

Exhibit No.:  
Issues: Fuel Model  
Witness: Tim M. Nelson  
Sponsoring Party: Aquila Networks-L&P  
Case No.: HR-

Before the Public Service Commission  
of the State of Missouri

Direct Testimony  
of  
Tim M. Nelson

**FILED<sup>4</sup>**  
APR 29 2004  
Missouri Public  
Service Commission

Exhibit No. 112  
Case No(s) FR-2004-0034  
Date 2/23/04 Rptr KF

**BEFORE THE PUBLIC SERVICE COMMISSION  
OF THE STATE OF MISSOURI  
DIRECT TESTIMONY OF TIM M. NELSON  
ON BEHALF OF AQUILA, INC.  
D/B/A AQUILA NETWORKS-L&P  
CASE NO. HR-\_\_\_\_\_**

1 Q. Please state your name and business address.

2 A. My name is Tim M. Nelson. My business address is 10750 East 350 Highway, Kansas  
3 City, Missouri, 64138.

4 Q. By whom are you employed and in what capacity?

5 A. I am employed by Aquila Inc. ("Aquila" or "Company") in the position of Electric  
6 Systems Analyst, Resource Planning.

7 Q. What are your responsibilities as Electric Systems Analyst- Resource Planning?

8 A. I am responsible for analyzing short-term production and purchases operations to meet  
9 the requirements of Aquila's domestic regulated electric utility operations.

10 Q. Please briefly describe your education, work experience, and participation in professional  
11 associations.

12 A. In 1993 I received a Bachelor of Science degree in Mechanical Engineering from Iowa  
13 State University - Ames. Since graduation from Iowa State the majority of my work has  
14 been in the field of electric utility power supply and delivery. In 1994 I joined St. Joseph  
15 Light and Power Company as a production engineer at the Lake Road Generating Station.  
16 In that position I was responsible for engineering projects concerning electric and steam

1 production. My main duties as a Results Engineer included responsibilities of  
2 maintaining operating data and overseeing efficiency compliance.

3 Q. What is the purpose of your direct testimony?

4 A. The purpose of this testimony is to present and support Aquila's position in this case  
5 regarding the production and sale of continuous process steam from the Lake Road  
6 Generating Facility.

7 Q. How is your direct testimony organized?

8 A. My direct testimony is organized as follows:

9 I. Lake Road Generating Station Operating Description

10 II. Production Modeling Description

11 III. Modeling Results

12 Q. Are you sponsoring any schedules?

13 A. Yes. I am sponsoring two schedules:

14 Schedule TMN-1: Lake Road Generating Station -- Fuel and Steam Flow Diagram

15 Schedule TMN-2: Steam Production Model for Lake Road

16 **I. Lake Road Generating Station Operating Description**

17 Q. Please describe the Lake Road generating facilities.

18 A. The plant is located in south St. Joseph, Missouri, on the east bank of the Missouri River.

19 The plant consists of four steam turbine-generators, three combustion turbines, and six

20 steam boilers. The plant's generating units have a net electric generating capability of

21 253.8 MW. In addition to generating electricity, the plant also supplies steam in the form

1 of continuous process steam for sale to six industrial steam customers. The steam sales  
2 are provided at a nominal pressure of 150-PSI. Steam sales are also provided to one of  
3 the six customers at a nominal pressure of 850-PSI. When I refer to PSI, as in 150-PSI, I  
4 mean pressure measured in pounds per square inch. I will also use the term "pound" as in  
5 900-pound system, which means the 900-PSI system.

