Exhibit No.:
Witness: Colin Pratt
Type of Exhibit: Surrebuttal Testimony
Issues: Noranda Economic Impact
Sponsoring Party: Noranda Aluminum, Inc.
Case No.: ER-2014-0258

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Union Electric Company, d/b/a Ameren Missouri's Tariff to Increase Its Revenues for Electric Service	**Case No. ER-2014-0258**

Surrebuttal Testimony of Colin Pratt

On behalf of

Noranda Aluminum, Inc.

February 6, 2014

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariff to Increase its Revenues for Electric Service	))))))	**Case No. ER-2014-0258**

Affidavit of Colin Pratt

Colin Pratt, being first duly sworn, on his oath states:

1. My name is Colin Pratt. I am Managing Consultant of CRU having its principal place of Chancery House, 53-64 Chancery Lane, London WC2A 1QS, United Kingdom.

2. Attached hereto, and made a part hereof for all purposes, is my surrebuttal testimony, which was prepared in written form for introduction into evidence in Missouri Public Service Commission Case No. ER-2014-0258.

3. I hereby swear and affirm that the testimony is true and correct.

Colin Pratt

Subscribed and sworn to before me this 6th day of February, 2015.

Notary Public or Commissioner for Oaths

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CHARLES EKENG HENSHAW
NOTARY PUBLIC
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MY COMMISSION IS
FOR LIFE

Before the
Missouri Public Service Commission

Case No. ER-2014-0258

Prepared Surrebuttal Testimony of Colin Pratt

Q: Please state your name and business address.

A: Colin Pratt. My business address is Chancery House, 53-64 Chancery Lane, London WC2A 1QS, United Kingdom.

Q: Have you filed direct testimony in this proceeding?

A: Yes.

Q: What is the purpose of your surrebuttal testimony?

A: It is to respond to issues raised in the rebuttal testimony of David Humphreys.

Q: Please describe the issues raised in Dr. Humphreys's testimony that you intend to address?

A: I wish to comment on the difference between the mean forecast of the aluminum price and the variance as captured in a sensitivity or simulation, and on the appropriate use of each. I will also comment on the method of using price cycles from historical time periods to perform simulations or scenarios, and the appropriate choice of time periods.

Q: Based on your experience, is it proper and reasonable to use simulated price cycles to stress test business plans?

A: Yes. As testified by Dr. Humphreys, these may involve historical prices, the consideration of industry cost structures or techniques such as Monte Carlo simulation.

Q: Do such stress tests aid in contingency planning?

A: Yes. A business may have a central estimate or mean expected forecast price, but there will be a considerable range or variance of potential outcomes around that central mean. In the case of aluminum the historical evidence is that prices do not proceed in a straight line, but fluctuate around the mean with a wide range or variance. I believe Dr Humphreys and I agree that the timing of these cycles cannot be predicted with any accuracy. However, the cycles can be simulated as an aid to contingency planning.

Q: Please explain how they aid in contingency planning?

A: It enables businesses to plan in advance how they will respond to different states of the world, including in this case how they will cope with downside price risks. The insights they gain may enable them to try to mitigate risks for example by changing the structure of purchase contracts, or the ratio of fixed to variable costs.

Q: What is your response to Dr. Humphreys's criticism of the analysis of the variance of price as compared to the CRU forecast?

A: The CRU forecast is a mean expected price, including implicit volatility as Dr Humphreys says. However, the future price path has both a mean and a variance. Both statistics are important, depending on the purpose for which they are used.

Q: Why must one consider variance of price as compared to just the CRU forecast?

A: It is important to consider the variance of prices in assessing business risks. Sometimes it is important to consider the variance of a variable as much as or even more than the mean. To give an analogy, for a ship navigating a channel the minimum depth of water is more important than the average depth of water. Or, to take another example, if we know from historical records that the average rainfall in a 4 week period is 7 inches, our mean expectation per day is one quarter inch. However, it is very unlikely that we will get exactly a quarter inch of rain each day. In fact the daily rainfall may vary from zero to two inches. If I were designing drainage capacity, I would need to consider the maximum rainfall. In addition the average over 4 weeks may also vary around the mean of 7 inches. I don't want to stretch these analogies too far, but my point is that there are circumstances in which average expectations need to be supplemented by an analysis of variance. These analogies are examples of where the mean is of limited use. Aluminum companies face an uncertain and volatile price. We can predict a mean expected price over a long period of time, such as ten years, within reasonably narrow confidence limits. However, for shorter time periods of one year we are faced with a wide potential range of prices.

