BEFORE THE
PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Complaint of	)	
McLeodUSA Telecommunications	)	
Services, Inc., against Qwest Corporation	)	Docket No. 06-2249-01
for Enforcement of Commission-	)	
Approved Interconnection Agreement.	)	
	)	

DIRECT TESTIMONY

OF

SIDNEY L. MORRISON

On behalf of

McLeodUSA Telecommunications Services, Inc.

April 14, 2006

PUBLIC VERSION

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I. INTRODUCTION AND QUALIFICATIONS

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, AND OCCUPATION.

A. My name is Sidney L Morrison. My business address is 550 Sunset Lakes Boulevard SW, Sunset Beach, North Carolina 28468-4900. I am currently employed by QSI Consulting, Inc. (QSI) as a Senior Consultant and the Firm's Chief Engineer.

Q. PLEASE SUMMARIZE YOUR PROFESSIONAL EXPERIENCE.

A. I have over 30 years of experience in the telecommunications industry. I began my telecommunications career in 1966 in Charlotte, North Carolina as a cable helper for Southern Bell Telephone and Telegraph. Southern Bell was an incumbent local exchange carrier (ILEC) managing numerous exchanges throughout North Carolina. My duties involved splicing underground, buried and aerial cable. I also worked as a switching technician and special services technician.

Beginning in August of 1970, I transferred to Mountain Bell in Denver, Colorado as a central office technician. In 1972, I was promoted to supervise main distribution frame (MDF) operations. My duties included supervising the installation of Plain Old Telephone Service (or POTS), Special Services, Central Office area cuts, MDF replacements and many other projects. In 1980 and 1981, I performed time and motion studies for service provisioning on approximately 75 of Mountain Bell's MDF operations. These time and motion studies included components for running jumpers and administrative activities on each of these frames. From 1983 until 1986, I was the switching control center and MDF subject matter expert for US West. In this position, I was responsible for staff level support for service provisioning and maintenance, including the development of enhancements for operational support systems (OSS) supporting these activities. From 1986 until 1993, I was responsible for the US West Automatic Message Accounting (AMA) teleprocessing organization for the fourteen state US West region.

In 1993, I retired from US West and began contract engineering work and consulting. In 1995, I took an assignment in Kuala Lumpur, Malaysia as a contractor/consultant with a team of specialists to build a competitive local exchange carrier (CLEC) network consisting of a Global System for Mobil (GSM) communications services, fixed network services, cable television (CATV) services and data services integrated into a common transport backbone. One of my primary responsibilities in Malaysia was organizing and implementing a field operations group (FOG) that was responsible for the installation and maintenance of all fixed network and CATV services. My responsibilities included the planning, organizing, staffing and implementation of the FOG, including an installation and maintenance group, assignment center, dispatch center, test center and a repair center. I also had the responsibility of developing business processes and OSS system requirements for provisioning and maintenance supporting the FOG. After launching the FOG, I managed the day-to-day operations of the department, ultimately refining the organization into an ISO 9002[1] qualified organization. In January 1997, the Binariang Maxis FOG became the first certified ISO 9002 service organization in Southeast Asia.

I returned from Malaysia in June of 1997 and worked for approximately two years as a contract outside plant/central office equipment (OSP/COE) engineer, and trained new engineers for US West collocation efforts.

[1] International Organization Standards, ISO 9002 is the standard set of requirements for an organization whose business processes range from, production, installation and servicing.

In May 1999, I accepted a contract in Switzerland building a new CLEC under the market name of diAx telecommunications. My responsibilities involved project management to establish OSS supporting all wireless, wireline, and data services offered by diAx. I also provided consulting services developing business processes supporting the establishment of the diAx Internet Provider Operations Center (IPOC) and diAx data services offerings. I established system requirements based on IPOC business processes for fault management systems, provisioning systems, capacity inventory systems, customer service inventory systems and workflow engines controlling overall maintenance and provisioning processes.

In December 2000, I returned from Switzerland and began working for QSI Consulting Inc. as a Senior Consultant. I provide telecommunications companies with engineering advice and counsel for direct network planning, management and cost-of-service support. My specific areas of expertise include network engineering, facility planning, project management, business system applications, incremental cost research and issues related to the provision of unbundled network elements.

Attached to my testimony as Exhibit SLM-1 is a copy of my *Curriculum Vitae*, which contains a comprehensive description of my work experience and educational background.

Q. DO YOU HAVE DIRECT EXPERIENCE IN PLANNING AND ENGINEERING COLLOCATIONS FOR US WEST (N/K/A QWEST) CENTRAL OFFICES?[2]

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[2] The FCC approved the acquisition of US West by Qwest in March of 2000.

A. Yes. As mentioned above and in Exhibit SLM-1, I worked for 22 years in US West's Network Management Group. In 1997, I contracted to US West as a central office engineer, where I was responsible for collocation planning and engineering in the common systems planning and engineering center. My duties in this capacity included Central Office Equipment Facility Management (COEFM) collocation design, floor space planning and allocation, power engineering, tie cable engineering, collocation cage placement, Heating Ventilation and Air Conditioning (HVAC) and collocation AC power and overhead lighting. During this time frame, collocation business processes were being developed, and I provided input to the development of engineering business processes used in the implementation of collocation engineering practices and procedures within the US West Common Systems Planning and Engineering Center (CSPEC) organization.

During my time as a central office engineer, I acquired first-hand experience in observing the power usage trends of Qwest (then US West) central offices and recommending power augments for those offices based on my observations and sound engineering principles and practices. The proper planning and sizing of DC power components in the central office is crucial to proper resolution of the disputed issues in this proceeding, and I can speak to this issue based on direct working experience in planning and sizing the power requirements of a central office.

Q. HAVE YOU PREVIOUSLY TESTIFIED AS AN EXPERT WITNESS ON COLLOCATION POWER ISSUES BEFORE OTHER STATE REGULATORY COMMISSIONS?

A. Yes. Most recently, I submitted expert testimony providing the engineering framework supporting McLeodUSA's complaint in Iowa Case FCU-06-20, which is a complaint case similar to this one. Before that, I sponsored testimony before the Indiana Utility Regulatory Commission (Cause No. 42398), in which I described the results of the collocation power audits I performed for a CLEC client in that state and explained that the CLEC did not, and indeed could not, utilize the amount of power for which it was being billed by AT&T/SBC Indiana. I wrote a similar audit report for a client for Public Utilities Commission of Ohio Docket No. 03-802-TP-CSS. The issues in this docket are identical to those in the companion Iowa docket and very similar to those I have testified to in other regions, in that in all instances, the incumbent local exchange carrier is billing the CLEC for an amount of power that the CLEC does not, and indeed could not, use. Throughout my testimony, I will reference positions taken on these issues by Qwest in Iowa because it is very likely that Qwest will take identical positions in its testimony here.

II. PURPOSE AND SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. QSI was retained by McLeodUSA to support the cost, policy and engineering framework underlying McLeodUSA's complaint against Qwest regarding the misapplication and excessiveness of Qwest's Direct Current (DC) power plant charges. Michael Starkey, from QSI, is filing testimony simultaneous with mine that will address the policy and cost framework, and my testimony addresses the engineering framework.

The purpose of my testimony is to, first, provide a general overview of electricity and power concepts and terminology that are important to a complete understanding of the disputed issues. Second, I will provide descriptions and diagrams of the components of a central office power infrastructure, with an explanation of how these components are engineered and sized. Once the components of the central office power infrastructure are addressed, I will identify the components of the central office to which McLeodUSA's complaint applies – DC power plant –and explain from an engineering perspective why: (a) it is inappropriate from an engineering perspective for Qwest to bill McLeodUSA for DC power plant usage on an "as ordered" basis instead of on an "as consumed" basis, (b) there is nothing improper about ordering more power capacity in the DC power distribution than the CLEC can or will actually use, (c) Qwest power engineers would not augment the power plant of the central office based on individual power-related orders from McLeodUSA, other CLECs, or Qwest, and (d) why Qwest's power reduction offering is not a suitable alternative to billing DC power plant based on McLeodUSA's actual usage.

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS.

A. My testimony concludes that McLeodUSA's recommended application of the DC power plant usage charge is consistent with the manner in which DC power plant is sized, and in turn, the manner in which Qwest incurs power plant costs. As my testimony will demonstrate, it is critical to distinguish between power *plant* facilities, which are shared among all power users in a particular central office and sized on an "as consumed" basis, from power *distribution* facilities, which are dedicated to a particular power user and sized on an "as ordered" basis. I will show that McLeodUSA makes the proper distinction between those two power-related infrastructure components by recommending that a power plant usage rate element be applied on an "as consumed" basis, while power distribution facilities may be recovered on an "as ordered" basis. Further, my testimony concludes that since the DC power plant facilities are sized according to forecasted actual peak *usage* of all users in a central office, there is no relationship between *orders* for power by CLECs and DC power plant augment/investment. This is a very important point because Qwest will undoubtedly submit testimony in this proceeding claiming that DC power plant is sized based on CLEC power *orders* – not forecasted actual peak power usage. My direct testimony will demonstrate, however, that Qwest's position is in direct conflict with Qwest's own engineering manuals and guidelines as well as inconsistent with the positions taken by Qwest in testimony on DC power issues elsewhere. My testimony will also show that the Commission should interpret the DC power measurement amendment, and, in turn, require Qwest to apply the DC power plant usage charge, in a manner consistent with the way in which the DC power plant is sized (or the way in which Qwest incurs DC power plant costs). My testimony will demonstrate that McLeodUSA's recommendation adheres to this principle and Qwest's recommendation does not. Finally, I will explain that that Qwest's Power Reduction is an unnecessary, risky and costly process that causes more problems instead of solving the existing problem related to Qwest's application of the DC power plant usage charge. As such, it is not a satisfactory alternative for addressing the problem of over-billed power charges when compared to a proper interpretation of the contract amendment at issue in this proceeding which should provide for "usage based" billing.

III. CENTRAL OFFICE POWER OVERVIEW

A. General Power Concepts and Their Application to Telecommunications Equipment

Q. IS A GENERAL UNDERSTANDING OF ELECTRICITY AND POWER CONCEPTS AND TERMINOLOGY IMPORTANT TO THIS PROCEEDING?

A. Yes. While I am an engineer by trade, my testimony will use layman's terms and descriptions when possible to limit the use of industry and technical jargon. However, there are certain technical terms and engineering concepts related to electricity and power that are important for a full understanding of the issues in dispute in this proceeding. Accordingly, I will provide a quick overview of the "building blocks" of power and then explain how these terms and concepts are relevant within the context of telecommunications equipment and collocation power. For ease of reference, I have attached to my testimony Exhibit SLM-2, which is a glossary of technical terms I use in my testimony.

Q. WHAT IS POWER AND HOW IS IT MEASURED?

A. In its most basic form, power is the rate at which work is done – whether that power is electrical or mechanical. Work is done whenever a force causes motion, and work is not done when a force does not cause motion. For instance, if a mechanical force is used to lift or move a weight, the force causes motion, and therefore, work is done. However, the force of a compressed spring acting between two fixed objects does not cause motion and, therefore, does not constitute work.

As it relates to electricity, electrical force is measured in voltage, which forces current to flow (i.e., electrons to move) in a closed circuit. When voltage (or force) exists between two points and current flows, then work is done. However, when voltage exists between two points, but current cannot flow, no work is done. This is analogous to the compressed spring example above that produced no motion.

When work is done by voltage causing electrons to move, the instantaneous rate at which this work is done is called the electrical power rate, and its unit of measure is the watt. The relationship between power, voltage and current can be expressed by the following equation: *Power = Voltage x Current*; where power is measured in watts, voltage is measured in volts and current is measured in amperes.

Q. PLEASE DESCRIBE THE FUNDAMENTAL DIFFERENCE BETWEEN ALTERNATING CURRENT (AC) VERSUS DIRECT CURRENT (DC).

A. Alternating current (AC) is a specific type of electric current in which the direction of the current's flow is reversed, or alternated, on a regular basis. Direct current is no different electrically from alternating current except for the fact that it flows in the same direction at all times. Nearly all modern electronic devices require direct current for their operation, but alternating current is what is provided by the electric utility. Therefore, rectifiers are used to convert AC power to DC power so that electronic devices can use it.[3] The issue of AC power and DC power is relevant because the power that is delivered to a telephone central office by the electric utility is AC power , but telecommunications equipment generally uses DC power (i.e., -48 VDC), and therefore, AC power must be converted to DC power at the central office.