6 Q. Please explain the Lake Road 900-PSI system.

7 A. The 900 PSI system, which is used to provide steam for the 900-pound turbine-generators  
8 and L&P industrial steam sales, operates at a nominal steam pressure of 900 PSI and is fed  
9 by four 900-PSI boilers (Boilers 1, 2, 4 & 5) and one 200-PSI boiler (Boiler 3). Boilers 1, 2,  
10 3 and 4 burn natural gas as their primary fuel. With the exception of Boiler 3, these boilers  
11 use #2 fuel oil as a back-up fuel. The majority of the 900-PSI system energy is produced by  
12 Boiler 5, which burns coal for its primary fuel, and natural gas for its back-up fuel.  
13 Therefore, the 900-PSI system is a unique system where there are multiple boilers  
14 producing steam in a common header system which in turn can drive three turbine-  
15 generators (1, 2, and 3) and also supply steam for industrial steam sales.

16 Q. Which fuels and production systems are dedicated to providing services to the steam  
17 customers?

18 A. There is no dedicated fuel source and there are no dedicated production systems for the  
19 steam customers. The configuration of this plant has common facilities used for both  
20 electric and steam production. Schedule TMN-1: Lake Road Generating Station – Fuel  
21 and Steam Flow Diagram, is attached. By inspection of this diagram it is evident that the

1 900-PSI system is common to multiple fuel inputs and produces steam for multiple  
2 turbines as well as the steam customers. The 150-PSI system also operates via multiple  
3 sources and has no dedicated production equipment.

## 4 II. Production Modeling System

5 Q. What method is used to allocate Lake Road's operating costs between the electric and  
6 steam customers.

7 A. We use the electric production modeling program RealTime® in an iterative process to  
8 simulate electrical and steam customer loads. An iterative process is required to find the  
9 balance point of costs in a system which has multiple fuel inputs and multiple steam  
10 outputs (generators and steam sales) from one common steam system. Schedule TMN-2:  
11 Steam Production Model for Lake Road is a diagram that describes the process flow for  
12 this method.

13 Q. How are the fuel expenses associated with the operation of the 900-PSI system allocated  
14 between the L&P division's electric and industrial steam jurisdictions?

15 A. Aquila allocates 900-pound fuel expense between its L&P division's electric jurisdiction  
16 and industrial steam jurisdiction using the allocation methodology approved by the  
17 Commission in its Case No. EO-94-36.

18 Q. Please describe the steam/electric fuel and purchase power expense model used by  
19 Aquila.

20 A. Aquila created two models in RealTime®, one for electric and one for steam, and two  
21 Microsoft Excel® spreadsheets to determine the annualized fuel and purchase power

1 expense costs for the L&P system. The RealTime® “electric” model is used first to  
2 dispatch all of the L&P electric system to meet the system load. One unique aspect of  
3 this model is that the fuel price (in \$/mmBtu) for the 900-pound electric turbines (Lake  
4 Road turbine generators 1, 2, and 3) is not known since the average fuel cost is affected  
5 by the dispatch of the units. For the first iteration this fuel price must be estimated, then  
6 after the RealTime® “steam” model is run, a new fuel price can be calculated and the  
7 electric model rerun with the new prices. The method for determining the average fuel  
8 price for the 900-pound electric turbines will be discussed in more detail later.

9 After the electric model has been run the 900-pound electric turbines hourly MW  
10 load is exported to a text file. This text file is then imported into the “Unit to Steam”  
11 spreadsheet where the steam input necessary for each of the three generators is calculated  
12 using the respective unit heat rate curves. In this spreadsheet, the total steam required for  
13 the turbines is calculated and then exported to a comma separated value (csv) file. The  
14 csv file is imported into the RealTime® steam model as another steam load for the steam  
15 system.

16 In the RealTime® steam model the electric turbine steam input from above is  
17 combined with the 2002 steam sales loads too produce 900-pound boiler hourly steam  
18 load input to the model. Boilers 1, 2, 3, and 4 are modeled as burning natural gas and  
19 Boiler 5 is modeled as burning a 60% PRB and 40% high Btu coal on an mmBtu basis  
20 (which is approximately a 65% / 35% when blended by weight). This is based on what  
21 the actual average coal blend ratio for Boiler 5 was for 2002. The RealTime® steam

1 model is then run using these steam loads to determine the total fuel burn and fuel cost  
2 for the Lake Road 900-pound boilers.

