NEBRASKA

DEPT. OF ENVIRONMENT AND ENERGY

06-252 March, 2020

Demand Growth Exclusions in Estimating Projected Actual Emissions in a Prevention of Significant Deterioration Review For Non-Electric Generating Units

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December, 2005

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I Introduction

The purpose of this article is to provide a modeling technique (paradigm, procedure, etc.) to estimate demand growth exclusions for emissions in accordance with the Clean Air Act. However, before considering the actual techniques for estimating demand growth exclusions, one must gain a better perspective of emissions regulations to accurately define demand growth exclusions.

In accordance with the Clean Air Act, states are to develop implementation plans that shall "contain emission limitations and such other measures as may be necessary to prevent significant deterioration of air quality."[1] Further, the requirements may apply to "any project at an existing major stationary source."[2]

The Act defines a project to an existing major stationary source as a major modification that leads to "a significant emissions increase … of a regulated NSR pollutant … and a significant net emissions increase of that pollutant from the major stationary source."[3] For projects that only involve existing emission units, significant net emissions increases are measured using an actual-to-projected-actual applicability test.[4] A significant net emissions increase is projected to occur under this test if the "sum of the difference between the projected actual emissions … and the baseline actual emissions … for each existing emissions unit, equals or exceeds the significant amount for that pollutant."[5]

Under Title 40, baseline actual emissions are defined as:[6]

> The average rate, in tons per year, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding either the date the owner or operator begins actual construction of the project, or the date a complete permit application is received by the reviewing authority.

Projected actual emissions are defined as:[7]

> The maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a regulated NSR pollutant in any one of the 5 years (12-month period) following the date the unit

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[1] 40 CFR 51.166 (a) (1).
[2] 40 CFR 51.166 (a) (7) (i).
[3] 40 CFR 51.166 (b) (2) (i).
[4] 40 CFR 51.166 (a) (7) (iv) (c).
[5] For projects that only involve construction of new emissions unit(s), 40 CFR 51.166 (a) (7) (iv) (d) calls for an actual-to-potential test. A significant emissions increase is projected to occur under this test if "the sum of difference between the potential to emit … for each new emissions unit following completion of the project and the baseline actual emissions of these units before the project equals or exceeds the significant amount for that pollutant." 40 CFR 51.166 (b) (4) defines potential to emit as "the maximum capacity of a stationary source to emit a pollutant under its physical and operational design."
[6] 40 CFR 51.166 (b) (47) (ii)
[7] 40 CFR 51.166 (b) (40) (i).

> resumes regular operation after the project, or in any one of the 10 years following the date, if the project involves increasing the emission unit's design capacity or its potential to emit that regulated NSR pollutant, and full utilization of the unit would result in a significant emissions increase, or a significant net emissions increase at the major stationary source.

In calculating projected actual emissions, Title 40 includes the following demand growth exclusion:[8]

> In determining the projected actual emissions under paragraph (b) (40) (i) of this section…, the owner or operator of the major stationary source: … Shall exclude, in calculating any increase in emissions that results from the particular project, that portion of the unit's emissions following the project that an existing unit could have accommodated during the consecutive 24-month period used to establish the baseline actual … and that are also unrelated to the particular project, including any increased utilization due to product demand growth.

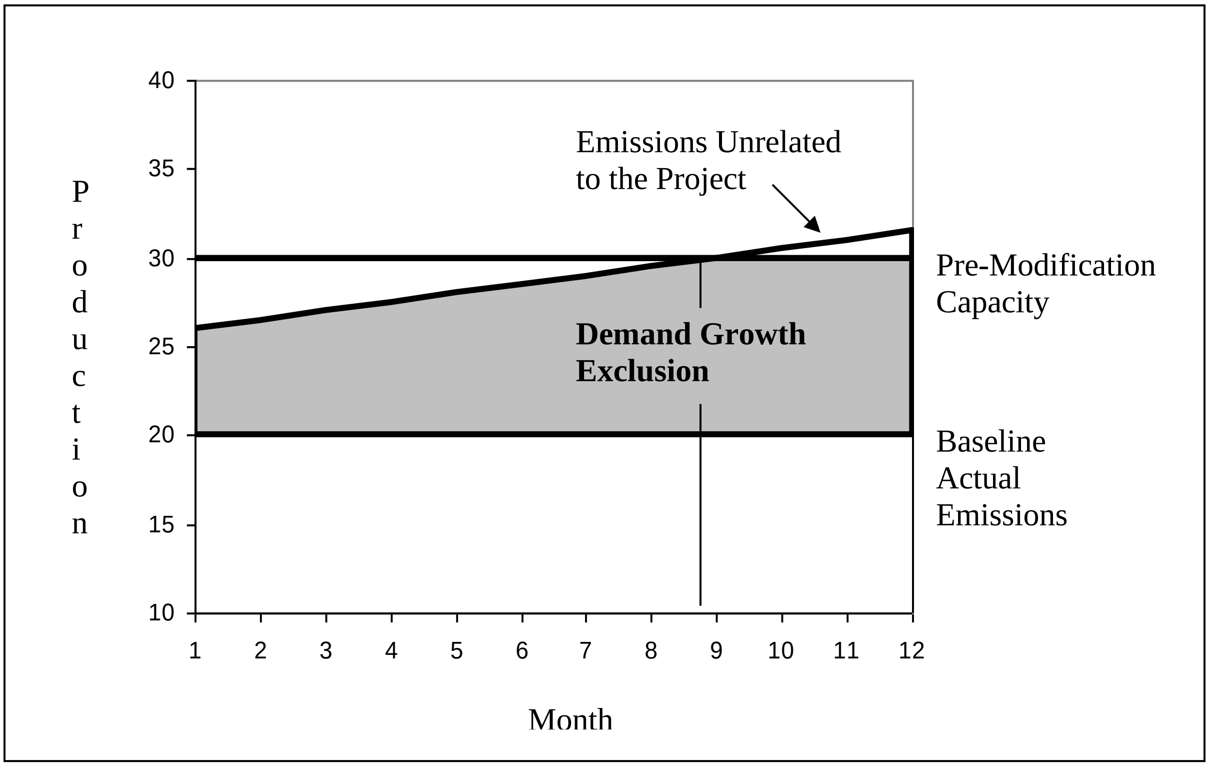
Based on the language above, there are three key elements that are required to calculate the demand growth exclusion. They are (1) baseline actual emissions; (2) emissions the unit could have accommodated during the baseline period that are above baseline actual emissions; and (3) the portion of the increase in emissions that is unrelated to the particular project. The first, baseline actual emissions, is something that the owner or operator of the source selects. The second, emissions the unit could have accommodated above baseline actual emissions, is determined by baseline actual emissions relative to the unit's rated capacity during the baseline period. For example, if a unit's baseline actual emissions are 20 tons per month (or 240 tons per year) of a particular NSR pollutant and if the unit has a permitted capacity to produce 30 tons per month of that pollutant, then the unit could have accommodated up to an additional 10 tons per month of the NSR pollutant.