Q. HOW DOES ELECTRICAL EQUIPMENT CONSUME POWER?

A. This will depend on the type of electrical equipment. Typically, however, the power consumed by telecommunications equipment is largely dependent on two factors. First, the power consumed by telecommunications equipment is dependent on the number of

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[3] http://www.energyvortex.com/energydictionary/alternating_current_(ac)__direct_current_(dc).html

active subscribers (or the percent fill) of the equipment. Second, telecommunications equipment power usage is dependent on actual traffic or usage the equipment is supporting. In other words, the consumption of electrical power is dependent upon the "work" undertaken by the equipment, and specific to telecommunications equipment, more (or less) work is generally dependent upon the fixed number of subscribers the equipment must be equipped to support, and the amount of activity required by that customer base.

Q. PLEASE DEMONSTRATE HOW TELECOMMUNICATIONS EQUIPMENT CONSUMES POWER USING AN ILLUSTRATIVE PIECE OF EQUIPMENT?

A. A Digital Subscriber Line Access Multiplexer (DSLAM) is a common piece of telecommunications equipment that exhibits power usage characteristics that are representative of how telecommunications equipment typically consumes power. A DSLAM receives signals from multiple customer Digital Subscriber Line (xDSL) connections and aggregates the signals on a high-speed backbone using multiplexing techniques. With the addition of a splitter, this combination of equipment allows voice (low band) and data (high band) signals to be carried over a copper twisted pair. To demonstrate my point, I will use a popular DSLAM model - the Alcatel 7300 Advanced Services Access Manager (ASAM),[4] which according to Alcatel, is "the most widely deployed digital subscriber line access multiplexer (DSLAM) in the world…"[5] This

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[4] I use this Alcatel DSLAM model for illustrative purposes because it is a popular model and because there is considerable public information available about the technical specifications of this particular DSLAM model. McLeodUSA may or may not use this particular Alcatel model somewhere in its collocations – though the particular DSLAM McLeodUSA does use in its collocations would exhibit power usage characteristics identical to those described above.

[5] http://www.alcatel.com/products/productsummary.jhtml?relativePath=/com/en/appxml/opgproduct/alcatel7300advancedservicesaccessmanagerasamansiversiontcm228115681635.jhtml

Alcatel DSLAM is capable of serving 5,000 lines per network interface with subtending shelves.[6] Regarding the first point – that power consumed is dependent on the percent fill of the equipment – this DSLAM at 50% fill (or serving 2,500 of the possible 5,000 lines) uses less power than if it were at 100% fill (or serving all 5,000 customers), everything else equal.

Regarding the second point – that power consumption is dependent on the traffic handled – the DSLAM will use less power when handling relatively lower levels of traffic, or in other words, whether the DSLAM is serving 2,500 or 5,000 customers, the power consumption is less when the circuits are idle and thus experiencing little or no activity from those customers, everything else equal. Even considering that the DSLAM may be fully utilized at 100% fill, the actual traffic patterns of customers varies with periods of minimum use and rises to an average period of peak demand. Hence, two Alcatel 7300 DSLAMs both supporting 2,500 customers may experience very different power requirements depending upon the usage patterns of the individual subscribers they support.

Q. ARE THESE FLUCTUATIONS IN POWER CONSUMPTION DUE TO PERCENT FILL AND ACTUAL USAGE PARTICULARLY CHARACTERISTIC OF TELECOMMUNICATIONS EQUIPMENT?

A. These general power consumption characteristics are largely common across telecommunications equipment, and they are particularly marked in a collocation environment. This results from the fact that, within a CLEC collocation, the CLEC equipment may have very low initial power requirements as the CLEC attempts to build a

[6] Alcatel 7300 ASAM product guide, p. 3. This DSLAM serves a maximum of 2,592 lines without subtending shelves.

customer base relative to that central office. Yet, as the carrier's business grows, the percent fill increases and the actual usage for that equipment will increase, as will the power draw required to electrify the equipment. Hence, with regard to most telecommunications equipment, and collocated telecommunications equipment in particular, the percent fill and the level of actual traffic generated by these customers will change over time.

Q. YOU EXPLAIN ABOVE THAT TELECOMMUNICATIONS EQUIPMENT DOES NOT CONSUME POWER AT A CONSTANT RATE AND THAT POWER DRAW REQUIREMENTS CHANGE OVER TIME. WHY IS THAT IMPORTANT IN THIS CASE?

A. The manner in which telecommunications equipment uses power is important to this case because one of the key issues in dispute in this case is how DC power plant is sized by Qwest. And because telecommunications equipment does not consume power at a constant rate, the DC power consumption of central offices also varies. This variation in DC power consumption of central offices impacts the manner in which Qwest engineers size DC power plant in Qwest central offices. In sum, the power engineer must make sure that the central office is capable of accommodating the forecasted actual peak usage of the central office so that when power consumption peaks, Qwest's central office power system can accommodate that peak level. Sizing DC power plant below this level would be under-sizing the DC power plant and could lead to constraints on Qwest's ability to provide power, and sizing DC power plant above this level would be wasteful and inefficient. This peak capacity level by which power engineers size DC power plant is referred to as the "average busy hour,"[7] and represents the level when the load on the central office telecommunications equipment is at its greatest. Busy hours can vary by central office, and as such, proper DC power planning calls for power engineers to plan for DC power plant in sufficient amounts to accommodate the average busy hour of that particular central office.

B. Central Office Power Infrastructure

Q. PLEASE DESCRIBE THE FUNDAMENTAL COMPONENTS OF A TYPICAL CENTRAL OFFICE POWER INFRASTRUCTURE?

A. There are four primary components of a typical central office power infrastructure. Those components are as follows:

1. **<u>Commercial Alternating Current (AC) Power</u>**: this category consists of the AC power procured from the electric utility and can include ancillary distribution equipment including, conduit, cabling, fasteners and protective equipment.[8]

2. **<u>Standby AC Power</u>:** this category consists of AC distribution equipment including engine/alternator, fuel tanks, fuel, AC switching and distribution equipment, that can be used in case of a failure of the office's primary power source (i.e., the commercial source).

3. **<u>Direct Current (DC) Power Plant</u>**: this category consists of equipment used to convert AC power to DC power regardless of whether the AC power is obtained from the commercial source or standby source. DC power plant generally consists of the following equipment: (i) rectifiers, which are used for the AC/DC conversion;[9] (ii) batteries, which "provide the necessary current to power telephone switches [or equipment,]" "serve as a filter to smooth out fluctuations in the commercial power[,]" "remove the 'noise' that

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[7] The average busy hour drain is established by determining the profile of the office load for the busy day of the busy season (excluding abnormally busy operating days such as Mother's Day and Christmas).

[8] Bellcore, <u>Central Office Environment Detail Engineering Generic Requirements</u>, Generic Requirements GR-1502-CORE, Issue 1, June 1994.

[9] Newton's Telecom Dictionary, 20th ed., p. 690.

power often carries[,]" and "provide necessary backup power should commercial power fail[;]"[10] and (iii) controllers, which manage the DC power.

4. **DC Power Distribution**:[11] this category is the power infrastructure that consists of DC power cables and fuses in the Battery Distribution Fuse Bays (BDFBs) and circuit breakers in the Power Boards (PBs). The DC power distribution cabling consists of paired copper cables in insulated sheaths that complete a power circuit from the BDFB/PB to the telecommunications equipment lineups or CLEC collocation cages. One portion of each pair represents the "battery" or distribution of power and the other portion of each pair represents the "ground" or power return to the power source. Given the importance of un-interruptible power to the telecommunications equipment, power cables come in pairs for redundancy purposes. The primary cable feed is known as the "A" lead and the backup power cable is known as the "B" lead. If the A lead fails, the B lead should continue to power the equipment.

   The BFDB is a fuse bay that contains fuses to protect power leads and cables from power surges and provides a distribution point where a large DC power lead can be broken down into smaller increments of power for distribution to telecommunications equipment. The BDFB allows for users of power in the central office to use smaller, more cost-effective power leads to power their equipment, while the fuses housed therein protect the power cables and telecommunications equipment from power currents that exceed the rated amperage of the fuses. The BDFB also contains alarms and monitors and usually contains ampere meters for manual monitoring.[12] The PB is similar to and provides the same functionality as the BDFB but is typically used for larger current distribution to equipment and collocations. For instance, as indicated in the Qwest/McLeodUSA DC Power Measuring Amendment, Qwest utilizes a BDFB for power orders in increments equal to or less than 60 amps and uses PBs for orders in increments greater than 60 amps.[13]

Figure 1 is a diagram of a typical central office power infrastructure, color-coded so as to distinguish the primary components of the central office power infrastructure from one another.

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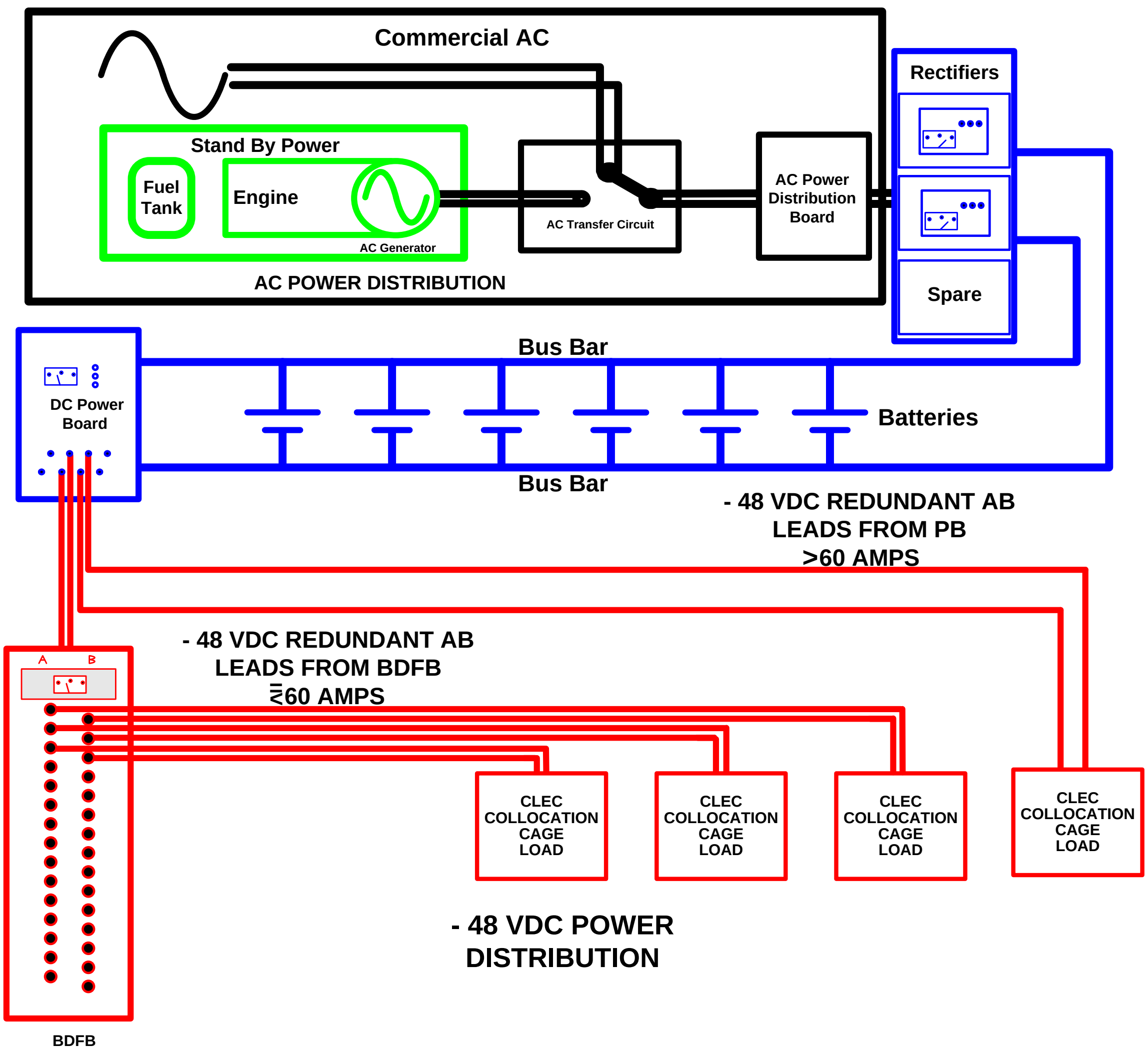
[10] Newton's Telecom Dictionary, 20th ed., p. 103.