3 After running the RealTime® steam model the fuel allocation is performed on a  
4 daily basis in the Allocation spreadsheet. To perform the allocation several inputs are  
5 required. From the steam model: 1) daily fuel quantity burned, by fuel type, and, 2) daily  
6 fuel cost by fuel type. From the electric model: 1) daily MW generated by the 900-pound  
7 electric turbines, 2) monthly MW generated by the 900-pound electric turbines, 3)  
8 industrial steam sales mmBtu, and, 4) the 900-pound electric turbines steam mmBtu from  
9 the Unit to Steam spreadsheet.

10 The fuel allocation is performed on a daily basis and is based on the following  
11 equations:

12 
$$F_S = [ S / ( E + S ) ] \times F$$

13 
$$F_E = F - F_S$$

14 Where,

15 F is total 900-pound boiler fuel

16  $F_S$  is 900-pound boiler fuel allocated to industrial steam sales

17  $F_E$  is 900-pound boiler fuel allocated to the electric turbines

18 S is industrial steam sales steam mmBtu from boilers

19 E is 900-pound electric turbine steam mmBtu from boilers

20 Once the allocation process is complete, the actual average fuel cost (in \$/mmBtu) for the  
21 900-pound electric turbines can be calculated and compared to the price used in the

1 RealTime® electric model. To calculate this, divide the total dollars of fuel allocated to  
2 the 900-pound electric turbines by the total mMBtu of fuel allocated to the turbines. This  
3 fuel price is calculated on a monthly basis and then compared to the monthly price used in  
4 the electric model. If the any of the calculated monthly fuel prices vary significantly from  
5 those used in the electric model then the new calculated fuel prices are inputted into the  
6 electric model and the whole model is rerun. This process is iterated until the calculated  
7 average fuel price for the 900-pound electric turbines matches the previous iteration.

### 8 III. Modeling Results

9 Q. What are the fuel and energy costs allocated to the steam business as determined by the  
10 steam model?

11 A. The fuel costs allocated to the steam business are \$2,169,731 for coal and \$3,678,427 for  
12 natural gas for a total of \$5,848,158 for fuel. The steam business is also allocated costs  
13 associated with its auxiliary power use and demand. These costs are \$192,092 for the  
14 energy component and \$397,252 for the demand component. This brings the total cost  
15 for the steam business to \$6,245,410.

16 Q. Does the fuel and energy allocation accurately reflect how the Lake Road Plant operates  
17 and does it properly allocate the fuel and energy costs?