The third element of the demand growth exclusion, the portion of the increase in emissions that is associated with product demand growth unrelated to the particular project, can be estimated using econometric techniques. The bulk of what follows describes the methodology used to make these estimates. The general idea, however, is to use historic emission trends to estimate future emissions. Since historic trends are not based on proposed plant modifications, the estimates show emissions as if the proposed plant modification did not take place. In this sense, the estimates meet the demand growth exclusion criteria. They predict emissions that the stationary source would have produced based on product demand growth unrelated to the particular project.

[8] 40 CFR 51.166 (b) (40) (ii) and 40 CFR 51.166 (b) (40) (ii) (c).

Figure 1 below provides an example of combining the three elements to calculate the demand growth exclusion. The vertical axis measures emissions in tons. The horizontal axis measures months. To continue with a previous example suppose, baseline actual emissions are 20 tons per month. Plant capacity during the baseline period is 30 tons per month. The angled line running through the figure shows estimated emissions that would be created by meeting demand unrelated to the plant modification.

Figure 1
An Example of the Demand Growth Exclusion



The grey area in Figure 1 shows the resulting emissions that could constitute the demand growth exclusion. These are that portion of the unit's emissions that the plant could have accommodated and that are due to product demand growth unrelated to the plant modification. In the first month, baseline emissions remain at 20 tons. Estimates based on historic production indicate that unrelated to the plant modification, demand would have created 26 tons of emissions in that month. Hence, in the first month, six tons of emissions would be excluded from the net emissions increase calculation due to the demand growth exclusion. The six tons represent the difference between baseline actual emissions and the emissions the plant would have been able to accommodate as a result of demand growth unrelated to the particular project. As historically-based emissions projections continue to grow, the exclusion would be ten tons by the ninth month. Beyond nine months, the exclusion would remain at ten tons even though emissions are projected to be more than ten tons above baseline actual emissions. The unit is at its pre-modification emissions capacity and there are no

additional emissions that the unit could have accommodated during the period used to determine baseline actual emissions.
The next section of this report provides a general explanation of the procedure that will be used to estimate the demand growth exclusion. Section III develops a more technical description of the modeling technique involved. A discussion of the statistical process used to estimate impacts is provided in Section IV. This is followed in Section V by a consideration of caveats that may affect the analysis. Section VI contains an application of the methodology to a hypothetical facility.

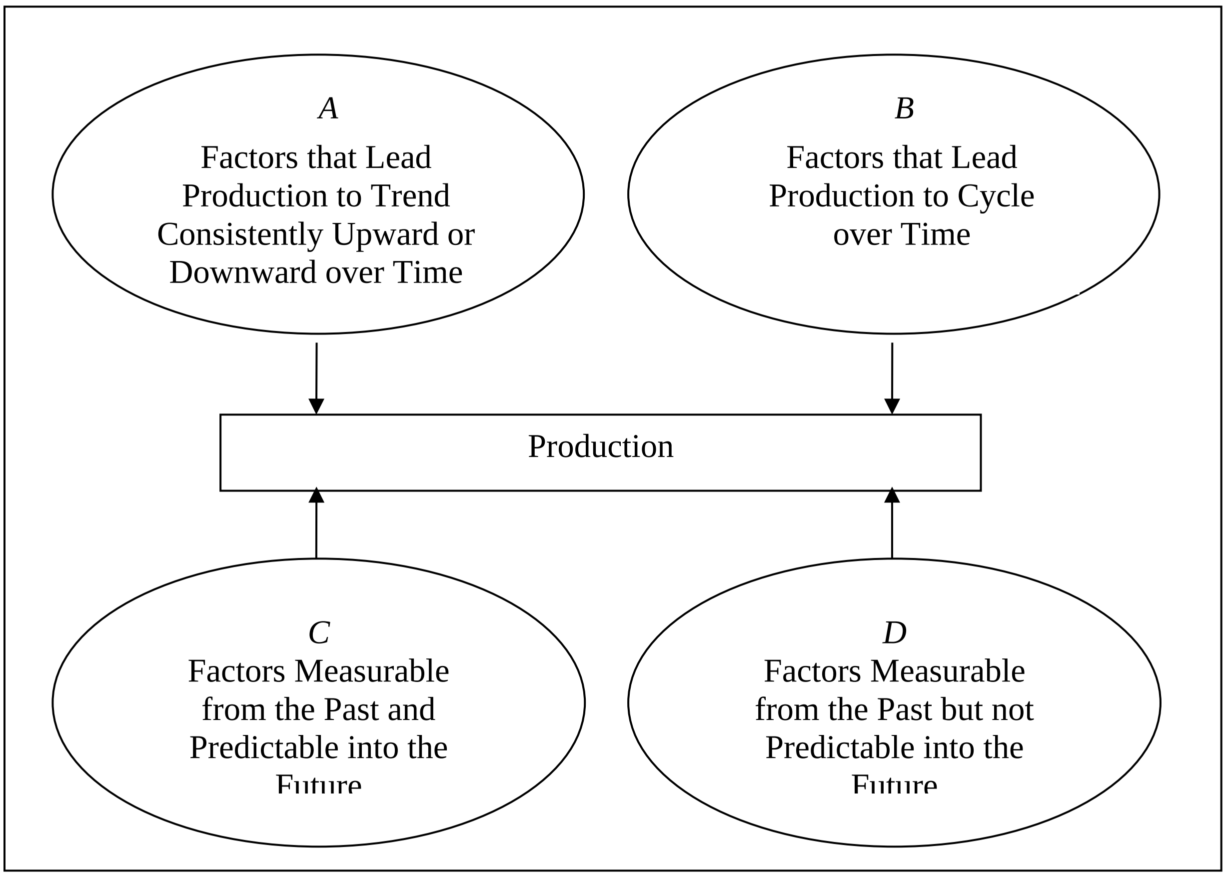
II General Description of Demand Growth Exclusion Estimation

The key to calculating the demand growth exclusion is estimating emissions that would be expected to occur from a stationary source if the source modification does not take place. Basing future predictions on historic emission rates may be a good place to start in making those estimates. Unfortunately, operators of many sources neither measure nor record emissions. Rather, they track an indicator that: 1) is more easily measured; and 2) can be tied directly to emissions. For example, a firm might track its daily output as an indicator of emissions. Output is readily measured and can be directly related to the level of emissions generated by the stationary source. Consequently, as a practical matter, the key to calculating the demand growth exclusion first becomes estimating production that would be expected to occur absent the source modification, and then translating the production into the associated emissions.

