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SUPPLEMENTAL TESTIMONY AND SCHEDULES

JAMES A HEIDELL

STATE OF NORTH DAKOTA
BEFORE THE
NORTH DAKOTA PUBLIC SERVICE COMMISSION

NORTHERN STATES POWER COMPANY

CASE NO. PU-17-120

ADVANCE PRUDENCE – 1,550 MW WIND PORTOFLIO

SUPPLEMENTAL TESTIMONY JAMES A HEIDELL - 1



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TABLE OF CONTENTS

I. Introduction 3
II. Summary of Recommendations..... 4
III. Findings 5
IV. Updates to the 1,550 MW Wind Portfolio..... 6
V. Review of the Company’s Analysis 11
VI. Analysis of the Projects as Dispatched into the MISO Market 13
VII. Recommendations 17

1
2 **I. Introduction**

3 **Q. Would you please state your name, affiliation, and address?**

4
5 **A.** My name is James A. Heidell. I am a Director at PA Consulting Group ("PA"). My
6 business address is 1700 Lincoln Street, Suite 3550, Denver, CO 80203.

7
8 **Q. On whose behalf are you filing this testimony?**

9
10 **A.** I am filing this testimony on behalf of the Advocacy Staff of the North Dakota Public
11 Service Commission ("Commission").

12 **Q. Have you provided prior testimony in this proceeding?**

13
14 **A.** Yes, I filed direct testimony and associated exhibits.

15
16 **Q. What is the purpose of your testimony?**

17
18 **A.** The purpose of my testimony is to address the Supplement filing made by Northern
19 States Power Company ("NSP" or the "Company") on May 18, 2018. On September 22,
20 2017 NSP and Advocacy Staff filed a settlement recommending that the Commission
21 approve the Advance Determination of Prudence (ADP) for the 1,550 Wind Portfolio.
22 The First Revised Settlement Agreement was withdrawn by mutual consent on March 19,
23 2018 to allow the parties to evaluate the implications of the December 2017 Tax Cuts and
24 Jobs Act (TCJA) on the economics of the proposed wind portfolio.

25 The NSP Supplement addressed the impact of the TCJA as well as other changes in the
26 Projects' economics since the original filing. My supplemental testimony addresses the
27 revised economics of the proposed transactions and my updated recommendations based
28 upon the updated information provided by the Company.

1
2 **Q. Would you please summarize the organization of your supplemental testimony?**

3
4 **A.** Yes. I start with presenting my findings and recommendations and then I describe the
5 updates to the original filing, followed by my additional analysis conducted to support
6 my findings and recommendation.

7 **Q. Are you sponsoring any exhibits to your testimony?**

8
9 **A.** Yes. I am sponsoring the following exhibits:

- 10 • Exhibit JAH-4: Resource Mix
11 • Exhibit JAH-5: Portfolio Energy Cost Savings Compared to Market Purchases

12
13 **II. Summary of Recommendations**

14 **Q. What is your recommendation with regards to approving the Company's**
15 **Application for an ADP to add 1,550 MW of wind-powered generation to the NSP**
16 **integrated system?**

17
18 **A.** My recommendation is that the Commission conditionally approve the Application on the
19 basis that the wind generation Projects are individually and collectively expected to lower
20 electricity costs for NSP's North Dakota customers. While the Projects will lower energy
21 costs, they will not meet any near term need for capacity. In addition, I note that both the
22 Foxtail and Clean Energy I Projects are renewable energy projects located in North
23 Dakota and have a rebuttable presumption of prudence under North Dakota statute.¹ I
24 evaluated the economic benefits of the wind Projects based upon information presented
25 by the Company, supplemented by my evaluation of the Company's analysis and my
26 independently developed supporting analysis.