[11] DC power distribution is also referred to as delivery, and the terms DC power distribution and DC power delivery can be used interchangeably.

[12] Bellcore, Central Office Environment Detail Engineering Generic Requirements, Generic Requirements GR-1502-CORE, Issue 1, June 1994.

[13] DC Power Measuring Amendment to the Interconnection Agreement between Qwest Corp. and McLeodUSA Telecommunications Services, Inc., Attachment 1, Sections 1.1 and 1.2.

Figure 1



As Figure 1 shows, the four basic power components – (1) AC commercial power (shown in black), (2) standby AC power (shown in green), (3) DC power plant (shown in blue), and (4) DC power distribution (shown in red) - work together to power the telecommunications equipment in a central office. It is important to note that the first 3 categories are shared among all power users in a central office, while the fourth category – DC power distribution – is dedicated to a specific customer (or group of customers). And while a CLEC collocation cage is depicted in Figure 1, the same AC power and DC power-related equipment are also used to serve Qwest's power needs in a nearly identical fashion.

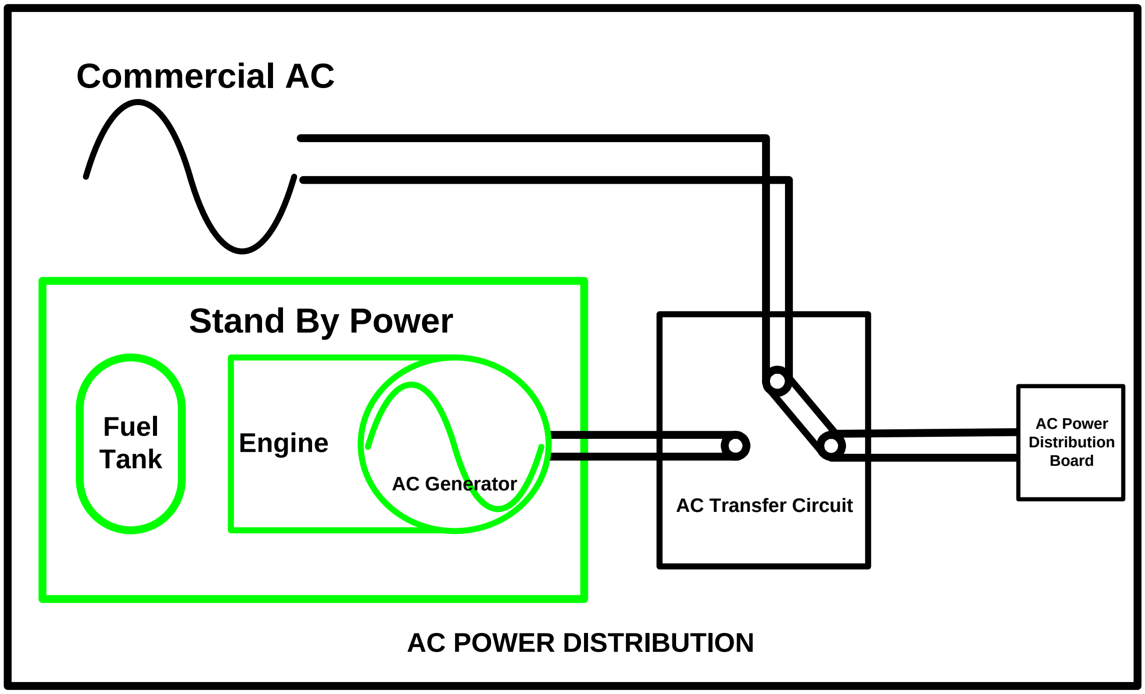
Q. YOU MENTIONED REDUNDANCY RELATED TO AC POWER SOURCES AND DC POWER DISTRIBUTION CABLES. WHY DO CENTRAL OFFICE POWER SYSTEMS EXHIBIT THIS LEVEL OF REDUNDANCY?

A. Redundancy is a basic concept in much of the telecommunications network. Given that electronic equipment commonly found in ILEC central offices is essential to providing service to customers (e.g., switches, processors, optical feeder networks), the power system is designed with redundancy so that this equipment can continue to function even if the primary source or delivery method fails.

Q. PLEASE ELABORATE ON EACH OF THE CATEGORIES OF CENTRAL OFFICE POWER COMPONENTS.

A. Figure 2 is a diagram of the components of AC power.

Figure 2



As Figure 2 shows, AC power is delivered to the central office by the electric utility (or the standby AC power source)[14] and is converted to DC power which is used by telecommunications equipment in the central office. AC power is delivered to the central office on a demand basis controlled by the requirements of the AC service within the office (e.g., AC lights, HVAC, elevators), and the demand requirements of the DC power plant serving telecommunications equipment.

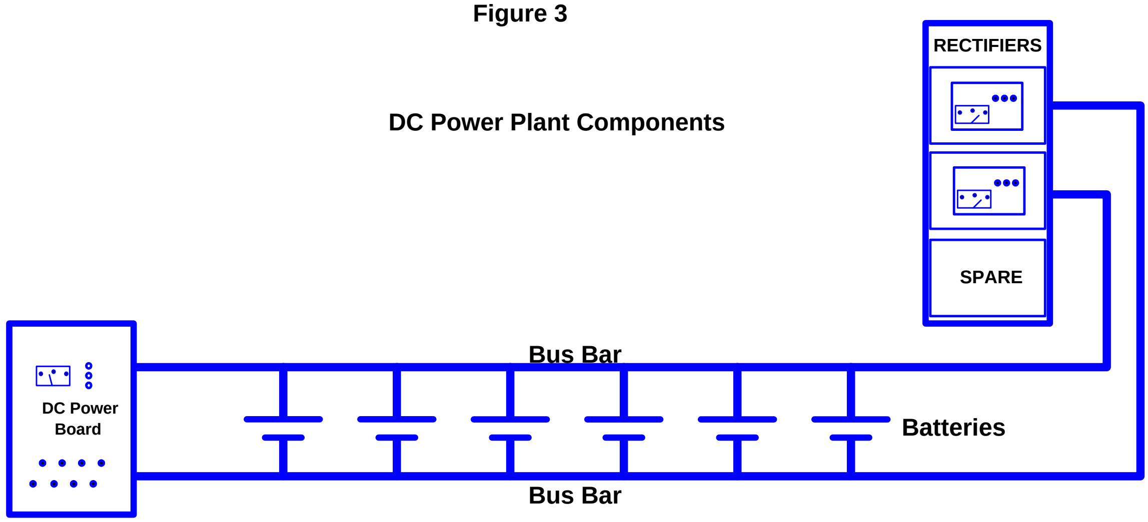
Q. PLEASE ELABORATE ON DC POWER PLANT.

A. Figure 3 below is a diagram of the DC power plant.

[14] Standby AC power consists of an arrangement of a engine, diesel, gasoline or jet turbine, and fuel tanks for producing mechanical power connected to a generator set for producing AC power and a switching mechanism, usually automated, to transfer AC service from a failed utility and to transfer service back to a successfully-recovered utility service.

Figure 3

DC Power Plant Components



The components of the DC power plant convert the AC power to DC power. The DC Power Plant is designed by power engineers to provide DC Power sufficient to accommodate the forecasted actual peak *usage* of all telecommunications equipment housed in that particular central office. Again, DC power plant equipment is common to the entire Qwest central office and is used to support the equipment of Qwest as well as the CLECs (and others).

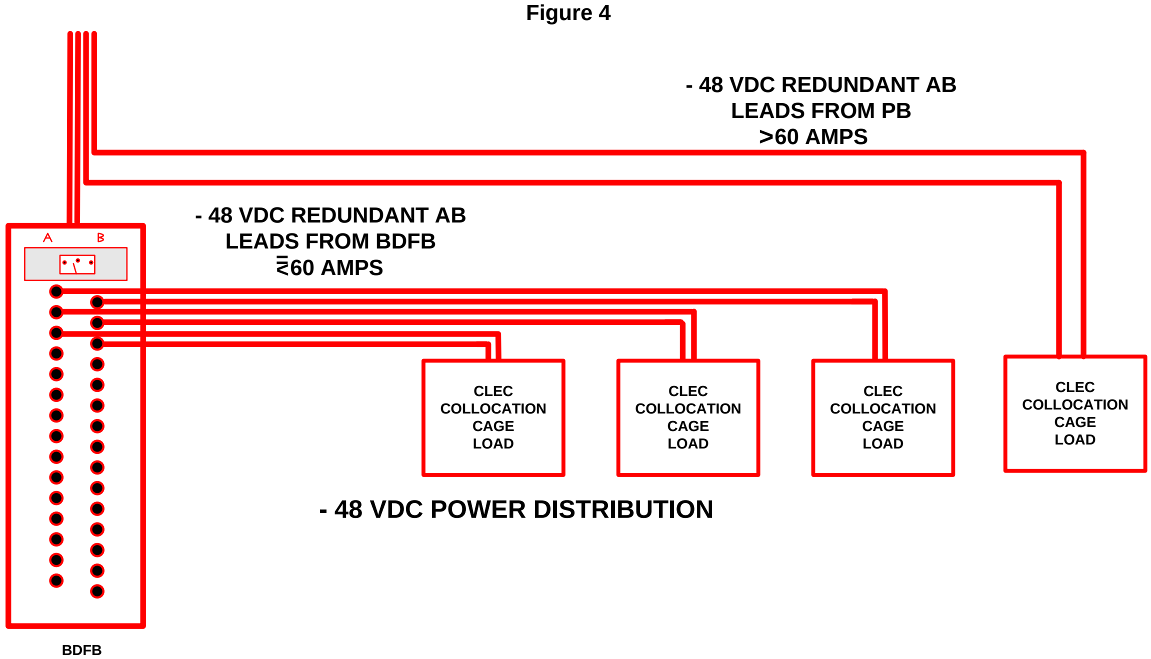
Q. YOU STATE ABOVE THAT POWER ENGINEERS DESIGN THE DC POWER PLANT OF A CENTRAL OFFICE BASED ON THE FORECASTED ACTUAL PEAK USAGE FOR THAT OFFICE. PLEASE ELABORATE ON THIS PROCESS.

A. In a basic example of a Qwest central office, Qwest power engineers monitor the actual usage of DC power and observe the peak power usage that takes place at the average busy hour. Qwest engineers would then take steps to ensure that the DC power plant is capable of handling the usage that occurs at this peak period. In other words, DC power plant is sized based on the maximum power draw that takes place on a CO-wide basis during the busy hour. I will also refer to this in my testimony as the List 1 drain – or the amperage that the equipment uses when the power plant is operating normally at maximum capacity (discussed in more detail below). So, in other words, DC power plant is sized based on List 1 drain. Power engineers oftentimes utilize a fill factor to build in a "cushion" of excess capacity between the busy hour load and the actual capacity of the DC power plant. Or, perhaps more appropriately, those engineers identify a "target" usage level which may indicate to them that the existing power plant, given forecasted peak usage, may fall short in a busy hour scenario. Hence, when usage hits that "target" level, they begin to explore augmentation alternatives. Importantly, however, Qwest DC power engineers do not augment the DC power plant infrastructure based on particular power orders of a CLEC or Qwest. Given that DC power plant is sized based on forecasted actual peak usage for all equipment in the office, there is no relationship between Qwest's investment/augmentation in DC power plant and individual <u>orders</u> for power (whether they be from Qwest or a CLEC). I will demonstrate below in Section IV that my testimony on the proper sizing of DC power plant and DC power distribution is backed by Qwest's own engineering manuals and guidelines.

Q. PLEASE ELABORATE ON DC POWER DISTRIBUTION.

A. Figure 4 below is a diagram of the components of the DC power distribution infrastructure.

Figure 4



As indicated in Figure 4, once the AC power is converted to DC power, that DC power is delivered to CLEC collocation equipment via power distribution cables. These power cables are protected from over-current situations by circuit breakers housed in power boards and fuses that are housed in the BDFBs. Unlike the DC power plant components which are a shared resource powering the equipment of all users in the office, the DC power distribution components are generally specific to a particular power user (or group of users), and it is, therefore, critical to distinguish the DC power *plant* from the DC power *distribution* when discussing how DC power systems are sized and how charges for DC power should be assessed to recover costs related to sizing these DC power system components.