This section describes development of a model that predicts production absent a source modification. The process begins by developing theoretical linkages between production and a variety of underlying factors. Then, historical data measured before the plant modification takes place, are used to empirically quantify the relationship between production and the underlying factors. A relationship based on historical data should not reflect any influences that a proposed plant modification would have on production. Once the historic relationship between production and the underlying factors is quantified, the underlying factors can be projected into the future. Then, the historic relationship is used to estimate future production as a function of those factor projections. These historically-based projections show future production estimates absent any plant modification. The future production estimates form the basis for calculating the demand growth exclusion.

Production can be theoretically linked to four potential sets of influences. This is shown below in Figure 2. The first set of influences in oval *A* includes factors that lead production to trend consistently either upward or downward over time. Successful branding, for example, may cause demand, and therefore production, to increase over time. Unsuccessful brand management, in contrast, may mean falling demand and production over time. Generally it is difficult to measure accurately all of the factors that would cause production to move consistently either upward or downward over time. Therefore, a variable that represents time is substituted for these factors. The time measure subsumes all of the factors that cause production to rise or fall systematically over time.

Figure 2
Factors Influencing Production



The set of influences in oval *B* includes factors that lead production to cycle over time. This cycle typically may be monthly or seasonal. Production of heating fuel, for example, may increase in fall and winter, and then decline in spring and summer.

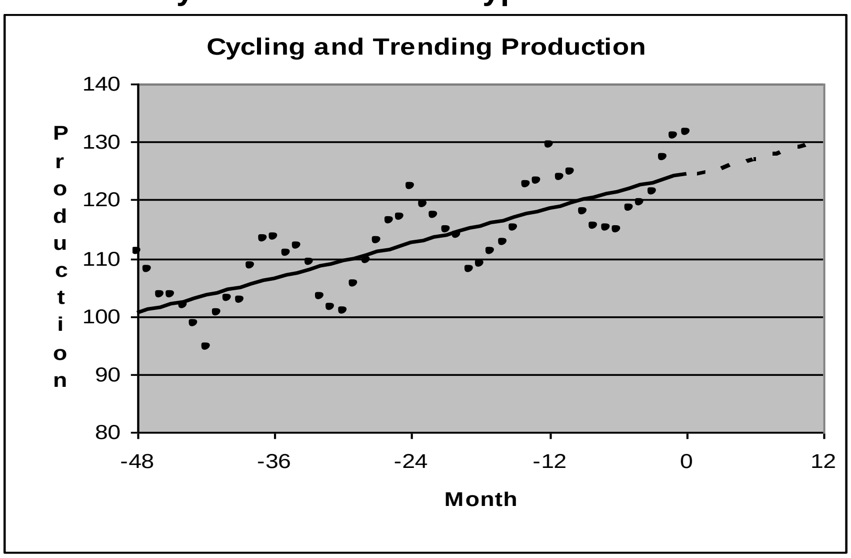
The third set of influences in oval *C* includes factors that are measurable from the past and predictable into the future. This set of factors generally will be fairly small. It may include indicators of past plant modifications or factor prices for which the firm has long-term contracts.

The final set of influences in oval *D* includes factors that are measurable from the past but not predictable into the future. For example, production may be tied to natural gas prices. It is certainly possible to measure historic gas prices. It would be very difficult, however, to get a consensus opinion as to what natural gas prices will be in the coming months. Natural gas prices may be related to production, are measurable in the past, but can not be accurately predicted into the future.

There may be other factors that affect production in a predictable way that are measurable from the past but not predictable into the future. Production may depend upon economic activity in general as measured by GDP or unemployment, or it may depend on input or output prices and relative demands. Corn millers, for example, may be able to produce a variety of sweeteners. Relative economics may dictate which are produced. Relative economies, however, may be hard to predict into the future.

Figure 3 below shows a graphical example of monthly production over time for a hypothetical product. The vertical axis measures production in tons. The horizontal axis shows months. Month zero (0) is the current month. The negative months are periods in the past. Month -48, for example, represents production four years ago. The positive months represent the future. Month 12, for example, shows expected production one year from now. The dots in Figure 4 show actual production for each of the last 48 months. Currently, monthly production is approximately 130 tons. Six months ago, production was about 115 tons. Forty-eight months ago, monthly production was just over 110 tons.

Figure 3
Monthly Production for a Hypothetical Product



The data in Figure 3 show both cyclical and trending movement. Production over the last 48 months has moved cyclically up and down, increasing in summer months and decreasing in winter months. Production also has trended upward, independent of this cycle. The solid line shows the upward trend in production over the last 48 months. It is important to note that the trend is in past production. The dotted line continues the historical trend in production into the next 12 months.

Figures 4A and 4B show cyclical production with no upward trend and upward trending production with no cycle, respectively.

