 4 4 2 2 1 1 /
'PERMX'  34 5 5 2 2 1 1 /
'PERMX'  30 1 1 3 3 1 1 /
'PERMX'  34 2 2 3 3 1 1 /
'PERMX'  38 3 3 3 3 1 1 /
'PERMX'  34 4 4 3 3 1 1 /
'PERMX'  30 5 5 3 3 1 1 /
'PERMX'  27 1 1 4 4 1 1 /
'PERMX'  30 2 2 4 4 1 1 /
'PERMX'  34 3 3 4 4 1 1 /
'PERMX'  30 4 4 4 4 1 1 /
'PERMX'  27 5 5 4 4 1 1 /
'PERMX'  23 1 1 5 5 1 1 /
'PERMX'  27 2 2 5 5 1 1 /
'PERMX'  30 3 3 5 5 1 1 /
'PERMX'  27 4 4 5 5 1 1 /
'PERMX'  23 5 5 5 5 1 1 /
'PERMX'  21 1 1 6 6 1 1 /
'PERMX'  23 2 2 6 6 1 1 /
'PERMX'  27 3 3 6 6 1 1 /
'PERMX'  23 4 4 6 6 1 1 /
'PERMX'  21 5 5 6 6 1 1 /
'PERMX'  18 1 1 7 7 1 1 /
'PERMX'  21 2 2 7 7 1 1 /
'PERMX'  23 3 3 7 7 1 1 /
'PERMX'  21 4 4 7 7 1 1 /
'PERMX'  18 5 5 7 7 1 1 /
'PERMX'  15 1 1 8 8 1 1 /
'PERMX'  18 2 2 8 8 1 1 /
'PERMX'  21 3 3 8 8 1 1 /
'PERMX'  18 4 4 8 8 1 1 /
'PERMX'  15 5 5 8 8 1 1 /
```

```
'PERMX'  12 1 1 9 9 1 1 /
'PERMX'  15 2 2 9 9 1 1 /
'PERMX'  18 3 3 9 9 1 1 /
'PERMX'  15 4 4 9 9 1 1 /
'PERMX'  12 5 5 9 9 1 1 /
'PERMX'  9 1 1 10 10 1 1 /
'PERMX'  12 2 2 10 10 1 1 /
'PERMX'  15 3 3 10 10 1 1 /
'PERMX'  12 4 4 10 10 1 1 /
'PERMX'  9 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ / /
ENDFIN
CARFIN
-- Name I1 I2 J1 J2 K1 K2 NX NY NZ NWMAX PARENT
'LGR8' 18 18 11 12 43 43 5 10 1 1* GLOBAL /
NXFIN 5 /
NYFIN 5 5 /
EQUALS
'PERMX'  9 1 1 1 1 1 1 /
'PERMX'  12 2 2 1 1 1 1 /
'PERMX'  15 3 3 1 1 1 1 /
'PERMX'  12 4 4 1 1 1 1 /
'PERMX'  9 5 5 1 1 1 1 /
'PERMX'  12 1 1 2 2 1 1 /
'PERMX'  15 2 2 2 2 1 1 /
'PERMX'  18 3 3 2 2 1 1 /
'PERMX'  15 4 4 2 2 1 1 /
'PERMX'  12 5 5 2 2 1 1 /
'PERMX'  15 1 1 3 3 1 1 /
'PERMX'  18 2 2 3 3 1 1 /
'PERMX'  21 3 3 3 3 1 1 /
'PERMX'  18 4 4 3 3 1 1 /
'PERMX'  15 5 5 3 3 1 1 /
'PERMX'  18 1 1 4 4 1 1 /
'PERMX'  21 2 2 4 4 1 1 /
'PERMX'  23 3 3 4 4 1 1 /
'PERMX'  21 4 4 4 4 1 1 /
'PERMX'  18 5 5 4 4 1 1 /
'PERMX'  21 1 1 5 5 1 1 /
'PERMX'  23 2 2 5 5 1 1 /
'PERMX'  27 3 3 5 5 1 1 /
'PERMX'  23 4 4 5 5 1 1 /
'PERMX'  21 5 5 5 5 1 1 /
'PERMX'  23 1 1 6 6 1 1 /
'PERMX'  27 2 2 6 6 1 1 /
'PERMX'  30 3 3 6 6 1 1 /
'PERMX'  27 4 4 6 6 1 1 /
'PERMX'  23 5 5 6 6 1 1 /
'PERMX'  27 1 1 7 7 1 1 /
'PERMX'  30 2 2 7 7 1 1 /
'PERMX'  34 3 3 7 7 1 1 /
'PERMX'  30 4 4 7 7 1 1 /
'PERMX'  27 5 5 7 7 1 1 /
'PERMX'  30 1 1 8 8 1 1 /
'PERMX'  34 2 2 8 8 1 1 /
'PERMX'  38 3 3 8 8 1 1 /
'PERMX'  34 4 4 8 8 1 1 /
'PERMX'  30 5 5 8 8 1 1 /
```