Q: Why is it important to a company like Noranda to consider risk?

A: Noranda needs to assess whether its New Madrid smelter can cover its operating costs, as well as its debt service obligations under a range of potential business conditions.

Q: In the past, have you been engaged to consider variance of price for purposes of credit or loan transactions involving companies like Noranda?

A: Yes.

Q: Please provide some examples?

A: I have managed several consultancy projects for CRU where we have acted as lenders' market consultant on new smelter and refinery projects. In addition I have managed consulting projects where CRU has advised a consortium of international banks on large scale debt restructurings of aluminum and copper companies. I have also advised power suppliers on their smelter clients' ability to pay for power. In each case I have supplemented the CRU price forecast with an analysis of price variance.

Q: In these cases, did you look only at the CRU forecast price in order to best guide the decision on whether to make a loan to the company?

A: No.

Q: Why not?

A: Lenders always like to know about downside risk, in order to see if cash flow is adequate to service loans. They generally ask such questions as how bad can things get (how low can prices go) and for how long. There is always a risk that a new project, which can take three years to build, will enter the market during a price downturn, and at a time when its debt service obligations are high.

Q: In this case, should the PSC look simply at the CRU forecast for aluminum or should it focus on price variance as it considers Noranda's request?

A: It should look at both the mean and variance of future prices.

Q: Why?

A: Noranda's ability to pay for power will depend on the price of aluminum. The price will not proceed in a straight line along the mean expected path, but will fluctuate around this value. The timing of these fluctuations cannot be predicted, but there is a significant chance of downside price risk, as will be described below.

Q: Do you and Dr. Humphreys agree on the ability to forecast the timing of future price cycles for aluminum?

A: I believe we do.

Q: In what way do you agree?

A: In that we have very little ability to predict cyclical timing beyond the short term (1-2 years) and even in the short term there is potential for significant errors and unforeseen events.

Q: How do you respond to Dr. Humphreys's criticisms of the three scenarios chosen by Noranda?

A: Dr. Humphreys's main point is that the three scenarios selected by Noranda are not sufficiently representative of potential price cycles, because they all contain a long sequence of negative variations from trend in the first few years of the forecast. I believe this is a valid point and that a broader range of samples should be selected.

Q: Were the scenarios chosen by Noranda reasonable for purposes of the analysis undertaken in this case?

A: The first point is that the three scenarios need to be seen as exactly that – i.e. as scenarios and not forecasts. This is an important distinction, and I believe it addresses some of Dr Humphreys's concerns. Secondly, the three scenarios were not sufficiently representative of different cyclical patterns (although a discussed below, Noranda has provided additional scenarios to be more representative). However, I would like to make the following points about these scenarios.

a. A negative "shock" sending prices well below trend in 2016 is clearly possible, judging by past price behaviour.

b. Long sequences of negative variations from trend do occur, and they tend to be longer than the sequences of above trend prices, which are shorter and sharper.

c. As I stated previously, the likelihood of a price peak, or a sharp spike in prices in the years 2016 and 2017 is low. This is firstly because of the poor initial conditions (high inventories, spare capacity, Chinese slowdown). Secondly, the conditions giving rise to price spikes take time to build up (inventory drawdown, using up of spare capacity) and so we have more visibility of these than we do of the sudden downturns. Finally, the sharp price spikes are quite rare – in the period since 1982 we can only identify two (1988-89, 2006-2008).

d. On the other hand, the probability of encountering a significantly below trend price in any six year period (since we are simulating six years 2016-2021) is high. In each six year period beginning 1982 through 2009, there has been a year with a negative variation of at least 14.7%, usually higher – the average is -20.4% (for a single year in each six year period). Thus, although we cannot predict the timing, we can say that there is a strong likelihood in any six year period, that Noranda will encounter an annual average price which is 15 to 20% below trend.