Figure 4A
Cyclical Production with no Trend

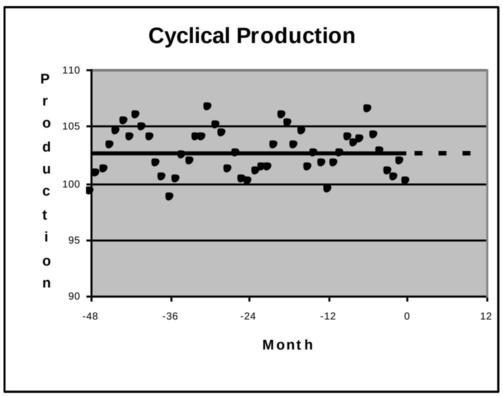


Figure 4B
Trending Production with no Cycle

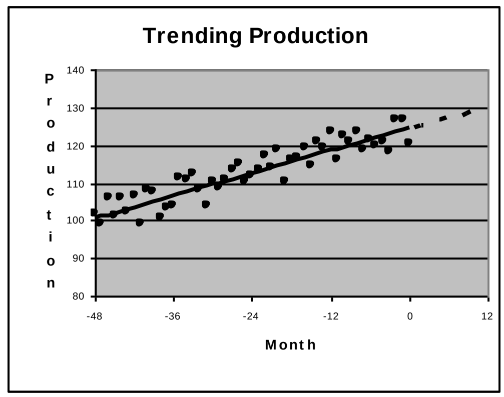
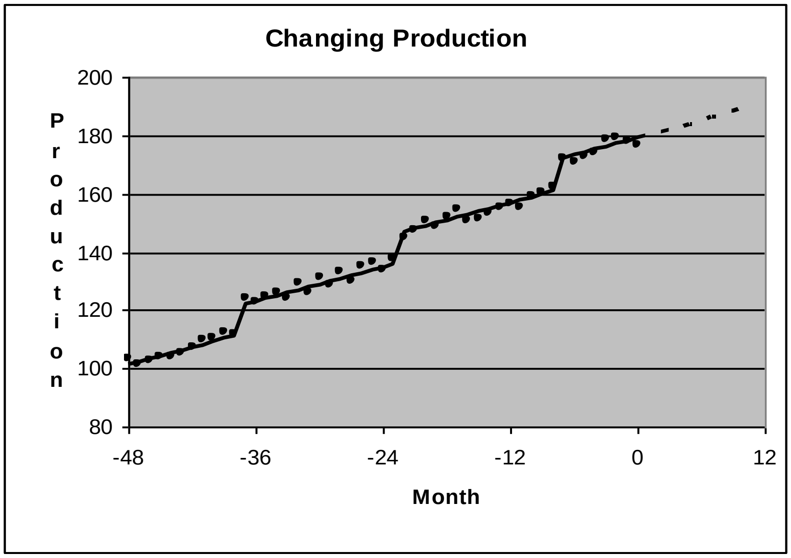


Figure 5 shows production data from a plant that had three small modifications in the past four years. Production starts near 100 units per month. It takes a jump in month -36 as the first modification is completed. There are jumps in months -20 and -9 as those modifications are completed as well. Throughout the period of interest, production is also trending upward. The dotted line in Figure 5 shows predicted production given the previous modifications but not the newest, proposed modification.

Figure 5
Changing Production with Previous Plant Modifications

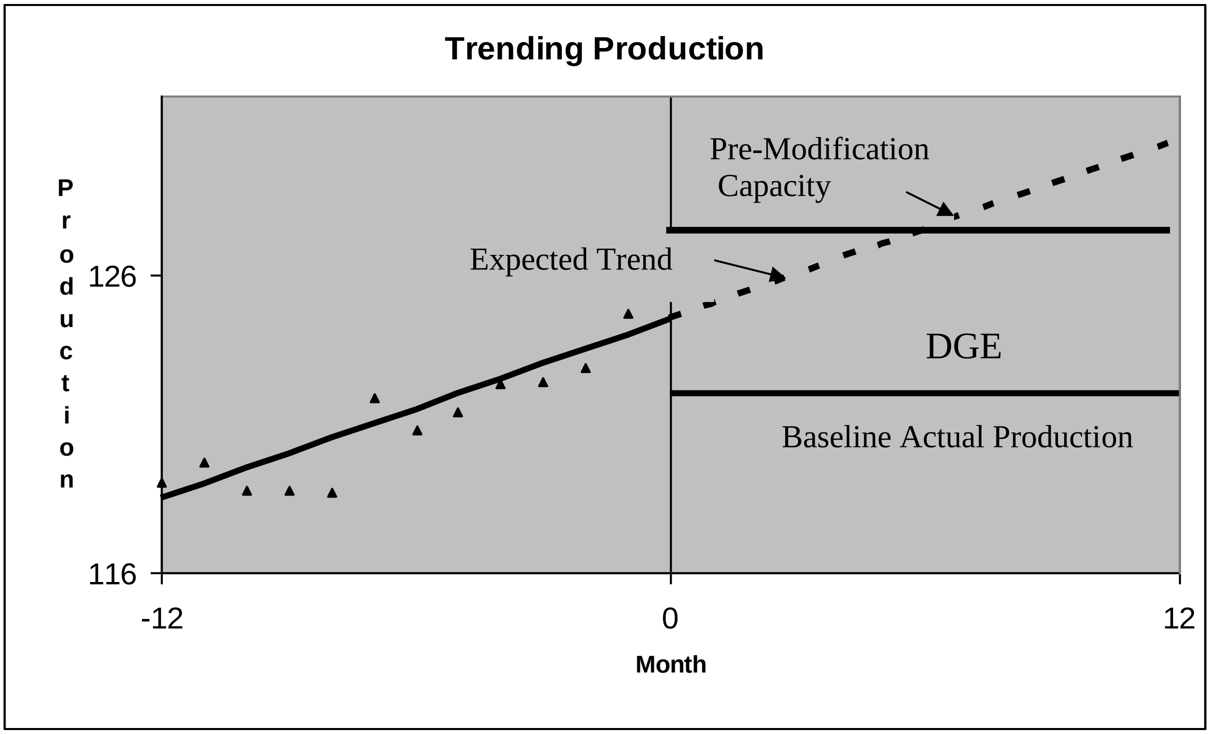


The focus for determining the demand growth exclusion is on measuring the historic trend in production growth. A positive trend indicates that production has been growing over time. If the trend is extended into the future, it will show how production would have been expected to continue to grow over time without plant modification. The trend shows future production with "product demand growth" that is "unrelated to the particular project". [9] This, in essence, identifies the demand growth exclusion.

Figure 6 below shows an example. Month 0 is the current point in time. The points to the left of time zero measure actual production in previous months. The solid line through those points is the historic trend. (Note that while 60 months of data were used to estimate the trend in production, only the last 12 are shown in the figure.) The lower solid flat line into the future shows baseline actual emissions used to determine the net emission increase from the proposed project. The upper solid line into the future shows pre-modification capacity. The dashed line shows expected future monthly production if production were to grow along its historic trend. This represents production into the future with product demand growth unrelated to the particular project. The area above baseline production and below the lower of either the expected trend or pre-modification capacity, labeled DGE, measures the amount of production each month that would be eligible for the demand growth exclusion.