Q. HOW IS DC POWER DISTRIBUTION SIZED?

A. The short answer to this question is that DC power distribution is sized based on List 2 drain. The List 2 Drain is the maximum current that the equipment will draw when the power plant is in worst case condition of voltage and traffic distress - when the DC power plant's batteries are approaching a condition of total failure (List 2 drain will be discussed in more detail below in Section IV). That being said, the process of actually sizing DC power distribution cables is a bit more complex.

The basic idea behind distribution cable design is to make the voltage drop in the cable as small as possible, while at the same time installing the power cable with the smallest diameter allowable within specific parameters. Given that the cost of power cables and power cable installation increases significantly as cable diameter increases, the smallest cable capable of maintaining the minimum voltage drop is chosen to minimize the cable cost, as well as to control the amount of space the cables occupy in the power distribution cable racks.

Q. PLEASE ELABORATE ON THE SPECIFIC PARAMETERS WITHIN WHICH POWER DISTRIBUTION CABLES MUST BE SIZED.

A. DC power distribution cables are sized using a formula and process related to the amount of voltage drop that will be allowed across the power distribution cables. That formula for calculating copper feeder cables is as follows:

CM = [K x Amperes x Feet] / Voltage Drop

Where:

CM = Circular Mills

K = 11.1, the conductance constant for copper cables

Amperes = List 2 drain

Feet= Distance of loop as measured from the relay rack top of each connection point and is not inclusive of the relay rack drop length.

Voltage Drop = Allowable voltage drop from Power Board to BDFB and the allowable voltage drop from the BDFB to the Equipment or Load.

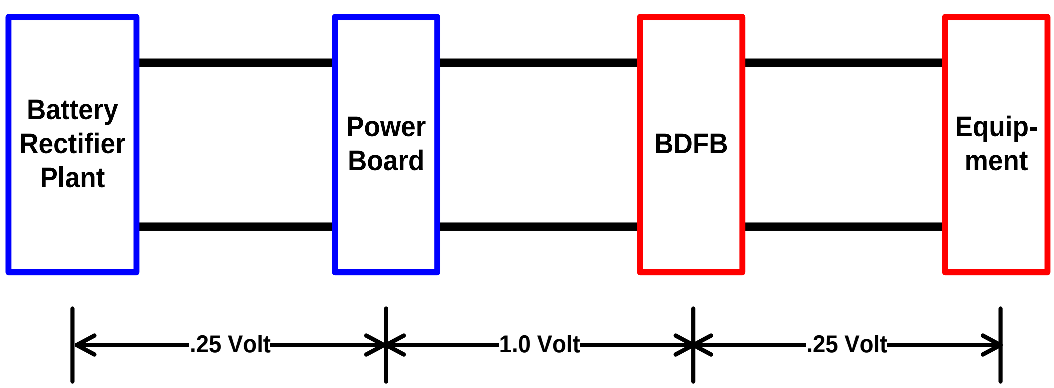
There are three key variables in the power cable sizing formula that leads to the correct sizing of power distribution cables. *First*, the amount of current (measured in amperes) that must be distributed through the cable is the primary variable. As an engineer increases the amount of current needed for distribution across the power cable, the larger the required cable diameter or cross sectional area that must be utilized to carry the added current. The amount of current (in amperes) used in the formula is referred to the List 2 Drain. When a DC power plant is in distress, as is the case with List 2 drain, the terminal voltage of the batteries begins to decrease. For the telecommunications equipment load to continue to draw the same amount of DC power, the current increases proportionately (recall that Power = Voltage x Current, wherein a drop in voltage requires a subsequent increase in current to keep the available power at a constant level). This increase in current and decrease in voltage occurs automatically in the telecommunications equipment, so it can continue operating properly. However, the power cable diameters must be sized to accommodate the additional current required in this worst case situation (or List 2 Drain). The List 2 drain is also known as the recommended amperage because it is the amperage level McLeodUSA must order to operate the equipment properly and in accordance with manufacturer's recommendations and safety standards. The recommended amperage is set at a higher amperage level (compared to the amperage that will actually be used by the equipment under normal circumstances) because it takes into account the worst case scenario, such as low voltage during a battery discharge.

Second, the longer the DC power cable, the greater the voltage drop that will occur, all other factors held constant. This means that, the longer the distribution cable through which the DC current must travel (measured in feet in the formula), the greater the cables resistance, thereby causing an increased voltage drop from the desired voltage level and corresponding increases in heat.

Third, the larger the diameter of the DC power distribution cable, the lower the voltage drop that will occur, assuming all else equal. That is, if the current has more cable cross-sectional area through which to travel, there is less resistance, thereby causing a smaller voltage drop and less heat.

When sizing power cables, a power engineer, using the formula above, must identify the allowable maximum voltage drop between the BDFB/PB and the telecommunications equipment or CLEC collocation. This allows the engineer to size the smallest diameter power cable based on the cable length that must be traversed with a given amperage. Figure 5 depicts an illustration of a typical voltage drop from the Power Board to BDFB and from the BDFB to the equipment.

Figure 5
Distribution Network Voltage Drops



In sum, the power distribution cables have a measurable resistance across them that must be controlled. This resistance causes a voltage drop that occurs between the DC Power Plant and the telecommunications equipment, which, if not managed, causes heat buildup in the distribution cables, and could lead to fire and/or service outages.

Q. IS THERE ANOTHER FACTOR THAT IS TAKEN INTO ACCOUNT WHEN SIZING DC POWER DISTRIBUTION INFRASTRUCUTRE?

A. Yes. Importantly, when a collocator orders a DC power distribution arrangement (or DC power cables), the CLEC is not ordering the DC power distribution capacity that the CLEC needs immediately based on current demand, but rather the DC power distribution capacity that the CLEC will ultimately require in the collocation arrangement when it matures. This is reasonable because it is extremely costly and risky to routinely re-engineer and physically modify its DC power distribution arrangements (e.g., swapping out power cables or resizing fuses/breakers). These costs and risks can be avoided by sizing the DC power cables for their ultimate demand.

Q. HAVE CENTRAL OFFICE POWER PLANNING PRINCIPLES AND PROCEDURES MATERIALLY CHANGED DUE TO THE INTRODUCTION OF COMPETITION?

A. No. In Iowa, Qwest insinuated that the credibility of my expert testimony should somehow be questioned because my experience with regard to central office power planning primarily predates the Telecommunications Act and the advent of collocated CLECs. The Commission should be aware that in case Qwest makes a similar insinuation here, Qwest's claim is not only factually inaccurate but also irrelevant. As the description of my experience above indicates, I contracted with Qwest f/k/a US West in the post-CLEC era (from August 1997 through May 1999) as a central office engineer, responsible for collocation planning and engineering in the common systems planning and engineering center. Moreover, the Telecommunications Act of 1996 and the advent of collocated CLECs did not necessitate material changes to the power planning guidelines or procedures that Qwest and other ILECs had used for years prior to that time. The host of Bellcore and Qwest engineering manuals and technical documents I reference above date back prior to 1996 (some going back to 1989), and are still relevant today, which shows that the introduction of collocated CLECs (due to the introduction of competition in local telecommunications markets) did not change the way in which central office DC power is engineered or how DC power plant is sized. Regardless of whether there is one (1) power user or ten (10) power users in a central office, DC power plant is sized based on the List 1 drain of all telecommunications equipment being powered in the central office, and as such, DC power plants are designed to accommodate loads, and not particular carriers. Therefore, it is truly irrelevant within the context of DC power plant sizing whether the equipment powered is the ILEC's or a CLEC's – or whether experience in designing central office power plants occurred in pre-CLEC or post-CLEC days – because the guidelines would be the same under each scenario.

C. Qwest/McLeodUSA DC Power Measuring Amendment and "As Consumed" Versus "As Ordered" Billing

Q. PLEASE DESCRIBE YOUR UNDERSTANDING OF THE INTERCONNECTION AGREEMENT AMENDMENT SIGNED BETWEEN QWEST AND MCLEODUSA RELATIVE TO THE ISSUE OF POWER MEASUREMENT (AND WHICH SERVES AS THE BASIS FOR MCLEODUSA'S COMPLAINT).

A. For McLeodUSA collocation arrangements with power feeds greater than sixty (60) amps, the Qwest and McLeodUSA Amendment[15] requires that Qwest monitor McLeodUSA's DC power usage at the power board on a semi-annual basis (unless otherwise requested by McLeodUSA). Per the terms of the amendment, these measurements support a process whereby Qwest measures and records McLeodUSA's actual power consumption and assesses "Power Usage" charges according to that actual usage. The measured usage rate structure required by the Amendment is in contrast to previous situations wherein Qwest assessed all "Power Usage" elements on an "as ordered," as opposed to "as consumed" basis.

Q. DO YOU UNDERSTAND THAT ONE OF THE PRIMARY POINTS OF CONTENTION BETWEEN MCLEODUSA AND QWEST IN THIS PROCEEDING IS WHETHER OR NOT THE "POWER PLANT" CHARGE SHOULD BE ASSESSED ON AN "AS CONSUMED" VERSUS AN "AS ORDERED" BASIS?

A. Yes, that is my understanding.

Q. AND DO YOU FURTHER UNDERSTAND THAT THIS PRIMARY ISSUE RESULTS FROM DISPARATE INTERPRETATIONS OF THE SAME POWER-MEASUREMENT AMENDMENT?

A. Yes, that is also my understanding.

---

[15] DC Power Measuring Amendment to Qwest/McLeodUSA interconnection agreement.

Q. DO YOU ADDRESS COST-CAUSATION OR ECONOMIC-COST RELATED ASPECTS OF THIS COMPLAINT?

A. No, Mr. Starkey will address those issues in his testimony. However, I do provide through my testimony the engineering foundation upon which Mr. Starkey bases his conclusions related to cost-causation and proper cost recovery.

Q. IS THERE ANY ENGINEERING BASIS FOR MCLEODUSA'S INTERPRETATION OF THE AGREEMENT AMENDMENT?

A. Yes, in fact, I am surprised that any engineer with an understanding of how central office power plant and power distribution infrastructure are designed would interpret the amendment as Qwest is. The key here is to compare how each party recommends the DC power plant usage charge be applied (i.e., Qwest's "as ordered" recommendation or McLeodUSA's "as consumed" recommendation) to each party's proposal on how the DC power plant is sized in the central office, and in turn, how Qwest invests in DC power plant.

Q. PLEASE SUMMARIZE MCLEODUSA'S VIEW ON "AS CONSUMED" VERSUS "AS ORDERED" BILLING FOR THE DC POWER PLANT USAGE CHARGE.

A. McLeodUSA's "as consumed" recommendation means that the DC power plant usage charge would be applied to the amps that McLeodUSA actually uses. Power plant related equipment is sized and constructed based upon the shared usage demands of the entire office, and as such, it is perfectly logical that users who consume more power will pay more, while users who consume less power should pay less (i.e., these costs should be recovered on an "as consumed" basis). Likewise, because power distribution systems are largely dedicated to individual users or groups of users, and must be sized to the original orders of the user, then those costs are legitimately recovered on an "as ordered" basis. I have read the Power Measurement Amendment referenced above and I interpret it to provide for exactly this situation.

Q. WHEN QWEST CLAIMS THAT DC POWER PLANT IS SIZED ACCORDING TO CLEC ORDERS FOR POWER, WHAT DOES THAT ACTUALLY MEAN?

A. The CLEC power orders that Qwest claims serve as the trigger for DC power plant augments/investment are orders for *DC power distribution* (*i.e.*, power cables), and as such, Qwest is saying that DC power *plant* is sized according to orders for power *distribution* cables. Or in other words, Qwest claims that if a CLEC orders a 175 Amp power cable to power its collocation cage, Qwest will build 175 Amps of capacity into its DC power plant infrastructure.[16] However, this is not the case, and Qwest is attempting to confuse the two issues of DC power plant and DC power distribution. As was explained above (and will be demonstrated in more detail below through the use of Qwest's own engineering manuals), DC power distribution is sized based on List 2 drain and DC power plant is sized based on List 1 drain. By claiming that DC power plant is sized based on CLEC orders for power distribution (or List 2 drain), Qwest is either misunderstanding or intentionally mischaracterizing its own engineering practices such that they appear to support Qwest's interpretation of the Amendment, wherein Qwest would prefer to continue applying the DC power *plant* usage charge based on ordered DC power *distribution.* Fortunately, Qwest's engineers who work with power plant on a

[16] In fact, in Iowa, Qwest witness Robert Hubbard testified that "even 175 amps…will definitely trigger a power plant capacity growth job." Direct Testimony of Robert J. Hubbard, Iowa Utilities Board Docket No. FCU-06-20, March 23, 2006, page 8.

daily basis document their actual practices in accordance with sound engineering standards and those records refute Qwest's claims in this regard.