```
'PERMX'  34 1 1 9 9 1 1 /
'PERMX'  38 2 2 9 9 1 1 /
'PERMX'  42 3 3 9 9 1 1 /
'PERMX'  38 4 4 9 9 1 1 /
'PERMX'  34 5 5 9 9 1 1 /
'PERMX'  38 1 1 10 10 1 1 /
'PERMX'  42 2 2 10 10 1 1 /
'PERMX'  45 3 3 10 10 1 1 /
'PERMX'  42 4 4 10 10 1 1 /
'PERMX'  38 5 5 10 10 1 1 / /
COPY PERMX PERMY / PERMX PERMZ //
ENDFIN
NOECHO
-- *****************
-- * EDIT Section *
-- *****************
EDIT
-- *****************
-- * PROPS Section *
-- *****************
PROPS
-- Compositional
CNAMES
CH4 /
PROPS
SWFN
-- Sw  krw    Pc
0.2   0      49.675
0.25  0      21.8172
0.3   0      12.07
0.35  0      8.0387
0.4   0.001  5.9155
0.45  0.003  4.6522
0.5   0.007  3.832
0.55  0.016  3.26392
0.6   0.031  2.8496
0.65  0.056  2.5349
0.7   0.095  2.2872
0.75  0.153  2.0859
0.8   0.237  1.917
0.85  0.354  1.770862
0.9   0.512  1.637557 /
SGFN
-- Sg  krg    Pc
0.1   0      1.637557
0.15  0.001  1.770862
0.2   0.008  1.917
0.25  0.024  2.0859
0.3   0.052  2.2872
0.35  0.094  2.5349
0.4   0.15   2.8496
0.45  0.219  3.26392
0.5   0.301  3.832
0.55  0.394  4.6522
0.6   0.498  5.9155
0.65  0.611  8.0387
0.7   0.732  12.07
0.75  0.862  21.8172
```

```
0.8      1         49.675 /
SOF3
          0         0         0
          1         0         0 /
ROCK  1.01325  0.00001 /
TEMPVD
250 18.91
500 22.82
718 26.22
935 32.30
1100 34.88 /
TCRIT
-- Unit is K
190.6
304.7
126.15/
PCRIT
-- Unit is Barsa
46.04208
73.865925
33.999/
ZCRIT
0.284729476628582
0.274077797373227
0.292047393612482/
ACF 0.013 0.225 0.040/
MW 16.043 /
OMEGAA 0.457235529 0.457235529 0.457235529/
OMEGAB 0.077796074 0.077796074 0.077796074/
SSHIFT -0.144265618878948/
BIC 0.1 0.1 -0.012 /
PARACHOR 77 78 41 /
RPTPROPS
 LANGMEXT DIFFCBM /
-- ********************
-- * REGIONS Section *
-- ********************
REGIONS

EQUALS
FIPNUM 1 1 25 1 25 1 1 /
FIPNUM 2 1 25 1 25 2 6 /
FIPNUM 1 1 25 1 25 7 7 /
FIPNUM 3 1 25 1 25 8 16 /
FIPNUM 1 1 25 1 25 17 17 /
FIPNUM 4 1 25 1 25 18 32 /
FIPNUM 1 1 25 1 25 33 33 /
FIPNUM 5 1 25 1 25 34 52 / /
-- ********************
-- * SOLUTION Section *
-- ********************
SOLUTION
INCLUDE
'..\mce_pressure' /
SWAT 625*0.01 3125*0.01 625*0.01 5625*0.01 625*0.01 9375*0.01 625*0.01 11875*0.01 /
SGAS 625*0.99 3125*0.99 625*0.99 5625*0.99 625*0.99 9375*0.99 625*0.99 11875*0.99 /
XMF
-- CH4 Component
```