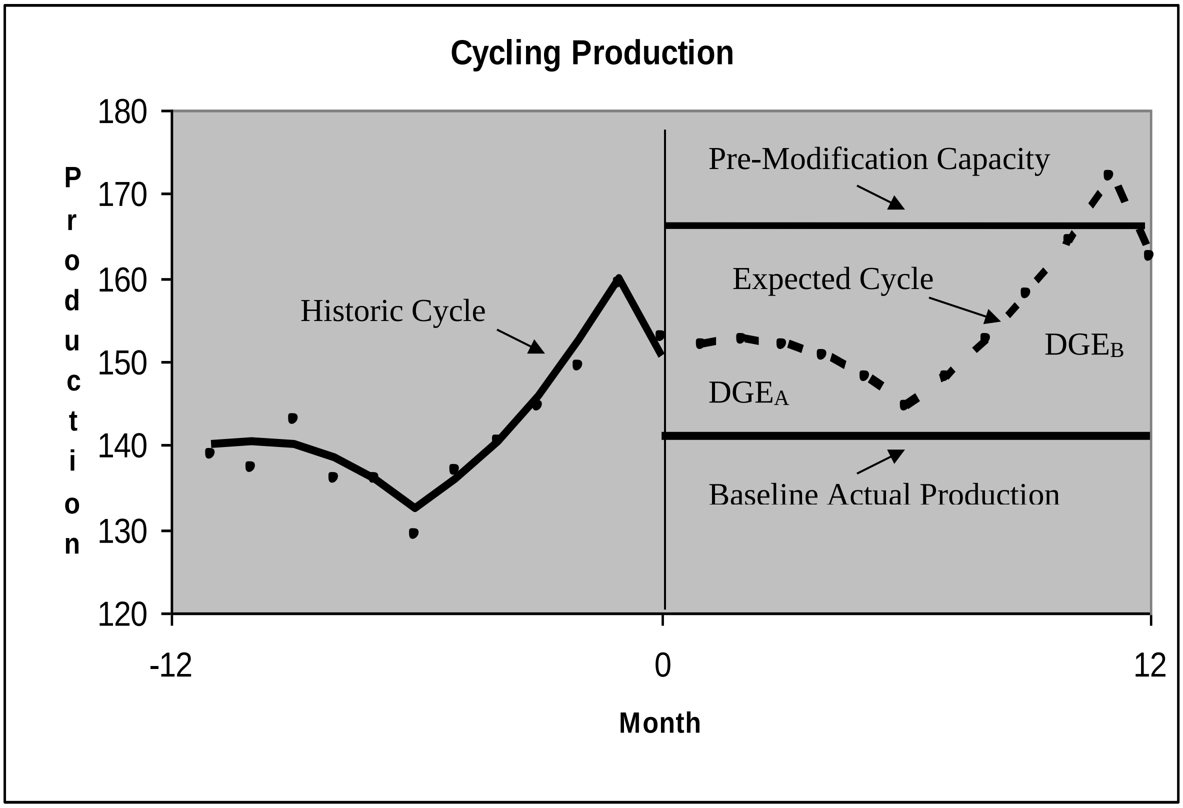
Figure 6
Estimating the Demand Growth Exclusion

[9] Language taken from 40 CFR 51.166 (b) (40) (ii) (c).



Cyclical measures can be included in determining the demand growth exclusion as well. Since monthly or seasonal data can be measured in the past, it can be used to explain fluctuations in monthly production. Since both can also be measured into the future, it is possible to use historic-based cycles to project expected production into the future. Figure 7 below shows an example. Month 0 is again the current point in time. The points to the left of month 0 measure actual production in previous months. The solid curve through those points is the historic cycle. The lower solid flat line into the future shows baseline actual emissions. The upper solid line into the future shows pre-existing capacity. The dashed curve shows expected future monthly production if production were to move along its historic cycle. The areas above baseline production and below either the expected cycle or pre-modification capacity, labeled DGE_A and DGE_B, measure the amount of production each month that would be eligible for the demand growth exclusion.

Figure 7
Demand Growth Exclusion with Cyclical Data


Cycling Production
Production
180
170
160
150
140
130
120
-12
0
12
Month
Pre-Modification Capacity
Expected Cycle
Historic Cycle
DGEB
DGEA
Baseline Actual Production

III Technical Description of Demand Growth Exclusion Estimation

The relationship between production, time and other explanatory variables can be described in a more technical manner. Let the variable t represent a month in time ranging from $-T_1$ to T_2, where $-T_1$ represents a point in the past and T_2 is some point in the future. From the examples above, $-T_1$ is -60 or 60 months in the past and T_2 is 12 months into the future. However, other starting and ending values can be used.

The variable P_t represents production in month t. Production can be specified as a function of time itself. In effect, time replaces other variables that may be trending either upward or downward. A successful advertising campaign, for example, may cause production to increase over time. Rather than measure the advertising campaign itself, time is included to explain production. Then the effects of the advertising campaign are captured in the time variable.

There can also be two sets of other variables that help to explain production. The first set of k other explanatory variables represents cyclical factors that influence production. These typically will measure either monthly or seasonal cycles. The set as observed in previous months can be represented by $\{X_t^1, X_t^2, \ldots, X_t^k\}$, where X_t^i is factor i as measured in previous period t.

The second set of m other explanatory variables represents other non-cyclical factors that influence production. These are factors that can be measured in the past and are predictable into the future. Previous plant modifications or long-term contracts would fit into this set. The set as observed in previous months can be represented by $\{Z_t^1, Z_t^2, \ldots, Z_t^m\}$, where Z_t^i is factor i as measured in previous period t.[10]

Using the previously described variables, past production can be modeled as a function of time and the two sets of other explanatory variables. This relationship is shown in equation (1), below. Equation (1) is made up of the previously described variables, a variety of coefficients, and an error term. The coefficients are β_0, β_1, α_1 through α_k, and δ_1 through δ_m. The error term is ε_t.

$$P_t = \beta_0 + \beta_1 t + \alpha_1 X_t^1 + \ldots. + \alpha_k X_t^k + \delta_1 Z_t^1 + \ldots + \delta_m Z_t^m + \varepsilon_t \qquad (1)$$

The coefficients in equation (1) show the impact that the related variables have on production. Coefficient β_0 is the intercept and β_1 quantifies the impact that time has on production. The coefficients α_1 through α_k quantify the impact that the cyclical variables have on production. The coefficients δ_1 through δ_m quantify the impact that the non-cyclical variables have on production. The last

[10] Note that the factors that are unpredictable into the future are not included in the statistical analysis. Including those variables would add another source of error into the prediction effort that may make the predictions less accurate than the analysis described in this section.

symbol in equation (1), ε_t, is an error term. It accounts for the difference between the estimated value of production and actual production. Its use will be explained in the next section.

The first coefficient of interest from equation (1) is β_1. From a statistical standpoint, it is important to test the hypothesis that $\beta_1 = 0$. If the hypothesis can be rejected in favor of the alternative hypothesis that $\beta_1 > 0$, it suggests that production is increasing over time, independent of other explanatory influences. This would indicate a positive trend in production and allow some emissions to be used to meet the demand growth exclusion. In this case, expected production would be predicted as:

$$P_t = \hat{\beta}_0 + \hat{\beta}_1 t\ , \qquad (2)$$

where $\hat{\beta}_0$ and $\hat{\beta}_1$ are the estimated coefficients.

If cyclical variables are included the estimation, it is important to test the hypothesis that $\{\alpha_{1, \dots ,}\ \alpha_k\} = 0$. If the hypothesis can be rejected, it suggests that production is cycling over time. In this case, expected production would be predicted as:

$$P_t = \hat{\beta}_0 + \hat{\beta}_1 t + \hat{\alpha}_1 X_t^1 + ... + \hat{\alpha}_k X_t^k\ , \qquad (3)$$

where $\hat{\beta}_0$, $\hat{\beta}_1$, and $\{\hat{\alpha}_{0, \dots ,}\ \hat{\alpha}_k\}$ are the estimated coefficients.