In the following section of my testimony, I will demonstrate that Qwest's "as ordered" billing recommendation fails to adhere to Qwest's engineering manuals and guidelines and does not square with positions on DC power expressed by Qwest Utah's affiliate, Qwest Communications Corporation.

IV. MCLEODUSA'S APPLICATION OF THE DC POWER PLANT RATE ELEMENT IS CONSISTENT WITH THE MANNER IN WHICH DC POWER PLANT IS ENGINEERED

A. It is critical to distinguish the sizing of DC power plant from the sizing of DC power distribution

Q. YOU EXPLAINED ABOVE THAT DC POWER PLANT IS SIZED DIFFERENTLY THAN DC POWER DISTRIBUTION, CAN YOU EXPLAIN WHY AND HOW THIS IMPACTS MCLEODUSA'S COMPLAINT?

A. Yes. I explained that DC power plant is sized by power engineers monitoring the DC power load requirements of the central office at peak capacity – based on List 1 drain - and growing the DC power plant accordingly, and as such, DC power plant is sized according to forecasted actual peak usage of the central office, in terms of the average busy hour of the office. DC power distribution, on the other hand, is sized based on the List 2 drain, or the power draw of the equipment when the power plant is under a worst case scenario and based on the ultimate demand for power. This results in a situation whereby DC power distribution capacity ordered by CLECs for their collocation, which is the amperage level of the DC power cables ordered for that collocation (or "as ordered" capacity) exceeds (oftentimes significantly) the DC power actually used by their equipment (or "as consumed" capacity), which is the capacity level on which the DC power plant is sized.[17] By billing McLeodUSA the DC Power Plant charge on an "as ordered" basis – or on the capacity level on which DC power ***distribution*** is sized - Qwest is attempting to fit a square peg in a round hole. Instead, DC power plant is sized on an "as consumed" basis and, therefore, it would be consistent and appropriate for the DC power plant charge to apply on an "as consumed" basis. In my opinion, therefore, the interpretation of the Amendment by McLeodUSA is correct.

Q. PLEASE DISCUSS IN MORE DETAIL THE CONCEPTS OF LIST 1 DRAIN AND LIST 2 DRAIN?

A. List 1 drain and List 2 drain are industry-standard measurements used to measure the power draw requirements of various types of equipment. As mentioned above, List 1 drain is the average busy hour current during normal plant operation. The value is used to size DC power plant, such as batteries and rectifiers. List 2 drain is the peak current under worst case conditions of voltage, traffic etc. This current is used to size power distribution cables, plant discharge capacity and over-current protectors. Generally, List 1 drain corresponds with the "as consumed" capacity (at the peak level), while List 2 drain corresponds to the "as ordered" capacity level. So, restating the problem with Qwest's application of the DC power plant usage charge in terms of List 1 drain and List 2 drain: Qwest is assessing the DC power plant charge based on the List 2 drain, when in reality, List 1 drain defines DC power plant sizing, augmentation and investment. Therefore, assessing the DC power plant charge on a List 2 drain is inconsistent with

[17] Notably, in the context of collocation, DC power distribution is dedicated to a specific user, while DC power plant is shared among all users in the central office (i.e., Qwest and CLECs alike).

proper engineering practices. Also, as described above, the List 2 drain significantly exceeds the List 1 drain, which means that Qwest's billing of McLeodUSA for DC power plant based on the higher List 2 drain results in DC power plant charges that significantly exceed the charges that would result from applying the charge to the "as consumed" amperage.

Q. IS QWEST'S ASSERTION THAT QWEST SIZES DC POWER PLANT BASED ON POWER ORDERS CONSISTENT WITH QWEST'S ENGINEERING REQUIREMENTS AND MANUALS?

A. No, it is not. Qwest's own engineering guidelines and requirements belie Qwest's assertions in this regard. In discovery, McLeodUSA requested Qwest to provide various technical documents used by Qwest's collocation planning and power engineers when they design central offices and their associated power infrastructure.[18] This documentation clearly supports my view of the proper sizing and engineering of DC power systems (both DC power plant and DC power distribution), and directly contradicts Qwest's view.

Q. PLEASE PROVIDE SOME EXAMPLES WHEREIN QWEST'S INTERNAL ENGINEERING DOCUMENTATION SUPPORTS YOUR POSITION AND REFUTES THE POSITION TAKEN BY QWEST.

---

[18] McLeodUSA Data Request #1 of First Set to Qwest reads as follows: "**Request 1:** Please provide the following Qwest technical documents, or their closest equivalents, used by Qwest collocation planning and power engineers. It is McLeodUSA's understanding that all of these documents were originally produced either by AT&T, Bellcore/Telcordia or US West Business Resources, Inc. and, in some cases, were adapted for Qwest's internal use. If that understanding is not correct, please clarify."

A. Consider "*Qwest Technical Publication: Power Equipment and Engineering Standards*, Technical Document No. 77385, Issue H, September 2003, Copyright 1996, 1998, 1999, 2000, 2001 and 2002."[19]

Chapter 2 of this document entitled "*DC Power Plants and Chargers*" states as follows:

> **2.4 Engineering Guidelines**
> When sizing power plants, the following criteria shall be used:
>
> **List 1** drain is used for sizing batteries and chargers; the average busy-hour current at normal operating voltage should be used. Telephony List 1 drains are measured at 9 ccs or at 18 ccs for the first 2 hours of a discharge and 6 ccs thereafter.
>
> **List 2** drain is used for sizing feeder cables, circuit breakers, and fuses; the current that is required for projected peak under worst operating conditions should be used. Telephony List 2 drains are measured at 36 ccs at -42.75 V for a nominal -48 VDC plant.

On the same page, the engineering manual discusses the sizing of battery plant – a component of DC power plant – as follows:

Q. IS THERE OTHER INFORMATION THAT SUPPORTS YOUR VIEW OF DC POWER PLANT SIZING AND DIRECTLY CONTRADICTS QWEST'S VIEW?

A. Yes. Take for example Bellcore's "*DC Distribution*," Technical Document No. 790-100-656, which confirms the information above in Qwest's Technical Publication. Specifically, Section 2 "Telecommunications Equipment Loads" states as follows:

*****BEGIN CONFIDENTIAL**

[redacted]

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[19] Provided in response to McLeodUSA Data Request #1b and available at http://www.qwest.com/techpub

[redacted]

END CONFIDENTIAL***

Furthermore, legacy document REGN 790-100-654RG "DC Plant" (published by Qwest) states as follows:

*****BEGIN CONFIDENTIAL**

[redacted]

[redacted]

[redacted]

END CONFIDENTIAL***

Another excerpt from Qwest's engineering manuals specifically warns against doing precisely what Qwest is claiming that it does – i.e., size DC power distribution on "as ordered" capacity, or List 2 drain. Qwest technical document REGN 790-100-655G "Batteries" Issue No. 9 dated February 2006 (at page 22) states:

*****BEGIN CONFIDENTIAL**

[redacted]

END CONFIDENTIAL***

It is concerning that Qwest would advocate a position that its own engineering manuals recommend against and that would create situations of *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL*****

Another one of these manuals – Bellcore technical document "Power Systems Installation Planning" BR 790-100-652 (at page 5-1) elaborates on a power study procedure used to size DC power systems. First it requires engineers to *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** This document also contains Figure 5-2 which is a flow diagram of a "Power Study Procedure". This flow diagram, which is documentation memorializing he DC power plant sizing exercise I descried, shows the following steps to sizing DC power plant (pages 5-4 and 5-5): *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** This manual also includes an example of the graph (see page 6-11, Figure 6-1) that is created *****BEGIN CONFIDENTIAL** [redacted]

[redacted] **END CONFIDENTIAL*****

Q. WHAT DO THESE QWEST ENGINEERING GUIDELINES AND REQUIREMENTS SHOW?

A. The above excerpts from Qwest's own power engineering manuals, individually and taken together, makes several points very clear:

*****BEGIN CONFIDENTIAL**

[redacted]

3. [redacted]

END CONFIDENTIAL***

All three (3) of these points support my testimony.

Q. YOU POINT TO A NUMBER OF ENGINEERING REQUIREMENTS AND MANUALS THAT SUPPORT YOUR VIEW OF THE METHOD FOR SIZING DC

POWER PLANT AND DC POWER DISTRIBUTION. DID QWEST POINT TO ANY ENGINEERING MANUALS, REQUIREMENTS OR OTHER DOCUMENTATION SUPPORTING ITS VIEW IN IOWA?

A. No and I highly doubt that Qwest will provide any relevant cites to engineering manuals in Utah either, primarily because there are no engineering manuals or specifications supporting Qwest's notion that DC power plant is sized according to power orders – or List 2 drain.

Q. YOU ALSO MENTIONED THAT QWEST'S ASSERTION THAT DC POWER PLANT IS SIZED BASED ON POWER ORDERS IS INCONSISTENT WITH THE POSITION QWEST HAS TAKEN ELSEWHERE. PLEASE ELABORATE.

A. Qwest Communications Corporation (which is, like Qwest Corp. the ILEC, a direct subsidiary of Qwest Services Corporation)[20] recently sponsored testimony in Illinois Commerce Commission Docket No. 05-0675, which addressed AT&T/SBC Illinois' collocation DC power policy. In that case, SBC Illinois was attempting to change the way in which it currently assessed power charges and was attempting to covert its existing measured, kWh based charge to a simple per-amp charge, similar to that assessed by Qwest in Utah. The testimony of the Qwest witness (Victoria Hunnicutt-Bisahra) in Illinois undermines Qwest's position here in Utah, and I have provided the pertinent portions of Ms. Hunnicutt-Bishara's response and surrebuttal testimony from Illinois as

[20] Qwest Services Corporation is a direct subsidiary of the ultimate parent company, Qwest Communications International, Inc.

Exhibit SLM-3 to my direct testimony. For instance, Ms. Hunnicutt-Bishara testified as follows in Illinois:[21]

> **Q. WHAT IS THE PURPOSE OF THE LIST 1 AND LIST 2 DRAIN SPECIFICATIONS?**
>
> A. In the telecommunications industry, List 1 and List 2 drains are the designations of the load current drains. These are used to size various elements of the battery plant. Generally speaking, the List 1 current drain is used to size batteries and rectifiers in the plant. The List 2 current drain is used to size the DC load feeder cables and the circuit protection device (fuse) for the DC power arrangement. The fuse size is also dependent upon the ampacity of the smallest conductor comprising the protected feeder. Protectors should be rated as high as allowable to avoid nuisance tripping due to high load conditions or inrush current during startup.

Ms. Hunnicutt-Bishara also testified in Illinois as follows:

> **Q. DOES BELLCORE HAVE ANY DOCUMENTATION RELATING TO THE FUSING OF TELECOMMUNICATIONS EQUIPMENT?**
>
> A. Yes, in its definition of List 2 drain, Bellcore (previously known as Bell Communications Research, now known as Telcordia) states:
>
> > "These drains are used to size feeder cables and fuses. These drains represent the peak current for a circuit or group of circuits under worst case operating conditions. For example, a constant power load requires maximum current at minimum operating voltage." (footnote omitted)

The excerpts from Qwest's Illinois testimony shows that at least one Qwest –sponsored witness understands that, consistent with Qwest's engineering guidelines, List 1 drain is used to size DC power plant and List 2 drain is used to size DC power distribution.

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[21] Surrebuttal Testimony of Victoria Hunnicutt-Bishara, ICC Docket No. 05-0675, March 29, 2006, p. 4.