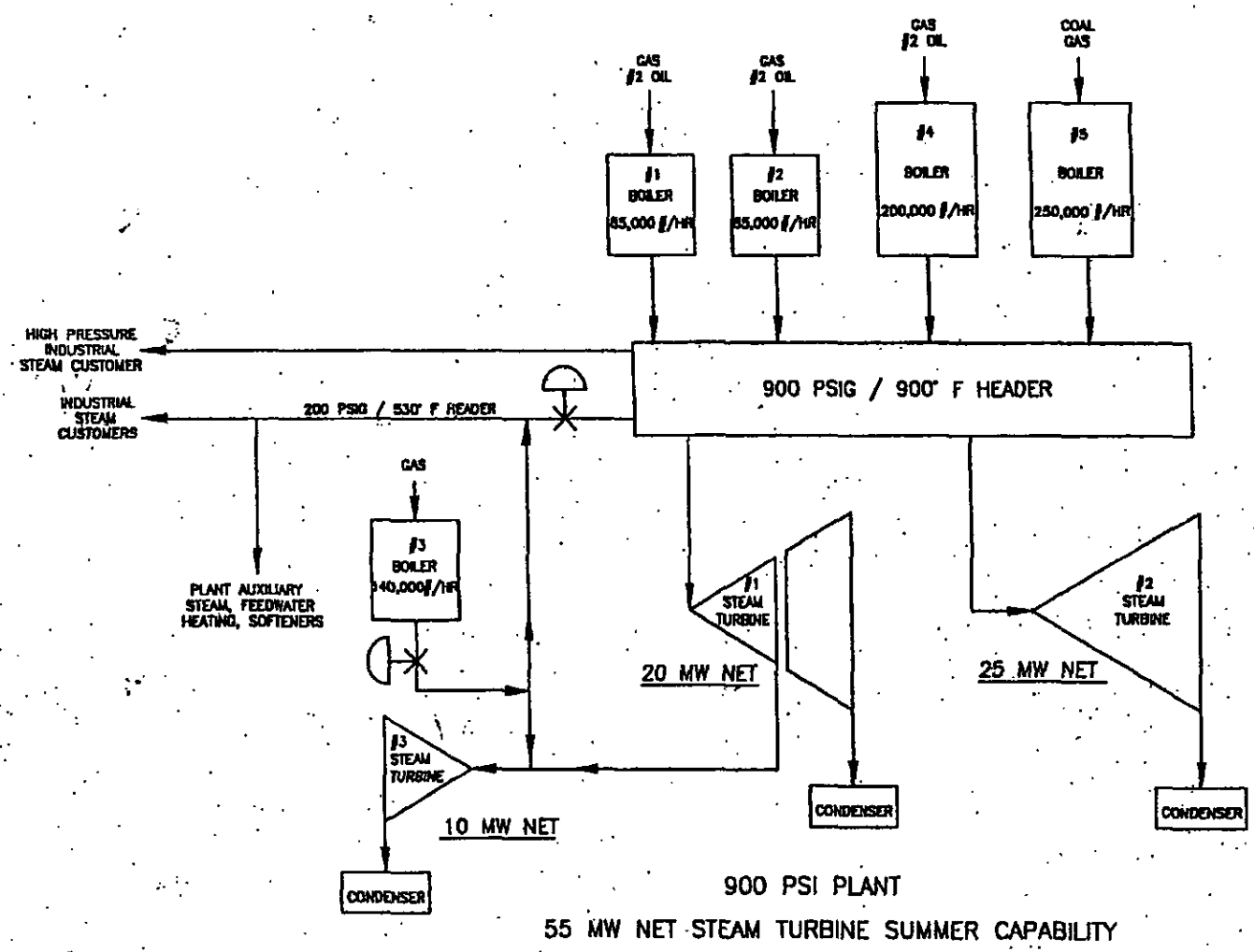
18 A. Yes, all costs associated with operating the steam business are accounted for and properly  
19 allocated.