If the other variables are included the estimation, it is important to test the hypothesis that $\{\delta_{1, \dots ,}\ \delta_m\} = 0$. If the hypothesis can be rejected, it suggests that production has been influenced by these variables. In this case, if cyclical effects are not included, expected production would be predicted as:

$$P_t = \hat{\beta}_0 + \hat{\beta}_1 t + \delta_1 Z_t^1 + ... + \hat{\delta}_m Z_t^m\ . \qquad (4A)$$

If cyclical effects are included, expected production would be predicted as:

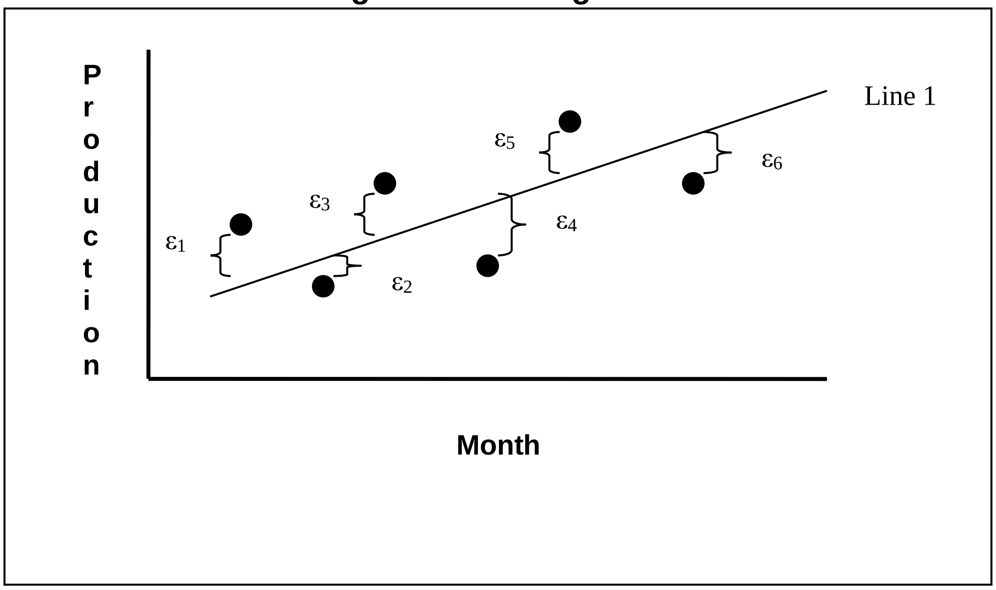
$$P_t = \hat{\beta}_0 + \hat{\beta}_1 t + \hat{\alpha}_1 X_t^1 + ... + \hat{\alpha}_k X_t^k + \hat{\delta}_1 Z_t^1 + ... + \hat{\delta}_m Z_t^m\ . \qquad (4B)$$

IV Econometric Techniques in Demand Growth Exclusion Estimation

Least squares econometric techniques can be used to estimate the coefficients in equation (1). Estimation of the coefficients requires historic observations of production and the other explanatory variables. Therefore, estimation is done using only past data, or observations bounded by the periods $-T_1$ through 0.

Estimating the coefficients in equation (1) can be thought of as fitting a line through all of the observed monthly production figures. The line represents the best estimate of how production is related to the explanatory variables. Figure 8 below shows a simplification of line fitting. In this case, production is modeled as a function of time alone. Each point in Figure 8 represents production in a particular month. The solid line shows a line fitted through the data. In this case, the line represents the best estimate of how production is related to time.

Figure 8
Fitting a Line Through Data



The distance between the line and each point in Figure 8 is called the error. It is a measure of how close the estimate comes to each point. There is an error associated with each observation. The errors are denoted as ε_t where the t denotes a particular observation. In this example, the error in the first month is ε_1 and the error in the sixth month is ε_6.

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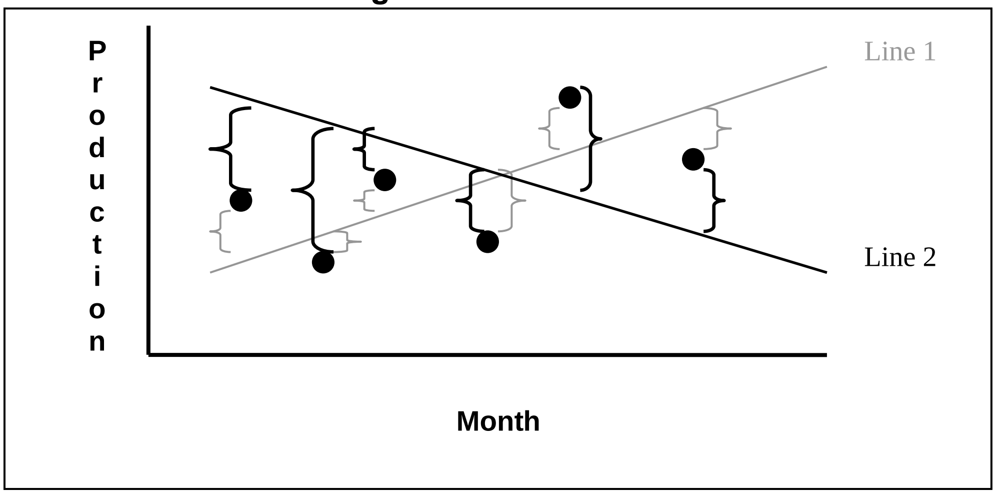
If the line in Figure 8 were to move, the error terms associated with each point would change as well. Figure 9 below shows a second line fitted through the same data and its associated error terms. Looking at Figure 9, Line 1 produces smaller errors than Line 2. The "best" line through the data is the line that minimizes the sum of the squares of all of its associated error terms. Least squares estimation is a technique that solves for the best line through a set of data.

Figure 9
Determining the "Best" Fit for a Line



Once the best line is fitted through the data, it is possible to represent that line using mathematical notation. The notation leads to the coefficient estimates. In other words, the coefficients describe the line the gives the best fit to the data. The coefficients, in turn, describe how a change in one of the explanatory factors affects production. A positive coefficient means that if the factor increases, so does production. A negative coefficient means that production decreases when the factor increases.

Regression analysis software exists to make the estimates described above. Care must be exercised when performing such estimation. Since the data are gathered over time, there may be persistent patterns in the errors. Statistical diagnostics can be applied to detect such patterns and, if found, techniques can be employed to enhance the efficiency of the estimation.