Indeed she cites to the same Bellcore technical document I cited to above ("*DC Distribution*," Technical Document No. 790-100-656) as support for her testimony and attaches this document to her testimony as an exhibit. There is no plausible explanation that Qwest can provide that can square its position in Utah that DC power plant is sized based on CLEC power orders (or List 2 drain) and its affiliate's testimony in Illinois stating (correctly) that DC power plant is sized based on List 1 drain. Indeed, based on my experience in Iowa, I suspect that Qwest Utah may not even address the concepts of List 1 drain and List 2 drain in its testimony, despite their importance to this proceeding, because when Qwest is forced to concede that DC power plant is sized on List 1 drain and DC power distribution is sized on List 2 drain, Qwest's position in Utah that McLeodUSA should pay for DC power plant based on List 2 drain is exposed as fatally flawed.

Q. ARE THERE OTHER PORTIONS OF QWEST COMMUNICATIONS CORP.'S TESTIMONY IN ILLINOIS THAT CONFLICT WITH QWEST'S POSITION IN UTAH?

A. Yes. In Illinois, Ms. Hunnicutt-Bishara testified that one of the problems with AT&T/SBC-Illinois' position in the Illinois docket was SBC's "false assumption that telecommunications equipment draws power at the maximum load required twenty-four hours a day, seven days a week."[22] Ms. Bishara explained that "[t]his assumption of a maximum and linear power load is erroneous…"[23] In other words, Ms. Hunnicutt-Bishara criticized AT&T/SBC Illinois for assuming in its DC power charge development

[22] Response Testimony of Victoria Hunnicutt-Bishara, Illinois Commerce Commission Docket No. 05-0675, on behalf Qwest Communications Corp., QCC Exhibit 1.0, Public Version, February 2, 2006, p. 8.

[23] *Id.*

that Qwest's equipment collocated in AT&T/SBC Illinois central offices draws a maximum load at all times. Instead, Ms. Hunnicutt-Bishara argued that Qwest's CLEC equipment draws power relative to factors associated with busy-hour usage.

Despite the recognition by its affiliate of the falsehood of a maximum 24x7 load, Qwest Utah is billing McLeodUSA for DC power plant usage as if this continuous, maximum load exists.

Q. IN IOWA, QWEST CLAIMED THAT IT MUST ENGINEER POWER PLANT BASED ON THE AMOUNT OF POWER (DISTRIBUTION) ORDERED BECAUSE QWEST HAS NO IDEA OF HOW FAST THE POWER REQUIREMENTS OF MCLEOD OR ANY OTHER CLEC ARE GOING TO GROW.[24] IS THIS TRUE?

A. No, this is factually inaccurate. Qwest does have an idea of how fast the power requirements of McLeodUSA and other CLECs will grow because CLECs must provide this information to Qwest when ordering and augmenting collocations. For instance, the collocation application form for a collocation new/change/augment contains Section II.F.5, which requires the collocator to provide: (1) a description of the equipment it will collocate, (2) the model numbers of collocated equipment, (3) functionality of collocated equipment, (4) dimensions of collocated equipment and (5) quantity of collocated equipment. Furthermore, Section III.B. of the collocation application form requires the collocator to indicate the quantity of DS0s, DS1s and DS3s the collocator intends to support. Therefore, collocated CLECs keep Qwest well-informed about how fast the power requirements of collocated CLECs are going to grow.

[24] See, e.g., Direct Testimony of Robert J. Hubbard, Iowa Utilities Board Docket No. FCU-06-20, March 23, 2006, p. 9, lines 17 – 20.

Q. QWEST ALSO CLAIMED IN IOWA THAT IT MUST ENGINEER DC POWER PLANT AT THE "AS ORDERED" CAPACITY LEVEL BECAUSE EQUIPMENT MODIFICATIONS TO THE POWER PLANT ARE TIME CONSUMING AND IT WOULD TAKE TOO LONG FOR QWEST TO RESPOND TO ACTUAL DEMAND FLUCTUATIONS.[25] IS THIS CORRECT?

A. No. Not only is Qwest made fully aware of the equipment type and amount that is collocated in its central office as well as the expected number of circuits served by that equipment, Qwest is given ample time to augment its DC power plant should conditions require it. For instance, Section 8.4.3.4.1 of Qwest Utah's SGAT shows that when certain conditions are met, Qwest has 90 days from receipt of a complete collocation application to provision the request. Accordingly, Qwest cannot be taken by surprise by an increase in usage at a collocation arrangement because it is aware of the equipment the DC power plant is serving, and Qwest is made aware well in advance of any changes to that equipment configuration.

Moreover, demand fluctuations are already accounted for in the proper sizing of DC power plant when it is sized according to List 1 drain. In other words, by sizing DC power plant based on List 1 drain, Qwest is sizing at peak capacity at the busy-hour, which means that all short-term (e.g., daily, weekly, etc.) demand fluctuations are accounted for and can be handled by the DC power plant.

Q. DOES DATA EXIST THAT REFUTES QWEST'S CLAIM THAT MCLEODUSA'S POWER USAGE COULD INCREASE TO A LEVEL THAT

[25] See, e.g., Direct Testimony of Robert J. Hubbard, Iowa Utilities Board Docket No. FCU-06-20, March 23, 2006, page 8, lines 14 – 17.

WOULD PUT QWEST'S ABILITY TO PROVIDE ORDERED DC POWER IN JEOPARDY ASSUMING THAT IT SIZED DC POWER PLANT BASED ON LIST 1 DRAIN?

A. Yes. In a vast majority of instances, McLeodUSA's power usage will constitute a very small fraction of the total power draw requirements of the central office. This is supported by the data Qwest provided in response to McLeodUSA's discovery. For instance, in response to McLeodUSA's data request No. 8(a) ["For each Qwest central office in Utah wherein McLeodUSA has a collocation space, please provide the following information: (a) the total installed -48V DC Power capacity considering all individual power plants within the office (in Amps)."], Qwest provided Confidential Attachment A, which shows this data by CLLI code. And in response to McLeodUSA data request No. 8(b) ["Actual measured load, busy day, busy hour (for most recent measurement and date of measurement)"], Qwest provided Confidential Attachment B, which provides these measurements by date and by CLLI. Comparing the McLeodUSA busy hour power draw for a central office from Confidential Attachment B to the total installed DC power capacity will show how much of the power capacity for an office McLeodUSA is actually using at peak normal operating conditions. Take for example, the following three (3) central offices: AMFKUTMA, PLGVUTMA, and TOOLUTMA. Confidential Attachment A indicates that the total installed DC power capacity (in Amps) for these offices is *****BEGIN CONFIDENTIAL**_[redacted]. **END CONFIDENTIAL***** Confidential B indicates that between February 6 and 8, 2006, Qwest measured McLeodUSA's busy hour draw at these offices to be *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** Hence, McLeodUSA's busy hour draw for these three central offices constitutes only *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** of the total installed DC power capacity of the offices. As further evidence that these findings are typical, Confidential Attachments A and B also indicate that for the following four (4) CLLI codes (BGCYUTMA, CLFDUTMA, SPVLUTMA, and OREMUTMA), McLeodUSA's busy hour power draw, as a percentage of the total DC power capacity of the end office is ***** BEGIN CONFIDENTIAL** [redacted] **END CONFIDENIAL***** The data demonstrates that McLeodUSA's busy hour power usage actually constitutes a very small percentage of the total installed power capacity of a particular central office. Given that power engineers size DC power plant based on the aggregate List 1 drain of all telecommunications equipment being powered, and given that McLeodUSA's peak power usage constitutes a small fraction of Qwest's power capacity, it is clear that McLeodUSA's DC power would be a relatively minute consideration in the Qwest DC power plant planning/sizing process.

Q. QWEST CLAIMED IN IOWA THAT IF MCLEODUSA ORDERS 175 AMPS OF CAPACITY (OR 175 AMP DISTRIBUTION CABLE), QWEST WOULD DEFINITELY AUGMENT ITS DC POWER PLANT CAPACITY REGARDLESS OF MCLEODUSA'S ACTUAL USAGE. WOULD QWEST ALREADY HAVE THE CAPACITY ON ITS DC POWER PLANT TO PROVIDE MCLEODUSA THE POWER USAGE OVER MCLEODUSA'S HYPOTHETICAL 175 AMP POWER CABLE WITHOUT AUGMENTING ITS DC POWER PLANT IN A VAST MAJORITY OF INSTANCES?

A. Yes. As demonstrated above, McLeodUSA's actual power draw constitutes a very small portion of the total DC power capacity of the central office, so even if the McLeodUSA DC power usage doubled or tripled (which is very unlikely in the short run), it would still constitute a very small portion of total capacity and Qwest's existing capacity could handle it.

Further, as even Qwest concedes, the power requirements of the entire central office are taken into account when sizing the DC power plant infrastructure to serve that central office. Since this DC power plant infrastructure is sized in the aggregate (with spare capacity), individual orders by CLECs for DC power distribution cables should not trigger an investment in DC power plant unless the power plant at that particular location is already nearing an augmentation threshold because of the aggregate demand for power from all users in the central office. Because the relative size of that individual order compared to the aggregate investment in DC power plant would be relatively small, it should have little effect on the ability of the DC power plant infrastructure to serve the power needs of that office. Rather, the power requirements associated with the usage over those cables would be aggregated with the power requirements associated with the usage over all other cables in the central office (as observed relative to the average busy hour) to determine the appropriate level of investment in DC power plant. So, when added to the mix, McLeodUSA's hypothetical 175 amp order would require no additional DC power plant augment/investment. This is especially true given that Qwest will monitor the aggregate power requirements of the central office over time and augment DC power plant on a central office-wide basis.

Q. QWEST'S POSITION RESTS ON THE ASSUMPTION THAT QWEST ADDS DC POWER PLANT EQUIPMENT WHEN MCLEODUSA ORDERS POWER TO A COLLOCATION ARRANGEMENT. DOES QWEST ALSO ASSUME THAT QWEST REMOVES DC POWER PLANT EQUIPMENT WHEN MCLEODUSA (OR ANY OTHER CLEC) DECOMMISSIONS A COLLOCATION ARRANGEMENT?

A. No, indeed Qwest specifically states that it does not remove or reduce DC power plant equipment when CLECs decommission collocation arrangements. In response to McLeodUSA data request #5, Qwest responded as follows:

> ***As a rule, Qwest does not remove or reduce its Power Plant Capacity based on decommissioned collocations***. However, there are instances where Qwest will reassign fuse positions for Battery Distribution Fuse Bay (BDFB) and Power Boards (PBD) based on demand. (emphasis added)

Therefore, what Qwest is saying is that CLEC orders for power distribution cables drive the addition of (and Qwest investment in) DC power plant equipment, but that CLEC requests to decommission collocation (thereby removing collocated equipment and rendering the DC power distribution arrangement to that collocation cage useless) would not trigger the removal of DC power plant equipment. Following Qwest's logic, what would result is an ever-increasing DC power plant capacity that has no relationship to the power requirements of the central office – regardless of whether those "power requirements" are based on List 1 drain as I contend or List 2 drain as Qwest contends.

Furthermore, Mr. Qwest's assertion in this regard conflicts again with Qwest's engineering guidelines -specifically Bellcore's "Power Systems Installation Planning" manual (at page 6-2), which states that *****BEGIN CONFIDENTIAL** [redacted]

[redacted] **END CONFIDENTIAL***** Thus, the busy-hour drain is calculated by Qwest and, in turn, the DC power plant is sized by Qwest, based on equipment in service. Again, this information contradicts Qwest's position which paints a picture of DC power plant being based on CLEC power orders, with Qwest being left "holding the bag" with regard to DC power plant investment when CLECs do not use the power capacity they ordered or if the DC power plant usage charge is applied on an "as consumed" basis. What Qwest power engineers actually do is *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** Hence, if CLEC A decommissions its collocation cage, the feeder serving those collocations would not have in-service equipment associated with it, and would therefore not be captured in the List 1 drain or included when sizing DC power plant.

Q. YOU EXPLAIN ABOVE THAT QWEST'S POSITION IS UNDERMINED BY ITS ENGINEERING MANUALS AS WELL AS QWEST EXPERT TESTIMONY IN ILLINOIS. IS QWEST'S POSITION IN THIS CASE ALSO UNDERMINED BY ITS DISCOVERY RESPONSES?