Q: Do experts rely upon scenarios like the ones produced by Noranda to analyze price volatility in the market?

A: Yes. In analyzing price volatility there are several methods that can be used, including the analysis of historical price behavior used by Noranda. In addition, in my own consulting work I have used analysis of the industry cost curve and the structure of costs, as well as Monte Carlo simulation to generate price paths based on a statistical model.

Q: Why?

A: In order to stress test business plans, assess ability to service loans, assess ability to pay for power, as described above.

Q: Are you aware that Noranda has run additional scenarios and have you analyzed them?

A: Yes.

Q: What did you conclude from your review of these additional scenarios?

A: They give a broader range of cyclical patterns, with "bad" scenarios balanced by "good" scenarios. They therefore have a more representative balance of future price patterns.

Q: Did the additional scenarios reinforce your earlier conclusions in your direct testimony?

A: Yes.

Q: In what ways did they reinforce your conclusions?

A: There is now a broader range of price patterns, giving a more representative sample of potential price cycles.

Q: Do you agree that the range and pattern of aluminum prices reflected in those additional analyses are reasonable?

A: They are reasonable. My one reservation is that because of the historical time period chosen (ten year periods beginning 1994 to 2005) many of the scenarios are influenced by the large spike in prices in the years 2006 to 2008, which tends to make the scenarios either unusually bad or unusually good, depending on when that spike occurs in the scenario. On the orther hand, as I explain below, there is also a sense in which they may have under-estimated downside price risk.

Q: Do you agree that the range and pattern of aluminum prices reflected in those additional analyses are the appropriate set of scenarios to evaluate Noranda's sustainability and risk profile?

A: As mentioned, they are now more representative. However, this is a difficult question, in that there are thousands of potential price scenarios. The scenarios chosen are balanced, but taken from a time period of above average price

volatility, when there was a more pronounced price cycle than usual. On the other hand, because all the scenarios by definition give the same ten year average price, it can be argued that they actually under-estimate downside price risk, since even ten year averages have a range of roughly +/- 10%.

Q: What is a negative shock, and why is it clearly possible that Noranda will face one based on past price behavior?

A: I have shown the negative price shocks in a chart in my direct testimony. They have usually been demand side shocks, rather than supply side shocks (such as strikes or natural disasters). In most cases I believe it is correct to say that these shocks were not predicted. There have been eight such shocks in the period since 1972. By their nature such shocks are not predictable, but their frequency suggests a negative shock in any six year period is a strong possibility.

Q: Why do long sequences of negative variations for aluminum from price trend occur?

A: Structural features in the industry, such as the "stickiness" of production can lead to large accumulations of excess inventory, as well as eventually idle capacity. Prices need to fall below the avoidable costs of marginal producers in order to induce a reduction in production. Once the production adjustment has been made, it can then take a long time for the inventory accumulation to be reduced to more normal levels, and for excess idle capacity to be absorbed. Small rises in price will encourage idled capacity to restart, thus dampening the price rise.

Q: Why are negative price variations longer as compared to the length of positive price variations?

A: There does appear to be an asymmetry in the price cycle, with shorter, sharper peaks, and longer shallower troughs. The peaks occur at times of excess demand, during the late stage of economic upturns. Whereas the price downturns are limited by the structure of production costs, the price spikes can only be limited by the rationing of demand by means of price (assuming the industry has reached a capacity constraint). Therefore the upper boundary of price is harder to define, and is dependent on the price elasticity of demand. In other words how high does the price have to go before some demand is choked off. In my view the reason such price spikes are relatively short lived in aluminum are:

- They occur at the late stage of economic upturns and are ended by the turning point in the business cycle
- Aluminum is easily substituted in certain applications – in other words there is high price elasticity in some applications.

Q: Is a sharp spike in aluminum prices likely in 2016 or 2017?

A: No.

Q: Why not?