V Other Concerns

There are a few caveats to consider when implementing this trending methodology for projecting the demand growth exclusion. These include time period and number of observations, measuring production, and multiple emission points.

Time Period and Number of Observations

Historic data are needed to predict future production. Data over too short a period may not allow establishing a trend. Data over too long a period may bring influences into the analysis that are no longer relevant. It is recommended that five years worth of data be used as a starting point for analysis. This represents a reasonable period of time for analysis and should not be too burdensome for companies to produce.

It is also recommended that monthly data be used in the analysis. Quarterly data would provide too few observations. Data shorter than monthly may include significant short term variations unrelated to the long term trend in production.

Measuring Production

The methodology explained above estimates the trend in production. More generally, the trending technique predicts some throughput indicator that can be tied directly to emissions. If the throughput can be measured each month, then its trend and cyclicality can be estimated and predictions can be made about future throughput. For example, at a steel plant, emissions may be correlated with the tons of scrap melted. Historic monthly melting data can be used to predict the trend of melting into the future. Future melting can then be tied back to emissions. The key factors to consider when selecting an indicator to trend are: 1) that it is measurable over time; and 2) that it is linked to emissions in a predictable, quantifiable way.

Multiple Emission Points

Most stationary sources have several emission points that may be associated with one or more production units. Trending analysis should be done for each production unit that is being proposed for modification. Each unit should use the indicator for trending that makes most sense for that unit. For example at a steel mill, the furnace may use tons of scrap melted as an indicator while the rolling mill may use tons of steel rolled. At a grain milling plant, the mill may use bushels of corn milled or particulate throughput from the scrubbers while the refinery may use some other indicator. Resulting emission projections from each production unit would be aggregated to determine the overall demand growth exclusion.

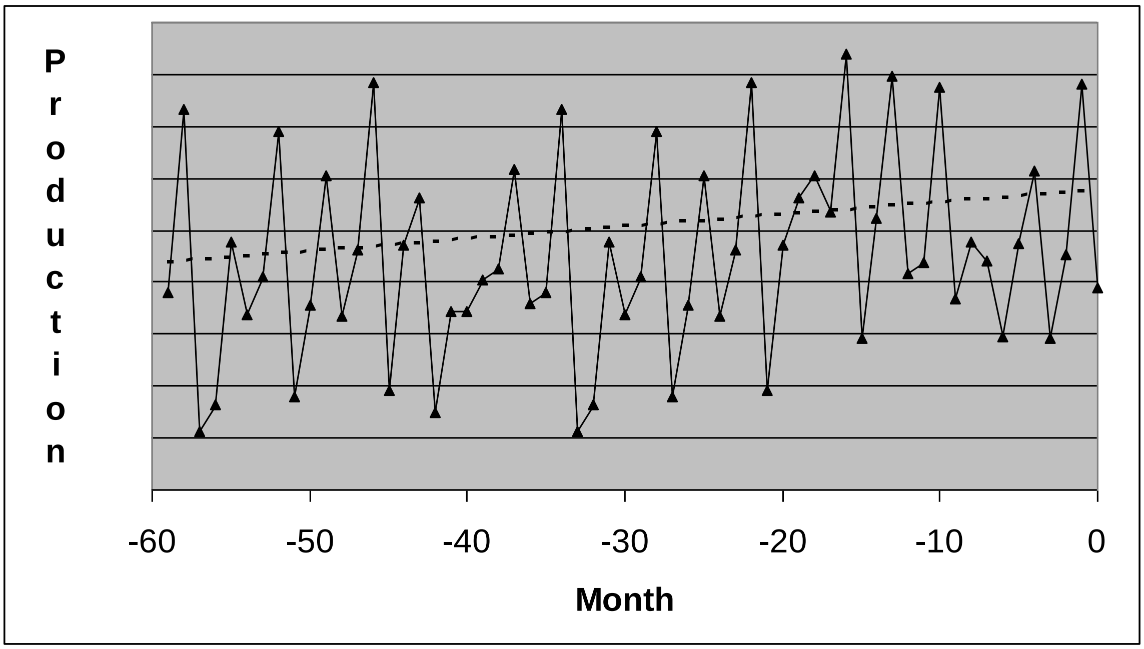
VI An Example

Consider a hypothetical firm that produces steel from scrap metal. It is considering a plant modification and wants to estimate its demand growth exclusion. The plant is currently permitted to melt 1.8 million tons of scrap metal per year, or 150,000 tons per month. Since the permit is in terms of tons of scrap melted per year, there must be a pre-established method for translating tons melted into emissions. Furthermore, the plant would keep records on tons of scrap melted. Therefore, the unit of production for this analysis is tons of scrap melted.

Based on historic data, the owner/operator selected a particular 24-month period within the previous ten years to measure baseline emissions. The average scrap melting rate during that period was 1.2 million tons per year, or 100,000 tons per month. This is the production unit's baseline actual emissions. The plant's permit allows it to melt up to 150,000 tons of scrap during the baseline period. Therefore, its capacity is 150,000 tons per month.

To estimate the trend in production, data are collected on scrap melted in each of the last 60 months. A graph of the data is shown in Figure 10, below. The points show actual melting in each month. The solid line shows the quarterly cyclical nature of production. The dotted line running through the data shows the trend.

Figure 10
Historic Production and Estimated Production from a Hypothetical Plant



The data in Figure 10 indicate that production (or the amount of scrap melted) trended slightly upward over the 5-year period. It also varied monthly, increasing through the three months of a quarter and then falling back in the first month of the following quarter. Therefore, a model is developed to explain production as a function of a long-term trend and monthly cyclical variables. The model is shown in equation (5)

$$P_t = \beta_1 t + \alpha_1 X_t^1 + ... + \alpha_{12} X_t^{12} + \varepsilon_t \quad (5)$$

with *t* representing time and X_t^1 through X_t^{12} representing the months January through December.

Equation (5) is estimated and the coefficient estimates are shown in Table 1 below. The positive coefficient on the trend variable indicates that production was generally trending upward by about 236 tons per month, or about two percent. Statistical tests also reveal that the monthly variables were important in explaining production. The coefficient estimates for January, February, March and April indicate that production increased over the first quarter and then dropped back in the first month of the second quarter. This pattern of increasing during the quarter and then dropping back at the start of the next quarter repeats itself throughout the year.