A. Yes. As mentioned above, Qwest's response to McLeodUSA data request number 5 indicates that Qwest does not remove DC power plant equipment when a CLEC decommissions a collocation arrangement. Therefore, following Qwest's logic that DC power plant investment is based on CLEC power orders and that Qwest would definitely augment its DC power plant capacity to accommodate a CLEC order for 175 amp DC power distribution cable, if that CLEC subsequently decommissioned its collocation arrangement, there should be 175 amps of excess capacity in the DC power plant for that central office. If McLeodUSA or another CLEC subsequently requests a collocation arrangement in that office – everything else equal – there should be 175 amps of capacity in the DC power plant to serve McLeodUSA without any DC power plant augment/addition/investment. According to Qwest, instead of using the 175 amps of excess capacity freed up by the original CLEC, Qwest would build in another 175 amps of DC power plant capacity to meet McLeodUSA's request. This would be wasteful and inefficient – not to mention inconsistent with Qwest's engineering guidelines. And this example is conservative because it only assumes one decommissioned collocation arrangement. If we modify the scenario to assume that five (5) CLECs decommissioned collocation arrangements, each with 175 amps of DC power distribution capacity, Qwest would apparently ignore the 875 amps of "freed up" DC power plant capacity due to collocation decommissioning and, instead, build in another 175 amps of DC power plant capacity to meet McLeodUSA's request.

Q. WHAT TYPE OF EQUIPMENT DOES MCLEODUSA TYPICALLY USE IN ITS COLLOCATION SITES IN UTAH AND HOW DOES THIS RELATE TO THE DISCUSSION ABOVE?

A. McLeodUSA typically uses a collocation design that contains the equipment listed in Figure 6 below.

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Fig. 6 Typical McLeodUSA Collocated Equipment and Associated Power Requirements

Collocated Equipment	Fuse Size	Manufac. Maximum Power Draw (DC amps)	McLeodUSA Est. DC Power Draw
Total DC Power Requirement (Amps)			

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Figure 6 provides the following information regarding McLeodUSA's typical collocation design. The collocated equipment and model is provided in column 1, the Fuse Size amperage is provided in column 2, the manufacturer's maximum DC power draw (in amps) is provided in column 3, and the estimated DC power draw (in amps) is provided in column 4. The fuse size refers to the amperage for which the fuse panel is fused, the manufacturer's maximum power draw is the same as the List 2 drain, and the estimated DC power draw amperage is based on actual power readings made by McLeodUSA.

Q. WHAT DOES FIGURE 6 SHOW?

A. Figure 6 demonstrates the point I have made in my testimony above, i.e., "as ordered" amperage bears no relationship to "as consumed" amperage. The "fused amps" power capacity is *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** As I have explained, carriers must design DC power distribution equipment such that it protects the power cables above and beyond what would be required under a "worst case scenario" draw or List 2 Drain. The List 2 drain is *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL*****, which means that, in this typical arrangement, McLeodUSA's fused amperage is over *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** greater than List 2 drain.[26] Moreover, Figure 6 shows that McLeodUSA was required to design its power distribution at an amperage level that is *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** greater than the actual McLeodUSA power draw, and the List 2 drain is *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** greater than McLeodUSA's actual power draw at the busy hour. While this difference between "as ordered" and "as consumed" DC power reflects a typical McLeodUSA collocation arrangement, this difference can vary by collocation site with the potential for differences between "as ordered" and "as consumed" amperages far larger than those identified above.

Q WHY DOES MCLEODUSA HAVE A FUSE PANEL AND FUSES IN THEIR COLLOCATION ARRANGEMENT?

A. McLeodUSA typically uses a mini-BDFB in their collocation arrangement for power management purposes, which accepts the DC power from Qwest and (i) distributes power to each individual relay, (ii) fuses the power at each relay to provide fuse panel protection and (iii) distributes DC power to the telecommunications equipment listed in Figure 5 above. This provides flexibility to McLeodUSA to better manage the power within its collocation cage and fuse the power at a level consistent with the need of the individual equipment.

Q. EXPLAIN THE *MCLEODUSA ESTIMATED DC POWER DRAW* IN COLUMN 4 OF FIGURE 6.

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[26] The List 2 Drain serves as one of the factors in sizing of power distribution cables as indicated in the power cable sizing formula, see *supra.*

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A. Column 4 of Figure 6 (McLeodUSA Estimated DC Power Draw) is the actual DC current in amperes as measured by a McLeodUSA technician using a clamp on ampere meter. This measurement was made by McLeodUSA during the busy hour period of approximately 10AM and Noon. As explained above, the measured actual DC power draw in amperes or "as consumed" power in column 4 is considerably less than "as ordered" amperage.

Q. HOW CAN YOU BE SURE THAT THE DC POWER DATA TREND REFLECTED IN FIGURE 6 – THAT FUSED AMPS AND LIST 2 DRAIN BOTH SIGNIFICANTLY EXCEED ACTUAL POWER DRAW – IS REPRESENTATIVE OF THE TYPICAL MCLEODUSA COLLOCATION SITE?

A. I performed my own analysis of the actual DC power draw requirements of a McLeodUSA collocation site and arrived at very similar findings. On February 28, 2006, I visited three (3) McLeodUSA collocation sites in Denver, Colorado: (i) Denver Curtis Park, (ii) Denver Capitol Hill and (iii) Denver South. During these visits, I had an opportunity to take my own measurements of the actual DC power draw of McLeodUSA's collocated equipment and the distribution of that DC current within the collocation cages to the collocated equipment being powered. I then compared these measurements to the amperage of the DC power distribution cables. The results of this comparison show that DC power distribution capacity for each of these collocation sites significantly exceed McLeodUSA's actual DC power draw at the busy hour.

Q. PLEASE ELABORATE ON THESE POWER MEASUREMENTS?

A. I personally measured the actual current in amperage being delivered from Qwest to these McLeodUSA collocation sites via a Fluke clamp-on meter for both the A and B power distribution leads during the busy-hour period of between 10AM and Noon (exact time of measurements provided below). I then checked the power distribution cable tags at the McLeodUSA mini-BDFBs for the power ratings of each cable. The tags are an installation requirement and state the design capability of the power distribution cables in amperes. The power data collected from the actual power measurements as well as the power distribution cable tags is provided below in Figure 7.

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Figure 7. McLeodUSA "as ordered" versus "as consumed" amperage

Qwest Central Office	"As ordered" Amperage	"As consumed" Amperage	Date & Time of Measurement	% Fused Vs Measured E = C/B
A	**B**	**C**	**D**	**E**
Denver Curtis Park	[redacted]	[redacted]	[redacted]	[redacted]
Denver Capitol Hill	[redacted]	[redacted]	[redacted]	[redacted]
Denver South	[redacted]s	[redacted]	[redacted]	[redacted]

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Q. PLEASE EXPLAIN THE DATA PRESENTED IN FIGURE 7.

A. Column A of Figure 7 provides the name of the Qwest central office in which the McLeodUSA collocation sites I visited reside. Column B is the amperage of the DC power distribution cables ("as ordered" amperage), as taken from the power distribution cable tags, which represents the current distribution capacity to the McLeodUSA collocation cage (i.e., the "as ordered" capacity). Column C is the actual measured amperage or "as consumed" power of the McLeodUSA collocation arrangement, as measured by me at the date and time specified in Column D. Finally, Column E represents the percent of total "as ordered" amps that McLeodUSA's collocation was actually using at the time of the power measurement.

Column E of Figure 7 shows that, for each McLeodUSA collocation site, the actual "as consumed" usage is about *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** of the "as ordered" amperage. In other words, the "as ordered" capacity of the power distribution cables exceeds the "as consumed" capacity by about *****BEGIN CONFIDENTIAL** [redacted]. **END CONFIDENTIAL***** This difference between "as consumed" and "as ordered" is even greater than the *****BEGIN CONFIDENTIAL** [redacted] **END CONFIDENTIAL***** difference attributed to a typical McLeod collocation site above in Figure 6.

Q. DO THESE RESULTS INDICATE THAT MCLEODUSA HAS SIMPLY "OVER-ORDERED" DC POWER DISTRIBUTION CAPACITY FROM QWEST?

A. No. Recall that McLeodUSA is required by engineering specifications and manufacturers' requirements to order power distribution capacity at amperage levels that significantly exceed the actual power draw of its collocated equipment at peak periods. In any event, DC power distribution facilities are sized differently and McLeodUSA compensates Qwest for costs related to DC power distribution facilities through separate charges.

Q. ARE THE RESULTS FROM YOUR AUDIT OF THE COLORADO COLLOCATIONS REPRESENTATIVE OF UTAH?

A. Yes, I have reviewed a list of collocation equipment within Utah collocations and it is comparable to the equipment in the Colorado locations. Given the nature of these devices, the power draw from equipment in a Colorado collocation would be representative of McLeodUSA's Utah collocations.

B. Proper DC power sizing and engineering supports McLeodUSA's recommended application of the DC power plant usage charge

Q. YOU EXPLAINED ABOVE THAT DC POWER DISTRIBUTION IS SIZED BASED ON LIST 2 DRAIN AND THAT DC POWER PLANT IS SIZED BASED ON FORECASTED ACTUAL PEAK USAGE. HOW DOES THIS RELATE TO MCLEODUSA'S COMPLAINT?

A. This shows that there is no relationship between the CLEC's order for power distribution and the power plant capacity the CLEC actually uses or the power the CLEC should be required to pay for. Therefore, Qwest's application of the rate for DC power plant needs to recognize the distinction between the ordering of the DC Power distribution network, which sizes the power distribution cables extended into the CLEC collocation arrangement on List 2 drain, *separately* from the demand for DC Power itself (i.e., List 1 drain). Any connection between the engineered size of the DC Power distribution network and the rate for DC power plant usage is inappropriate and inconsistent with the way in which DC power is sized and consumed. The crux of McLeodUSA's complaint stems from the fact that Qwest is assessing a DC power plant usage charge, based on the "as ordered" amps, when proper engineering practice (and the parties' DC Power

Measurement Amendment) calls for Qwest to assess this charge based on the actual power consumed (or "as consumed" amps).

Q. DOES THE FACT THAT CLECS ORDER DC POWER DISTRIBUTION CAPACITY BASED ON A HIGHER LIST 2 DRAIN IMPACT QWEST'S DC POWER PLANT PLANNING/AUGMENTS/INVESTMENTS?

A. No. Again, DC power plants are sized based on forecasted actual peak usage, i.e., average busy hour for the entire central office and is not dependent on the amount of amps ordered by a particular CLEC for distribution facilities for a collocation. Therefore, the central office engineers observe the peak power requirements of the central office power plant as a whole and augment the DC power plant if the peak usage approaches a level that would exceed the current power capacity. DC power plant augments are not driven by individual orders for power distribution cables and/or fuses by CLECs (or Qwest).[27] Simply put, Qwest does not plan or augment its power requirements or power plant based on individual power orders of CLECs and hence, its power plant investments are not incremental to those orders (as described in more detail by Mr. Starkey).

Q. WILL QWEST BE FULLY COMPENSATED FOR DC POWER PLANT COSTS IF IT ASSESSES THE DC POWER PLANT USAGE CHARGE ON AN "AS CONSUMED" BASIS INSTEAD OF AN "AS ORDERED" BASIS?

A. Michael Starkey addresses cost recovery in his testimony. However, it has been my experience in the past that one of the arguments ILECs use to argue against billing DC

[27] Note: a possible exception to this general rule is if Qwest would install an entire switch or major switch addition, or similar, very large-scale equipment addition. My testimony above pertains to the normal, or average, growth in power plant capacity that typically occurs within a central office, the type of growth experienced by McLeodUSA collocated equipment.

power usage on an "as consumed" basis is that such a rate structure will result in stranded DC power plant investment. The basic (and erroneous) premise of the ILEC argument is: CLECs order power distribution cables based on the relatively higher "as ordered" amperage, ILECs must build out their DC power plant to meet these power requirements, and therefore, assessing DC power plant charges based on the relatively lower "as consumed" amperage would result in stranded costs for DC power plant. There is no engineering validity to such an argument.

Q. WHY DO YOU SAY THAT THERE IS NO ENGINEERING VALIDITY TO QWEST'S ARGUMENT?

A. As explained above, ILECs do ***not*** augment the shared DC power plant of their central offices based on the ordered capacity of the power distribution cables, and as such, Qwest would not have augmented (or invested in) its DC power plant based on McLeodUSA's (or any other CLEC's) collocation power orders. Accordingly, there is no stranded investment related to billing DC power plant based on an "as consumed" basis because this so-called stranded investment was never made in the first place, assuming Qwest is monitoring and sizing its DC power plant consistent with proper engineering practices.