A: The initial conditions and the near term outlook do not suggest a strong upside risk to prices. The initial conditions include a very high level of industry inventories, both as reported LME inventories and unreported "off warrant" stocks; a low

degree of capacity utilization (80% in 2014); a continuing rapid expansion of production capacity in China, and a slowdown in China's economic growth. I also think there are some significant downside risks. One is that the financial demand for inventories, which has supported prices despite the high inventory levels, will subside as interest rates begin to rise in the next two years. In other words it will not be so attractive for banks to finance aluminum inventories once the cost of money begins to rise. A second is that China could relax its restrictions on the export of primary aluminum. These are currently discouraged by a 15% export tax, but industry is lobbying government to have this tax reduced or removed. Meanwhile, Chinese smelters have decided to stockpile 1.2 million tonnes of excess production this year.

Q: Do poor initial conditions exist now in the market?

A: Yes.

Q: Do you see the existence of any conditions from which you conclude an aluminum price increase is expected?

A: The central view of CRU in its January 2015 forecast is for very little change in the annual average price in 2015 followed by a 5.5% decline in real terms in 2016. CRU also assesses downside risks and has produced a downside scenario with prices 15% below the base case in 2016 and 2017. I should explain that these scenarios were derived from changing the economic assumptions behind the

forecast, rather than from historical cycle analysis, although the results are of a similar order of magnitude.

Q: When was the last sharp price increase experienced in the aluminum market?

A: 2010, when prices rebounded strongly from the recession. However, because they were rebounding from a low in 2009, the price was only 6.4% above trend in 2010. The last big spike in terms of deviation from trend was in 2006-2008. In 2006 prices rose to 30.4% above trend.

Q: How about sharp price decrease?

A: 2008-09 was the last sharp decrease, with prices falling 17% below trend in 2009.

Q: Is there a price cycle associated with aluminum prices generally?

A: Yes.

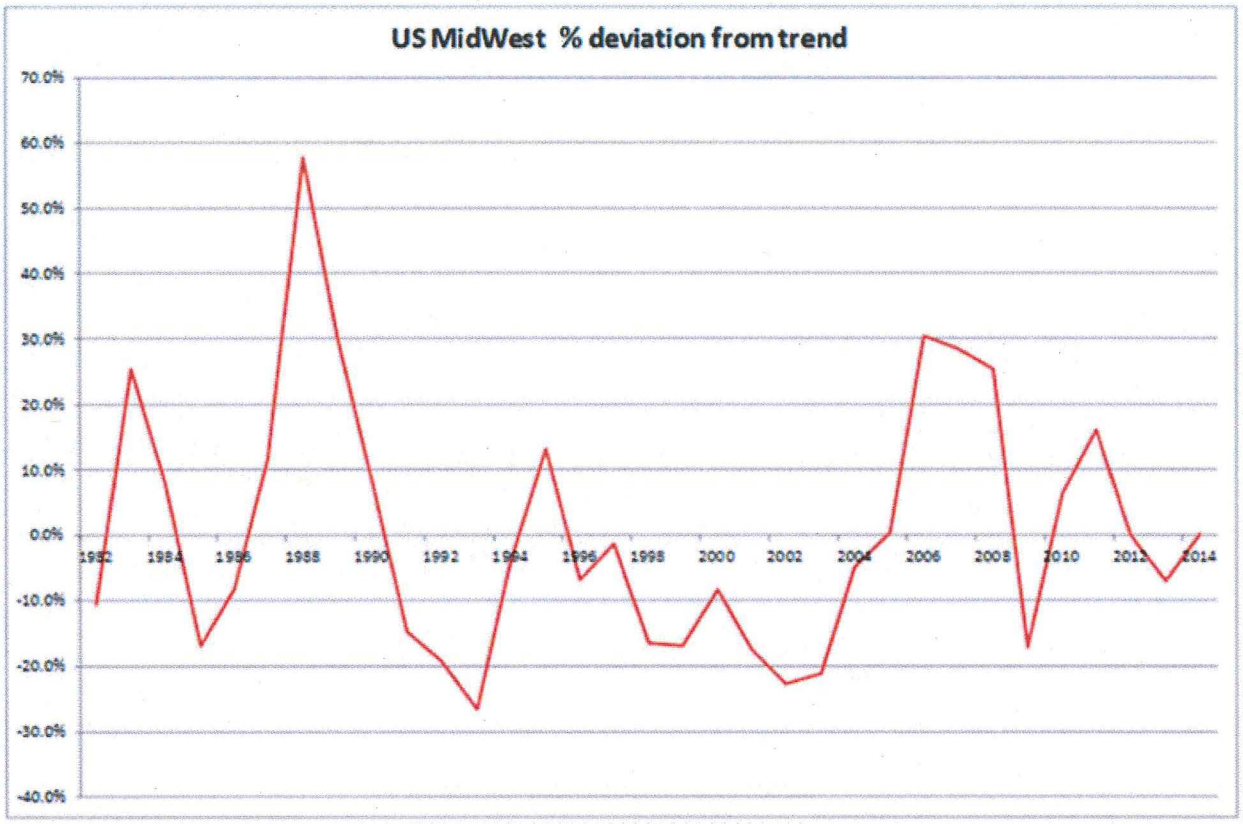
Q: Have you studied price cycles for aluminum?