27
28 ¹ N.D.C.C. § 49-05-16
SUPPLEMENTAL TESTIMONY JAMES A HEIDELL - 4

1 A. Based upon my review and analysis of the testimony filed in the Application, the exhibits
2 contained within the Application, the Supplement and the information produced in
3 discovery, I conclude the following:

- 4 • The wind generation Projects are anticipated to dispatch into the MISO market at
5 prices that will result in margins (revenues less revenue requirement) that yield
6 electricity cost savings for North Dakota customers.
- 7 • The levelized costs of the Projects are below the likely alternative wholesale
8 market energy cost. The Company's estimated savings, expressed as the Present
9 Value of Revenue Requirements ("PVRR"), are approximately \$1,408 million (in
10 2017 dollars) for the total NSP integrated system over twenty-five years. While
11 the Company's estimate is based upon non-current market assumptions, they are
12 still reasonable.
- 13 • I have calculated the savings relative to market purchases for both low and high
14 gas case based upon PA's market price projections. The expected electricity cost
15 savings range from [CONFIDENTIAL DATA BEGINS ██████████
16 ██████████ CONFIDENTIAL DATA ENDS]
17 million (discounted to 2017).

18 IV. Updates to the 1,550 MW Wind Portfolio

19 Q. What changes to the economic analysis of the Portfolio did the Company make in its
20 Supplement?

21 A. The Company's economic analysis of the 1,550 MW portfolio of wind generation was
22 updated in the Supplement to reflect the following:

- 23 • The impact of the TCJA;
- 24 • A reduction in capital cost estimates for Crowned Ridge and Lake Benton; the
25 two BOT Projects;
- 26 • A reduction in capital cost estimates for Foxtail, Freeborn, Blazing Star I and
27 Blazing Star II; the four Company build projects;

- 1 • Reconfiguration of the turbines for the Company build projects with an associated
2 increase in production for the Foxtail, Freeborn Blazing Star I, and Blazing Star II
3 Projects; and
- 4 • An assumption of lower O&M costs for the Company operated projects.

5
6 **Q. What impact did these changes have on the levelized costs of the Projects?**

7 **A.** The original and revised estimated construction cost and Levelized Cost of Energy
8 (“LCOE”) for each Project are shown in Table 1.² LCOE is an economic assessment of
9 the discounted annual cost to build and operate a power generating asset over its lifetime,
10 divided by the discounted annual energy output of the asset over the same lifetime. The
11 net changes increased the costs from 0% to 32% depending on the project. The largest
12 percent increases were associated with what were initially the lowest cost projects.

13
14 The Clean Energy #1 and Foxtail Projects have a rebuttable presumption of prudence
15 under North Dakota law since they are renewable energy projects located in North
16 Dakota. Clean Energy #1 was originally the most expensive of the seven Projects.
17 However, it is no longer the most expensive Project. Foxtail is also cost competitive with
18 the other wind Projects in the portfolio. It is important to note that while the Clean
19 Energy #1 Project is a 20-year purchase power agreement (“PPA”), the Company
20 calculated the LCOE on a 25-year basis so that all Projects are compared over a
21 consistent timeframe.³

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28 ² Current completion status based upon Annual Report NSP filed with the MNPUC on January 2, 2018.

³ Advanced Prudence – 1,550 MW Wind Portfolio Application, p 35.

Table 1. Updated Project Costs

Project Name	Total Cost Before**	Total Cost Current**	LCOE Before	LCOE Current
***** Confidential Data Begins				
Blazing Star I				
Blazing Star II				
Freeborn				
Foxtail				
Clean Energy #1 (PPA)				
Crowned Ridge (PPA)				
Crowned Ridge				
Lake Benton				
Confidential Data Ends *****				
** Total costs include AFUDC, construction and interconnection do not include AFUDC				

12
13 **Q. Have the economics of the two PPAs changed?**

14
15 **A.** The levelized costs for the two PPAs, Clean Energy #1 and Crowned Ridge, have not
16 changed. While the developers have termination rights on those Projects based upon an
17 expired approval date, those rights have not been exercised and the economic analysis for
18 those Projects is unchanged from the Company's perspective. The economic benefits
19 have changed based upon my changes in expectation of wholesale market electricity
20 prices.

21 **Q. Have the in-service dates of the Projects changed?**

22
23 **A.** No, the construction of the all the Projects is proceeding on schedule.⁴ All of the Projects
24 are still projected to be in-service by December 31, 2020. The 2020 end date is critical
25 because the Projects must be in service within four years of the end of the year that
26

27
28 ⁴ Compliance Filing Annual & Quarterly Report Wind Generation Acquisition Docket No. E0002/M-16-777. Xcel Energy, January 31, 2018.