```
625*0.0 3125*0.0 625*0.0 5625*0.0 625*0.0 9375*0.0 625*0.0 11875*0.0
-- mole fractions in gas phase
YMF
-- CH4 component
625*1.0 3125*1.0 625*1.0 5625*1.0 625*1.0 9375*1.0 625*1.0 11875*1.0
-- *******************
-- * SUMMARY Section *
-- *******************
SUMMARY
ELAPSED
EXCEL
FGIP
FGPP
FGPR
FGPT
FRPV
FHPV
FGSAT
FWPR
FWPT
FPR
FPPG
WGIR /
WGIT /
WGPT /
WGPR /
WGPRH /
WGPTH /
WGPP /
WWPR /
WWPT /
WBHP /
WTHP /
WTHPH /
GPR /
WWGR /
WCMPR MCE-1 1 / /
FCMPR 1 /
WCMPT MCE-1 1 / /
FCMPT 1 /
WCHMR MCE-1 1 / /
FCHMR 1 /
WCHMT MCE-1 1 / /
FCHMT 1 /
WXMF MCE-1 1 / /
FXMF 1 /
WYMF MCE-1 1 / /
FYMF 1 /
WZMF MCE-1 1 / /
FZMF 1 /
WCWGPR MCE-1 1 / /
FCWGPR 1 /
WCWGPT MCE-1 1 / /
FCWGPT 1 /
-- Methan production rate
FCWGPR 1 /
-- *********************
-- * SCHEDULE Section *
```

```
-- ********************
SCHEDULE
--CVCRIT
--3* 400 /
TUNING / / 2* 400 /
NSTACK 200 /
RPTRST
BASIC=2 BGAS DENG DENW PGAS PRESSURE PSAT SGAS SWAT XMF YMF ZMF /
RPTSCHED
FIP=2 /
RPTPRINT
5* 1 1 /
SAVEEND
WELSPECS
'MCE-1' 1* 13 13 950 WATER / /
COMPORD
'MCE-1' INPUT / /
COMPDAT
'MCE-1' 13 13 4 4 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 4 4 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 4 4 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 4 4 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 4 4 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 4 4 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 4 4 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 4 4 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 12 12 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 12 12 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 12 12 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 12 12 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 12 12 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 12 12 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 12 12 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 12 12 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 25 25 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 25 25 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 25 25 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 25 25 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 25 25 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 25 25 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 25 25 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 25 25 OPEN 0 0 0.1524 3* X/
'MCE-1' 13 13 43 43 OPEN 0 0 0.1524 3* X/
'MCE-1' 14 13 43 43 OPEN 0 0 0.1524 3* X/
'MCE-1' 15 13 43 43 OPEN 0 0 0.1524 3* X/
'MCE-1' 16 13 43 43 OPEN 0 0 0.1524 3* X/
'MCE-1' 17 13 43 43 OPEN 0 0 0.1524 3* X/
'MCE-1' 18 13 43 43 OPEN 0 0 0.1524 3* X/
'MCE-1' 19 13 43 43 OPEN 0 0 0.1524 3* X/
'MCE-1' 20 13 43 43 OPEN 0 0 0.1524 3* X/ /
WELSEGS
-- Name       Depth 1      Tlen 1  Type of dep information
'MCE-1'       950.00  0.0          1*       'ABS' /
-- First Last  Branch      Outlet  Length  Depth      Diam      Ruff       Area   Vol
-- Seg  Seg    Num         Seg
-- Main Stem
      2     2      1            1           2.5          952.5        0.1524  3E-04  1*     1*
/
```