A: Yes.

Q: What did you find?

A: In my previous consulting work, and in some further analysis conducted for this case, I have conducted my own analysis of historical prices. In doing so I have

analysed the pattern of percentage variances from a trend line fitted to the US MidWest price data from 1982 to 2014, expressed in dollars of 2013.



The trend line shows a slight decline in real prices of 0.278% per year. Because the price simulation in this case covers the six year period 2016 to 2021, I have analysed price variations from trend in each six year period beginning from 1982 to 2009. Using this method I do not need to make any *a priori* assumptions about the length of a business cycle. My results show the following:

- The minimum negative deviation from trend for a single year in each six year period was -14.7%.
- The average negative deviation in a single year in each six year period was -20.4%.

- The maximum negative deviation in a single year in any six year period was -26.5%
- In the entire time period, prices were below trend in 19 years, and above trend in 14 years. The spikes were shorter and sharper than the troughs.
- The average deviation in any six year period ranged from +14.9% (2006-2011) to -17.2% (1998-2004). This extreme range in the period 1998 to 2011 explains my comments about the time period chosen by Noranda

Q: A negative variation of at least 14.7% in each six-year cycle from 1982 to 2009?

A: Yes, for one year.

Q: And in each six year cycle that, on average, there was at least one year where the negative variation was 20.4%?

A: Yes. And a maximum negative variation of 26.5% (in 1993).

Q: What was your methodology in these analyses?

A: As above.

Q: Based on your experience and your analysis, for what should Noranda plan in terms of the price of aluminum in the future?

A: It must plan on the basis of mean and variance in prices. The mean used by Noranda is based on a ten year CRU forecast. But prices will not follow a mean path, so Noranda must also consider the variance.

Q: 15 to 20% below trend means below the expected price of aluminum?

A: Yes.

Q: Please summarize your conclusions?

A: Aluminum prices are uncertain and volatile. Prices do not follow a straight line but fluctuate with a wide range around a trend. Although we cannot predict the timing of price cycles, we can use scenarios or simulations of their amplitude and frequency to stress test business plans. I stated in my direct testimony that to forecast the timing of price cycles would be misleading. That is why it is important to regard these price paths as scenarios rather than forecasts. The expected mean of a price forecast is an important statistic. However, for many business purposes the expected variance in prices is as important, if not more so. By increasing its choice of scenarios Noranda has produced a balanced set of scenarios, although they are based on a historical period with a bigger than average cycle. Having said that, my own analysis suggests there is a high likelihood that in any six year period prices will fall 15 to 20% below trend in at least one year. In addition, by definition, all the Noranda scenarios produce the same ten year average price of $1.06 in real dollars of 2013, whereas in fact there is a degree of risk even around this ten year average. For example some of the

historical ten year averages have been over 10% below trend. In this sense Noranda's ten year scenarios could actually underestimate downside risk. I therefore conclude that although I have used a different method to measure price volatility, the full set of scenarios developed by Noranda is a reasonable and representative set for stress testing its business plans.

Q: Does this conclude your surrebuttal testimony?

A: Yes.