1 construction commenced. The projected in-service date for each Project is shown in
2 Table 2.

3
4 **Table 2. Proposed Wind Projects & Current Projection of In-Service Date**

5

Project Name	Size ¹	Type ²	Location	In-Service Date ⁵
Blazing Star I	200 MW	Self-Build	Lincoln County, MN	Dec 2019
Blazing Star II	200 MW	Self-Build	Lincoln County, MN	Sept 2020
Freeborn	200 MW	Self-Build	Freeborn County, MN Worth and Mitchell Counties, IA	Dec 2020
Foxtail	150 MW	Self-Build	Dickey County, ND	Sept 2019
Clean Energy #1	100 MW	PPA	Mercer and Morton Counties, ND	Q4 2019
Crowned Ridge	600 MW	BOT/PPA	Codington County, SD	Dec 2019
Lake Benton	100 MW	BOT	Pipestone County, MN	Dec 2019

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11 (1) Nameplate rating

(2) Self-Build: Projects developed and owned by the Company

12 BOT: Build – Operate – Transfer. Developed and constructed by a third-party, then purchased, owned,
and operated by the Company thereafter.

13 PPA: Power Purchase Agreement.

14
15 **Q. What is the construction status for each wind generation Project?**

16
17 **A.** The Company in its April 30, 2018 quarterly reporting to the MNPUC reported that the
18 construction for all seven Projects are on track.⁶ Foxtail is under construction, Blazing
19 Star 1 is scheduled to start mobilization in August 2018 and the remaining Projects are
20 still in the development stage.⁷

21 **Q. Is there an update to the status of each proposed Project's interconnection**
22 **agreement and costs?**

23
24
25
26 ⁵ NSP response to NDPSC Data Request No. 7-1.

27 ⁶ Compliance Filing-Quarterly Report Wind Generation Acquisition Docket No. E0002/M-16-777, April 30, 2018

28 ⁷ NSP response to NDPSC Data Request No. 7-2.

**Public Document
Trade Secret Data Excised**

1 A. The Company's summary of the status of the network upgrades is shown in Table 3 along
2 with the original estimates of the network upgrade and interconnection costs. The
3 Company has indicated that upgrade and interconnection costs have not been finalized
4 and that there have been both cost increases and decreases.⁸

Table 3. Interconnection Status

Project Name	Original Estimated Completion	GIA Status	Estimated Cost of Network Upgrades	Estimated Cost of Interconnection
***** Trade Secret Data Begins				
Blazing Star I	Dec 2017	GIA negotiations expected start 8/18	██████	██████
Blazing Star II	June 2018	Study not completed	██████	██████
Freeborn	TBD ⁽²⁾	Executed	██████	██████
Foxtail	Aug 2016 ⁽¹⁾		██████	██████
Clean Energy #1	May 2014		██	██
Crowned Ridge	3Q 2018	1 & 2 Executed. 3 not completed	██	██
Lake Benton	NA		██	██
Trade Secret Data Ends *****				
(1) Foxtail's Generator Interconnection Agreement ("GIA") was executed August 30, 2016.				
(2) Freeborn's Impact and Facilities Studies are complete, and the GIA is under negotiation.				
(3) Lake Benton is a repowering of the existing Lake Benton II wind facility, in operation since 2000. Lake Benton will use the existing interconnection.				

18
19
20 **Q. Has the Commission issued related approvals for the two North Dakota Projects?**

21 A. Yes. On Jan 31, 2018 the Commission issued a Certificate of Site Compatibility for the
22 Foxtail Project in Case No. PU-17-284. In August 2012 the Commission issued a
23 Certificate of Site Compatibility for the Clean Energy #1 Project. On November 16,
24 2017 the Commission issued an amended Certificate of Site Compatibility in Case No.
25 PU-17-302.