C. Qwest's Power Reduction offering is not a suitable option to billing DC power usage charges on an "as consumed" basis

Q. QWEST OFFERS A "POWER REDUCTION" AMENDMENT THAT CLECS CAN INCORPORATE INTO THEIR INTERCONNECTION AGREEMENTS. QWEST HAS ARGUED THAT THIS AMENDMENT SHOULD ALLOW MCLEODUSA TO MORE CLOSELY ALIGN ITS "AS ORDERED" USAGE

WITH ITS "AS CONSUMED" USAGE SO AS TO AVOID THE TYPES OF ISSUES YOU DESCRIBE ABOVE. PLEASE BRIEFLY DESCRIBE POWER REDUCTION.

A. Qwest's "Power Reduction" offering allows CLECs to eliminate or reduce multiple feeds from 60 to zero amps or reduce main feeds from 60 to 20 amps.[28] According to Exhibit A to the Power Reduction Amendment, the work performed by Qwest under the Power Reduction offering includes: changing fuses at the BDFB, changing breakers at the power plant, re-engineering smaller power cables and various other detailed engineering work aimed at re-engineering a CLEC's power *distribution* infrastructure. Qwest has proposed non-recurring charges for Power Reduction of $787 and $1,028 if power cabling changes are not necessary and ICB-based rates for power cabling changes. Apparently, Qwest has offered the Power Reduction offering in order for CLECs to reduce the fused amp capacity of their DC power ***distribution*** infrastructure (i.e., fuses and power cables).

Q. YOU EXPLAIN ABOVE THAT QWEST'S POWER REDUCTION OFFERING PERTAINS TO RESIZING DC POWER *DISTRIBUTION* INFRASTRUCTURE. DOESN'T THE PRIMARY DISPUTE IN THIS PROCEEDING PERTAIN TO QWEST'S RATES RELATED TO ITS DC POWER *PLANT* – NOT DISTRIBUTION – CHARGES?

A. Yes, and this underscores the inapplicability of the Power Reduction Amendment and its inability to solve the problem McLeodUSA believed it was solving in signing the Power Measurement Amendment. That is, Qwest is apparently attempting to resolve an issue

[28] Qwest DC Power Reduction Amendment, Attachment 1, Section 4.0.

pertaining to its billing of DC power ***plant*** charges by creating a process (and a costly one at that) for the CLEC to resize its DC power ***distribution*** infrastructure.

Qwest's position is that the Power Reduction offering will allow CLECs to more closely align their "as ordered" capacity in their DC power distribution arrangements and their "as consumed" DC power usage, such that the CLEC could theoretically lower its DC power plant charges. While Mr. Starkey will address the appropriate charges for DC power plant, from an engineering standpoint, the possibility of reducing power charges through the Power Reduction process is riddled with flaws and is not a suitable substitute for assessing DC power plant charges on an "as consumed" basis.

Q. WHAT ARE THE PROBLEMS WITH QWEST'S POWER REDUCTION OFFERING?

A. First and foremost, a CLEC does not want to align its "as ordered" capacity for DC power distribution with the "as consumed" amperage of the DC power plant, which is the stated objective of Qwest's Power Reduction offering. As discussed above, there is no relationship between DC power distribution capacity and DC power plant investment, and Qwest should not attempt to create such a relationship through the Power Reduction offering because doing so could result in refusing DC power distribution arrangements below the level recommended by manufacturers and safety standards. As a result, the most evident problem is that it does nothing to address the problem with the manner in which Qwest assesses its DC power plant charge. Under Qwest's proposal, it would continue to bill the DC power plant charge on an "as ordered" capacity instead of "as consumed" – though the "as ordered" level could theoretically be lowered after the resizing of DC power distribution occurs. For example, if a CLEC resizes its power distribution arrangement from 60 Amps to 20 Amps, but only uses 8 Amps of DC power, the CLEC is still overpaying for DC power by 12 Amps (instead of the higher overpayment of 52 Amps). Such a situation is still inconsistent with the manner in which DC power plant is sized and would still result in overcharges to McLeodUSA. Furthermore, Qwest's Power Reduction is unnecessary, potentially dangerous, service-affecting and costly.

Q. PLEASE ELABORATE ON WHY QWEST'S POWER REDUCTION OFFERING IS UNNECESSARY, POTENTIALLY DANGEROUS, SERVICE-AFFECTING AND COSTLY?

A. Qwest's power reduction offering is unnecessary because the CLECs to which this offering is geared have already engineered and installed power distribution infrastructure and fused that equipment based on the proper engineering criteria described above. Hence, to subsequently resize the power cables and fuses serves no real useful purpose. For instance, if a CLEC's power cables and fuses are sized for 60 Amps, it makes no sense to reduce the fuse size to 20 Amps, such that the CLEC's power feeds are 60 Amps while the fuses that protect them are 20 Amps. And since power distribution infrastructure is sized for ultimate demand, if a CLEC reduces the rated amperage of its power cables through Qwest's Power Reduction offering (and incurs the costs to resize), the CLEC may find itself in a situation where it must add capacity in the future. This constant resizing of DC power distribution infrastructure based on existing demand is unnecessary and does not comport with good engineering practice.

Such resizing of DC power distribution infrastructure can also be dangerous and service-affecting. Any time power is augmented in the central office for a collocation arrangement, there is a risk of losing power altogether to that collocation arrangement, which, in turn, risks service outages for CLEC customers. For instance, I have explained that CLECs engineer redundancy into their collocation power leads, wherein a collocation arrangement is served by both an "A" lead and a backup "B" lead. If the power for that collocation is switched over to the "B" lead while augmenting the "A" lead or associated fuses, power could be lost in the transition. Further, augmenting power cables within the cable racks in the central office, as would be performed under Qwest's power reduction offering, poses operational risks related to technicians.

Qwest's Power Reduction offering is also costly. According to Qwest, this offering poses both administrative (e.g., Quote Preparation Fee) and engineering costs, and can exceed $1,000 to change a fuse and potentially thousands of dollars to change out a power cable.[29] This is in addition to the costs that CLECs would incur to make these changes. Additionally, the CLEC would place their collocation sites at risk for large, additional power charges each time equipment additions are made to the collocation site. In sum, instead of assisting CLECs in managing their power costs, Qwest's Power Reduction offering would likely result in very large power charges to the CLEC for changing power requirements to meet ongoing equipment changes and augments within a particular CLEC collocation site, while at the same time providing no assistance relative to the underlying problem, i.e., Qwest will continue to bill power plant-related charges inappropriately on an "as ordered" as opposed to an "as consumed" basis.

[29] Qwest proposes individual case basis (ICB)-based pricing for this option, so the pricing is not actually known. However, it is reasonable to assume that it will significantly exceed the charges for changing fuses.

Q. DO YOU HAVE OTHER CONCERNS WITH THE POWER REDUCTION AMENDMENT?

A. Yes. Qwest's Power Reduction would force the CLEC to bear all risk associated with this unnecessary and costly work. Section 2.6 of Qwest's DC Power Reduction Amendment states: "CLEC assumes all responsibility for outages and/or impacts to CLEC-provided service and equipment due to the reduction in DC Power." As explained above, there is potential risk of service-affecting problems due to changing out fuses/breakers and replacing power cables – all of which is unnecessary given that the power infrastructure is already in place and working properly – and Qwest's Amendment provides no recourse for a CLEC should a Qwest mistake result in the CLEC's customers being without service. Further, given the power problem would be localized to BDFBs or power cables dedicated specifically to the CLEC (as opposed to the DC power plant shared by the entire central office), the service-affecting problems would only be experienced by the customers of that particular CLEC – not by Qwest's customers or the customers of other carriers.

Q. DID QWEST'S AFFILIATE EXPRESS SIMILAR CONCERNS RELATED TO A "RE-FUSING" PROPOSAL OF AT&T/SBC ILLINOIS?

A. Yes. In the same Illinois case mentioned above, AT&T/SBC Illinois apparently modified a fusing proposal such that instead of fusing at 125% of the ordered amount, it would fuse at 100% of the ordered amount provided that the fuse size is not more than 200% greater than the CLEC's actual usage. Qwest witness Hunnicutt-Bishara's testimony explained Qwest's concerns related to AT&T/SBC's fusing proposal as follows:

> **Q. WHAT ARE YOUR CONCERNS WITH SBC'S MOST RECENT FUSING PROPOSAL?**

A. I have three major concerns, among others, with SBC's most recent fusing proposal. These concerns are legal, financial and operational. First, if the DC power arrangements are fused based upon the usage at any point in time, and not the List 2 drain of the load, it is probable that the fusing would not be in compliance with NFPA 70-2005, Article 215.3. As a result, the fusing would violate Administrative Code Part 785.20(b)(1), which obligates companies to abide by NFPA 70. In other words, collocators will be forced to either ignore SBC's fusing limitations or ignore the Commission's electrical and fire safety requirements.

Second, on a financial level, changes in a collocator's power draw (for instance, because it adds cards to an existing, but under-utilized, multiplexer) will require the collocator to pay SBC to re-fuse the collocator's collocation power arrangement. For each power delivery arrangement (a single collocation arrangement may include multiple power delivery arrangements), SBC would charge the collocator an Order Charge of $300.50 (physical caged and shared) or $115.26 (cageless and virtual) and a Power Delivery charge of $1,802.03. Regular or periodic re-fusing – which is unnecessary from a safety perspective and, in fact, inconsistent with national fire protection standards and the Commission's rules – will obviously prove quite expensive for collocators.

Third, on an operational level, the low fusing amperage will make unnecessary and harmful overloads more likely and more common. An overload is an overcurrent that is confined to normal current paths and could occur when a single high amperage device is on a circuit that is marginally sized for the demand. The purpose of overcurrent protection devices is to prevent conductor insulation failure caused by overloads or short circuits. An overload condition would be the result of a marginally fused power feed during a power outage.

Q. WHAT ARE THE IMPACTS OF A BLOWN FUSE TO QWEST COMMUNICATIONS CORPORATION ("QCC")?

A. The impacts of power outages due to a blown fuse are numerous, including but not limited to equipment damage, economic loss due to lost production, and irreparable damage to the reputation of QCC with respect to service reliability.

Q. COULD A BLOWN FUSE REALLY DO DAMAGE TO DIGITAL TELECOMMUNICATIONS EQUIPMENT?

A. Absolutely. Years ago, equipment was not as susceptible to power outages as is the sensitive digital equipment of today. Any equipment

> containing microprocessors, such as computers and telecommunications equipment, is especially vulnerable to power down via a blown fuse. The May 24, 1999 article in Telephony Magazine Online "CIRCUIT PROTECTION RUNS DEEP" by Dan O'Shea speaks to this issue specifically:
>
> > "The telecom industry's migration to digital networking has taken several years but is now nearly worldwide. The shift to digital networks triggers numerous benefits that affect network efficiency, performance, capacity and reliability. However, one side effect of this trend is the fact that distributed electronics are more sensitive to fuse outages. Also, the migration to new network architectures and equipment means that different network elements are constantly being replaced or installed, brought on-line or taken off-line. This type of situation is conducive to fuse overloads and other potential problems." (footnotes omitted)

The above excerpt from Qwest's testimony in Illinois is relevant because it shows that Qwest's affiliate possesses the same concerns related to AT&T/SBC Illinois' re-fusing proposal (i.e. such proposal is unnecessary, costly, may result in service outages, etc.) as I have about Qwest Utah's re-fusing proposal. Indeed, Ms. Hunnicutt-Bishara recognizes the disproportionate impacts such re-fusing proposals could have on competitors of the incumbent as follows: "SBC's own equipment – used to serve *its* own retail customers – will likely remain unaffected given that SBC fuses based on List 2 drain, according to SBC's own technical publication." (pg. 9).

Q. WOULD THESE COSTS AND RISKS ASSOCIATED WITH QWEST'S POWER REDUCTION OFFERING OCCUR IF THE COMMISSION ADOPTS MCLEODUSA'S RECOMMENDATION WITH REGARD TO THE DC POWER PLANT CHARGE?

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A. No. McLeodUSA believes it has already addressed this issue by signing the Power Measurement Amendment. If the Commission requires Qwest to abide by the terms of that Amendment and apply its DC power plant charge on an "as consumed" basis, the risks, costs and futility of power reduction activities would be avoided.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, at this time.