20 Q. Does this conclude your direct testimony?

21 A. Yes it does.

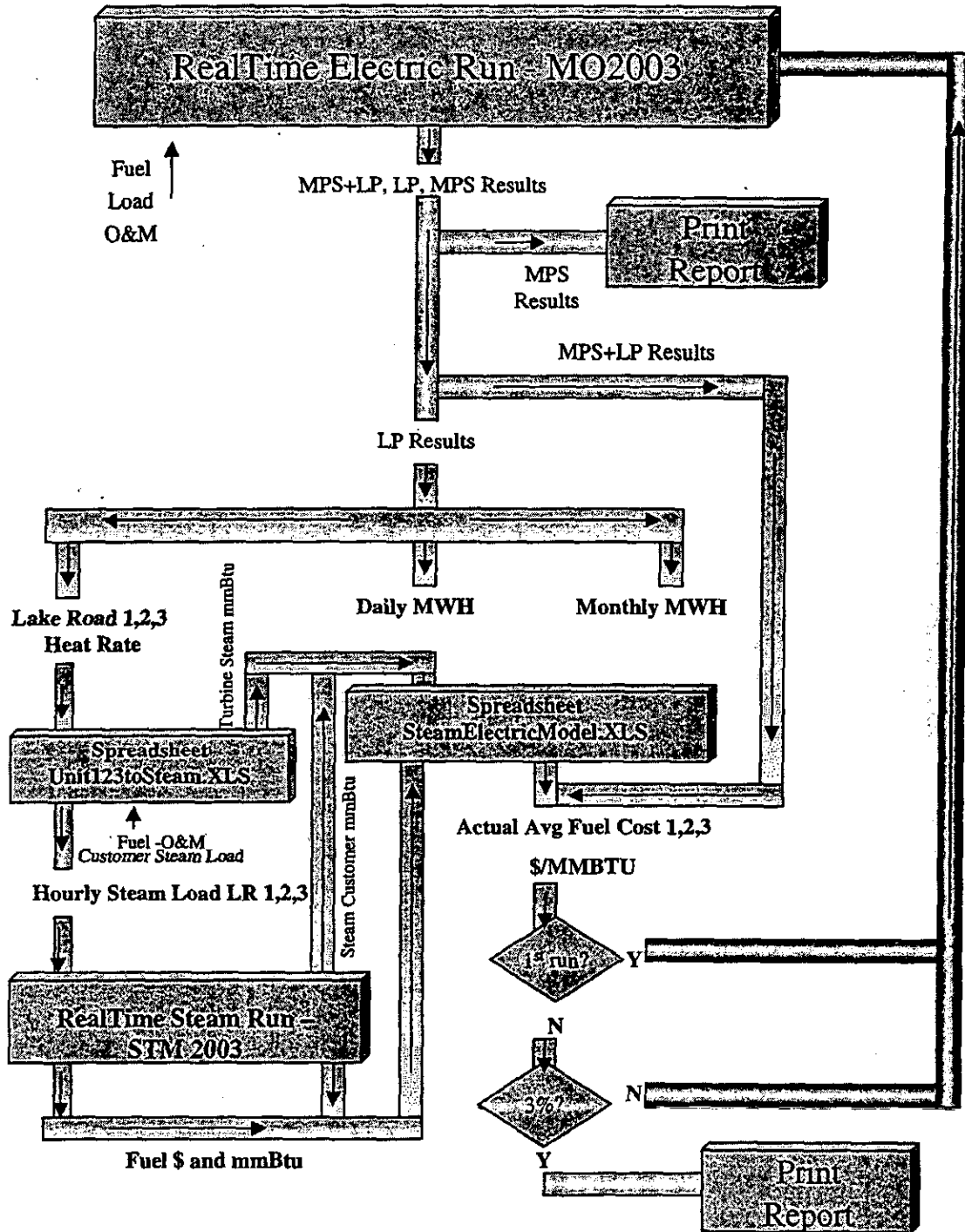


Diagram 1 - Lake Road Generating Station - Fuel and Steam Flow Schematic



Schedule TMN-1

# Missouri Steam/Electric Production Model Process



**BEFORE THE PUBLIC SERVICE COMMISSION  
OF THE STATE OF MISSOURI**

In the matter of Aquila, Inc. d/b/a Aquila     )  
Networks-L&P, for authority to file tariffs     )  
Increasing steam rates for the service provided     )  
To customers in the Aquila Networks-L&P area     )

Case No. HR-\_\_\_\_\_

County of Jackson   )  
                          )       ss  
State of Missouri    )

**AFFIDAVIT OF TIM M. NELSON**

Tim M. Nelson, being first duly sworn, deposes and says that he is the witness who sponsors the accompanying testimony entitled "Direct Testimony of Tim M. Nelson;" that said testimony was prepared by him and under his direction and supervision; that if inquiries were made as to the facts in said testimony and schedules, he would respond as therein set forth; and that the aforesaid testimony and schedules are true and correct to the best of his knowledge, information, and belief.

*Tim M. Nelson*

\_\_\_\_\_  
Tim M. Nelson

Subscribed and sworn to before me this 16th day of June, 2003.

*Linda C. Howell*

\_\_\_\_\_  
Notary Public  
Linda C. Howell

My Commission expires:

May 4, 2004\_\_\_\_\_

Linda C. Howell  
Notary Public-Notary Seal  
State of Missouri  
Jackson County  
My Commission Expires: May4, 2004