26
27
28 ⁸ NSP response to NDPSC Data Request No. 7-6.
SUPPLEMENTAL TESTIMONY JAMES A HEIDELL - 10

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2 **V. Review of the Company's Analysis**
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4 **Q. Did the Company update its resource planning model in conjunction with its**
5 **Supplement?**

6 **A.** My understanding is that the Company did a limited update to Strategist to reflect new
7 financial parameters resulting from the TCJA, the Company's cost of capital, and the
8 impact of the TCJA and cost of capital on the cost of capacity for a new CT. However,
9 the Company did not update its analysis of fuel costs, market electricity costs, or the load
10 forecast.⁹

11 **Q. Did the Company update its analysis of congestion costs, wind integration costs, or**
12 **coal plant cycling costs?**

13
14 **A.** No, the Company indicated that it does not have updated forecasts.¹⁰
15

16 **Q. Did the Company update its analysis of the levelized costs of the Projects?**

17 **A.** Yes, the Company updated its financial model for each Project and the associated
18 calculation of the revenue requirement and levelized cost of each Project under the base
19 case. (Note, the costs do not change in conjunction with the low gas case that was also
20 modeled in Strategist.) The updated analysis, depending on the Project, includes updated
21 assumptions on capital costs, O&M costs, electricity production, cost of capital, and
22 impact of the TCJA.
23

24 **Q. Did you review the updated analysis provided by NSP?**
25
26
27

28 ⁹ PU-17-120 Supplement p 11.

¹⁰ NSP Response to NDPSC 6-5 (g).

1 A. Yes, I reviewed the Company provided summaries of its Strategist model runs for the
2 base and low gas cases as well as updated revenue requirement models. I have relied on
3 those data in developing my updated assessment of the Projects.

4 Q. What are the Company's current projections of the resource mix?

5
6 A. The Company's current projections of the resource mix, assuming all 1,550 MW of
7 Projects are completed, are shown in Table 4 on a percentage basis for the base case.
8 Table 5 shows the change in estimated generation by resource type as forecast by
9 Strategist. The projections for the low gas case are shown in Exhibit JAH-4. Table 4
10 shows that the 1,550 MW of wind significantly increases the renewable portion of the
11 portfolio after all the Projects are on line and that initially the company will have
12 significant market energy sales. The proportion of energy sales declines as other
13 generation assets retire and power purchase agreements expire.

14 **Table 4. NSP's Base Case Projected Resource Mix**

15 ***** Confidential Data Begins

16

17 Resource Mix including 1,550	2018	2022	2023	2024	2025	2026	2027	2028	2029	2030
18 Coal										
19 Nuclear										
20 Gas										
21 Hydro										
22 Wind / Solar / Bio										
23 Net Market Purchases										
24 Other										

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Table 5. NSP's Base Case Projected Strategist Generation

Base Case Resource Change	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1,550 Wind										
Other										
Reduced Coal Gen										
Reduced Gas Gen										
Reduced Market Purchases										
Increased Market Sales										
Other										

***** Confidential Data Ends

Q. Does the addition of 1,550 MW of wind-powered generation to the NSP integrated system result in a reasonable resource balance?

A. The resource balance is heavily tilted toward renewables compared to the expected MISO distribution. For example, the MISO 2017 MISO Transmission Expansion Plan Study's highest renewables penetration case, the Accelerated Alternative Technologies future, projects renewables to reach 26% of MISO's energy supply in 2031 versus 33% for the NSP system.¹¹ While NSP will have a higher percentage, the percentage is not inconsistent with the current Minnesota requirement for Xcel to have 31.5% renewable energy by 2020.

VI. Analysis of the Projects as Dispatched into the MISO Market

¹¹ MTEP17 MISO Transmission Expansion Plan, MISO, December 2017. Figure 5.2-3 p 86.
SUPPLEMENTAL TESTIMONY JAMES A HEIDELL - 13

1 **Q. Did you update the Company's analysis of the estimated revenues by Project from**
2 **dispatch into the MISO market?**

3
4 **A. Yes. I evaluated the savings compared to market purchases and the savings under three**
5 **gas price scenarios compared to the levelized cost of each Project. The analysis is based**
6 **upon long-term hourly forecasts of Minnesota Hub prices developed by PA with the**
7 **AuroraXMP hourly production cost model. I also conducted a comparable analysis with**
8 **the Company's recent projections of Minnesota Hub prices.**