```
	3	3	1	2	10.5	960.5	0.15243E-04	1*	1*
/
	4	4	1	3	23.5	973.5	0.15243E-04	1*	1*
/
	5	5	1	4	41.5	991.5	0.15243E-04	1*	1*
/
-- First Zone
	6	6	2	2	102.5	952.5	0.15243E-04	1*	1*
/
	7	7	2	6	202.5	952.5	0.15243E-04	1*	1*
/
	8	8	2	7	302.5	952.5	0.15243E-04	1*	1*
/
	9	9	2	8	402.5	952.5	0.15243E-04	1*	1*
/
	10	10	2	9	502.5	952.5	0.15243E-04	1*	1*
/
	11	11	2	10	602.5	952.5	0.15243E-04	1*	1*
/
	12	12	2	11	702.5	952.5	0.15243E-04	1*	1*
/
-- Second Zone
	13	13	3	3	110.5	960.5	0.15243E-04	1*	1*
/
	14	14	3	13	210.5	960.5	0.15243E-04	1*	1*
/
	15	15	3	14	310.5	960.5	0.15243E-04	1*	1*
/
	16	16	3	15	410.5	960.5	0.15243E-04	1*	1*
/
	17	17	3	16	510.5	960.5	0.15243E-04	1*	1*
/
	18	18	3	17	610.5	960.5	0.15243E-04	1*	1*
/
	19	19	3	18	710.5	960.5	0.15243E-04	1*	1*
/
-- Third zone
	20	20	4	4	123.5	973.5		0.15243E-04	1*
	1* /
	21	21	4	20	223.5	973.5		0.15243E-04	1*
	1* /
	22	22	4	21	323.5	973.5	0.15243E-04	1*	1*
/
	23	23	4	22	423.5	973.5	0.15243E-04	1*	1*
/
	24	24	4	23	523.5	973.5	0.15243E-04	1*	1*
/
	25	25	4	24	623.5	973.5	0.15243E-04	1*	1*
/
	26	26	4	25	723.5	973.5	0.15243E-04	1*	1*
/
-- Fourth Zone
	27	27	5	5	141.5	991.5	0.15243E-04	1*	1*
/
	28	28	5	27	241.5	991.5	0.15243E-04	1*	1*
/
	29	29	5	28	341.5	991.5	0.15243E-04	1*	1*
/
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        30      30      5               29              441.5           991.5           0.15243E-04  1*       1*
/
        31      31      5               30              541.5           991.5           0.15243E-04  1*       1*
/
        32      32      5               31              641.5           991.5           0.15243E-04  1*       1*
/
        33      33      5               32              741.5           991.5           0.15243E-04  1*       1*
/ /
COMPSEGS
-- Name
'MCE-1' /
--      I       J       K       Brn  Start      End             Dirn    End
--                      No   Length    LengthPenet  Range
-- First Zone
        13      13      4       2       2.5             102.5           'X'     13 /
        14      13      4       2       102.5           202.5           'X'     14 /
        15      13      4       2       202.5           302.5           'X'     15 /
        16      13      4       2       302.5           402.5           'X'     16 /
        17      13      4       2       402.5           502.5           'X'     17 /
        18      13      4       2       502.5           602.5           'X'     18 /
        19      13      4       2       602.5           702.5           'X'     19 /
        20      13      4       2       702.5           802.5           'X'     20 /
-- Second Zone
        13      13      12      3       10.5            110.5           'X'     13 /
        14      13      12      3       110.5           210.5           'X'     14 /
        15      13      12      3       210.5           310.5           'X'     15 /
        16      13      12      3       310.5           410.5           'X'     16 /
        17      13      12      3       410.5           510.5           'X'     17 /
        18      13      12      3       510.5           610.5           'X'     18 /
        19      13      12      3       610.5           710.5           'X'     19 /
        20      13      12      3       710.5           810.5           'X'     20 /
-- Third Zone
        13      13      25      4       23.5            123.5           'X'     13 /
        14      13      25      4       123.5           223.5           'X'     14 /
        15      13      25      4       223.5           323.5           'X'     15 /
        16      13      25      4       323.5           423.5           'X'     16 /
        17      13      25      4       423.5           523.5           'X'     17 /
        18      13      25      4       523.5           623.5           'X'     18 /
        19      13      25      4       623.5           723.5           'X'     19 /
        20      13      25      4       723.5           823.5           'X'     20 /
-- Fourth Zone
        13      13      43      5        41.5           141.5           'X'     13 /
        14      13      43      5       141.5           241.5           'X'     14 /
        15      13      43      5       241.5           341.5           'X'     15 /
        16      13      43      5       341.5           441.5           'X'     16 /
        17      13      43      5       441.5           541.5           'X'     17 /
        18      13      43      5       541.5           641.5           'X'     18 /
        19      13      43      5       641.5           741.5           'X'     19 /
        20      13      43      5       741.5           841.5           'X'     20 / /
TSCRIT 2* 1 /
WCONPROD
'MCE-1' OPEN BHP 5* 6.9 / /
TSTEP
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