9 **Q. Why did you develop three natural gas price scenarios?**

10
11 **A. MISO market prices are strongly influenced by the cost of natural gas. This is the result**
12 **of natural gas-fired generation units frequently being the marginal units setting market**
13 **prices. In the production cost model, the hourly marginal electricity price is determined**
14 **by the last unit dispatched to serve the forecast load and the associated fuel and variable**
15 **operating costs i.e. gas costs. The MISO May 2018 Market Monitor reports that over the**
16 **last 13 months, the correlation coefficient between the Henry Hub natural gas price and**
17 **the MISO RT LMP was 0.843.¹² The 2018 Market Monitor Report notes that gas-fired**
18 **generation sets the market marginal energy price for approximately "44% of all intervals**
19 **for the year including almost all peak hours" and coal-fired generation sets the marginal**
20 **price for approximately 56% of the intervals.¹³**

21 **Q. Why are savings based upon MISO market prices relevant?**

22
23 **A. The Projects will earn revenues based upon dispatching against the clearing price in the**
24 **MISO market. The market clearing price will reflect congestion and losses allocated to**

25
26
27 ¹² MISO May 2018 Monthly Market Assessment Report, Market Evaluation and Design, July 12, 2018, p 16.

28 ¹³ 2017 State of the Market Report for the MISO Electricity Markets, Potomac Economics, p4. (Note hydro and wind each set the price 1% of the intervals.)

1 each generator's interconnection node. In most hours, wind units are essentially price
2 takers since they have virtually zero SRMC with the exception of the PTC, which incents
3 them to generate even if market prices are negative.

4
5 **Q. Please describe the savings calculation you developed based upon a forecast of**
6 **market prices?**

7 **A.** I calculated the market revenues based upon the hourly production profile of each Project
8 in the 1,550 wind portfolio. I summed each Project's production profile into on- and off-
9 peak generation by month, and multiplied by the associated on- and off-peak forecast of
10 Minnesota Hub prices. I made an associated adjustment in the revenues for wind
11 integration costs, coal plant cycling costs, and congestion costs. I then calculated the
12 annual savings based upon the revenue requirements prepared by NSP.¹⁴ This calculation
13 is shown in Exhibit JAH-5.

14
15 **Q. Did you consider any other scenarios?**

16 **A.** Yes, I evaluated the savings of the Projects based upon plus/minus 5% of production. In
17 addition, I evaluated the savings compared to a current MN Hub monthly on and off-peak
18 price forecast provided by the Company.¹⁵

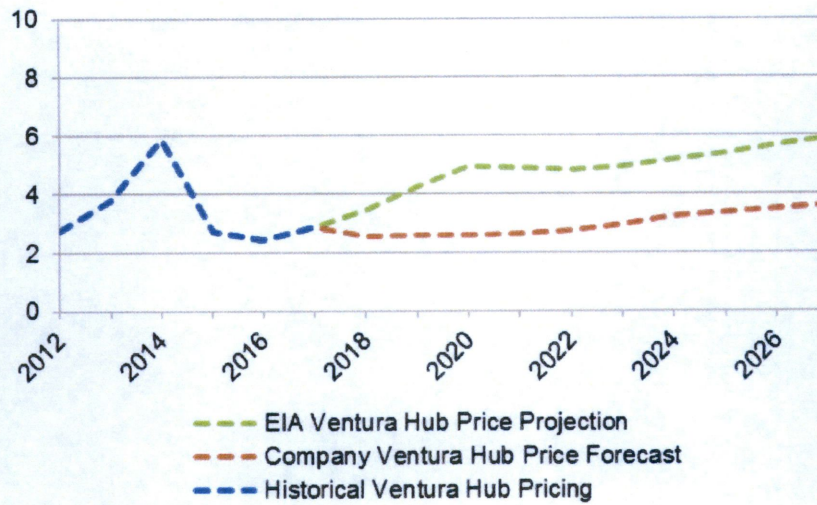
19
20 **Q. Have you compared the base case Minnesota Hub electricity and Ventura Hub**
21 **natural gas prices that you used with NSP's current projections?**

22
23 **A.** Yes.

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28 ¹⁴ See NSP response to NDPSC Data Request No. 6-7 Attachment A-F.

¹⁵ NSP response to NDPSC Data Request No. 6-5 Attachment A.

Figure 1: Gas Price Comparisons



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13 Q. What are the estimated savings of the Portfolio compared to MISO market purchases?
14

15 A. I have summarized the results for the entire 1,550 portfolio in Table 6 and exhibit JAH-5.
16 The estimated net present value of savings for the base case are [CONFIDENTIAL
17 DATA BEGINS ██████████ CONFIDENTIAL DATA ENDS]. This
18 estimate of savings is approximately 22% lower than the Company's estimate.
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Table 6. Market Price Sensitivity Analyses

[CONFIDENTIAL DATA BEGINS]

Scenario	Estimated Savings ¹ (Millions)	% Decrease in Savings	% Increase in Savings	Description
PA Base Case	█	█		PA's base case compared to Company's Strategist Base Case
PA Low Gas Case	█		█	PA's low gas case results in higher energy savings compared to Company's Strategist Low Gas Case
PA High Gas Case	█	█		The Company did not project a Strategist High Gas Case
PA Base Case + 5% Production	█	█		PA's base case with 5% additional production compared to Company's Strategist Base Case
PA Base Case - 5% Production	█	█		PA's base case with 5% lower production compared to Company's Strategist Base Case
NSP Base Case	█	█		The Company's market pricing views compared to its Strategist Base Case
NSP Low Gas Case	█	█		The Company's low gas market pricing views compared to its Strategist Low Gas Case
NSP Base Case + 5% Production	█		█	The Company's market views with 5% additional production compared to Company's Strategist Base Case results in higher savings
NSP Base Case - 5% Production	█	█		The Company's market views with 5% lower production compared to Company's Strategist Base Case

1. NPV discounted to 2017

[CONFIDENTIAL DATA ENDS]

Q. Is it likely that market power prices will decrease to the point that these Projects are not economic?

A. I do not think it is likely since the market power prices would have to drop below the levelized cost of the Projects. Even at a long-term average market heat rate of 7,000 Btu/kWh and \$3/MMBtu natural gas, these Projects will be cost effective based upon the revenue requirements that the Company has calculated.

VII. Recommendations

Q. Should the Commission grant an ADP for the proposed wind Projects?

1
2 A. Yes, subject to the qualifications I discuss. I have reviewed the Company's revised cost
3 estimates and associated revenue requirements and compared those to market power costs
4 and my conclusion is that the Projects remain in the interest of the utility's North Dakota
5 customers.

6 Q. **Based upon the rebuttable presumption that the Foxtail and Clean Energy #1 wind**
7 **Projects are prudent, have you identified any basis for demonstrating that the**
8 **Projects are not prudent?**

9
10 A. No. The Projects are expected to save money compared to market purchases under the
11 Base Case and two down side cases I considered (5% lower production and low gas
12 prices). In addition, the Company's analysis also demonstrates that individually the
13 Projects reduce total power supply costs compared to the base case of not proceeding
14 with the wind Projects.

15 Q. **Are you recommending the same qualifications on Commission approval that you**
16 **proposed in your direct testimony?**

17 A. Yes, NSP is shifting its portfolio significantly towards wind by going from an estimated
18 20% of its electricity production from wind in 2018 to 34% in 2021. Qualification for the
19 full amount of the PTC is an important part of the economic analysis and foundation for
20 the savings estimates. As a result of the Company ownership and BOT structures, the
21 Company has control over the necessary completion of the Projects to qualify for the full
22 PTC and the Company has indicated that the Projects are on schedule and expects to
23 qualify for the full PTCs.¹⁶ Therefore, I continue to recommend that the Company and
24 not North Dakota customers are economically responsible for securing the PTCs.

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28 ¹⁶ NSP response to NDPSC Data Request No. 7-4.
SUPPLEMENTAL TESTIMONY JAMES A HEIDELL - 18

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2 **Q. Does this conclude your supplemental testimony?**

3

4 **A. Yes.**

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JAH - 4

TRADE SECRET DATA

NOT FOR PUBLIC DISCLOSURE

JAH – 5

TRADE SECRET DATA

NOT FOR PUBLIC DISCLOSURE