Table 1
Coefficient Estimates

Variable	Coefficient Estimate
Trend	236
January	101,582
February	110,374
March	130,114
April	93,267
May	108,435
June	133,928
July	102,349
August	110,772
September	144,290
October	87,360
November	102,572
December	117,716

The coefficient estimates in Table 1 can be used to calculate expected production. It is assumed in this example that it would take one year to complete the plant modification. Therefore, the first month after the modification is complete would be 13 months into the future. Five years beyond the completion of the modification would be the seventy-second month into the future. Expected production in any month is estimated by multiplying the place that the month holds in the sequence 13 to 72 times the coefficient estimate from Table 1 for the variable *Trend*, and then adding the coefficient estimate from Table 1 for the relevant month. For example, if August is the first month after the modification is complete, the expected production in that August would be 13 times 236 (the coefficient estimate for *Trend*) plus 110,772 (the coefficient estimate for *August*) or 113,840 tons of scrap melted. Expected production in the next month would be 14 times 236 plus 144,290 (the coefficient estimate for *September*) or 147,594 tons of scrap melted. Expected production in the last month would be 72 times 236 plus 102,349 or 119,341 tons of scrap melted.

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The production estimates, combined with baseline actual production and capacity, can be used to estimate the demand exclusion. Figure 11 below shows baseline actual production at 100,000 tons of scrap melted per month. Capacity is shown at 150,000 tons per month. Expected production is shown by the jagged line running from month 13 through month 72. The demand growth exclusion in any month is the difference between the smaller of capacity or expected production, and baseline actual production.

Figure 11
Demand Growth Exclusion

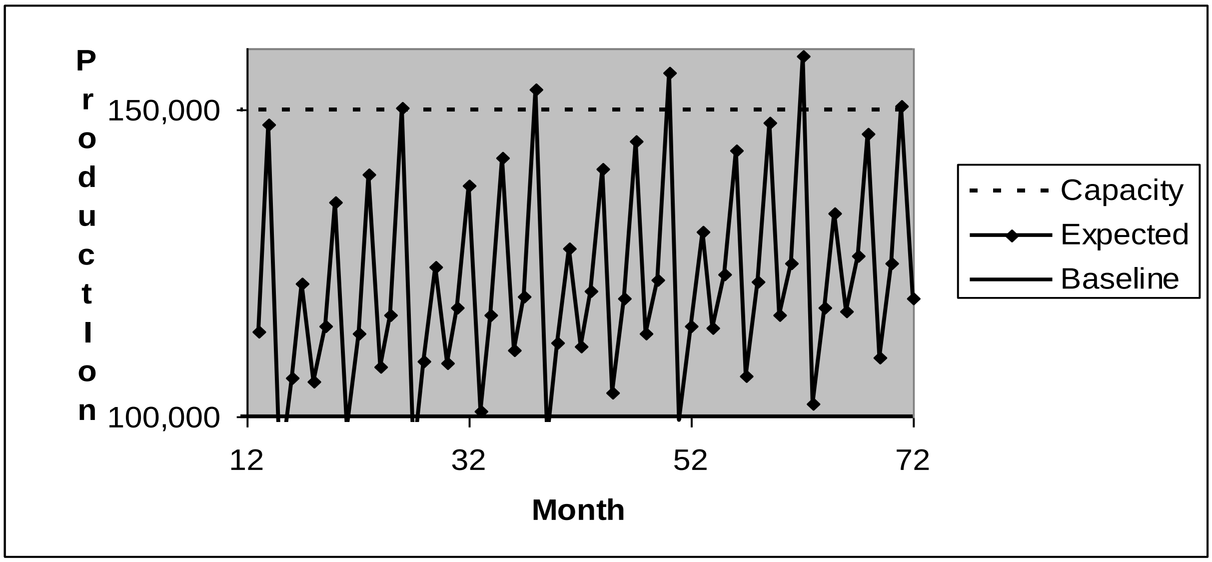

Table 2 on the next page quantifies baseline actual production, capacity, expected production and the resulting demand exclusion for each of the 60 months following the plant expansion. In the first month after expansion, for example, baseline actual production is 100,000 tons and expected production is 113,840 tons, which is well below capacity. The resulting demand exclusion in the first month is 13,840 tons of scrap melted. In month three, expected production falls below the baseline and there is no demand exclusion that month. In month 26, expected production is above capacity and only 50,000 tons are allowed in the demand exclusion.

Table 2
Hypothetical Example of Monthly Demand Growth Exclusion

Month	Baseline Production	Expected Production	Capacity	Demand Exclusion		Month	Baseline Production	Expected Production	Capacity	Demand Exclusion
1	100,000	113,840	150,000	13,840		31	100,000	120,522	150,000	20,522
2	100,000	147,594	150,000	47,594		32	100,000	140,498	150,000	40,498
3	100,000	90,900	150,000	0		33	100,000	103,887	150,000	3,887
4	100,000	106,348	150,000	6,348		34	100,000	119,291	150,000	19,291
5	100,000	121,728	150,000	21,728		35	100,000	145,020	150,000	45,020
6	100,000	105,830	150,000	5,830		36	100,000	113,677	150,000	13,677
7	100,000	114,858	150,000	14,858		37	100,000	122,336	150,000	22,336
8	100,000	134,834	150,000	34,834		38	100,000	156,090	150,000	50,000
9	100,000	98,223	150,000	0		39	100,000	99,396	150,000	0
10	100,000	113,627	150,000	13,627		40	100,000	114,844	150,000	14,844
11	100,000	139,356	150,000	39,356		41	100,000	130,224	150,000	30,224
12	100,000	108,013	150,000	8,013		42	100,000	114,326	150,000	14,326
13	100,000	116,672	150,000	16,672		43	100,000	123,354	150,000	23,354
14	100,000	150,426	150,000	50,000		44	100,000	143,330	150,000	43,330
15	100,000	93,732	150,000	0		45	100,000	106,719	150,000	6,719
16	100,000	109,180	150,000	9,180		46	100,000	122,123	150,000	22,123
17	100,000	124,560	150,000	24,560		47	100,000	147,852	150,000	47,852
18	100,000	108,662	150,000	8,662		48	100,000	116,509	150,000	16,509
19	100,000	117,690	150,000	17,690		49	100,000	125,168	150,000	25,168
20	100,000	137,666	150,000	37,666		50	100,000	158,922	150,000	50,000
21	100,000	101,055	150,000	1,055		51	100,000	102,228	150,000	2,228
22	100,000	116,459	150,000	16,459		52	100,000	117,676	150,000	17,676
23	100,000	142,188	150,000	42,188		53	100,000	133,056	150,000	33,056
24	100,000	110,845	150,000	10,845		54	100,000	117,158	150,000	17,158
25	100,000	119,504	150,000	19,504		55	100,000	126,186	150,000	26,186
26	100,000	153,258	150,000	50,000		56	100,000	146,162	150,000	46,162
27	100,000	96,564	150,000	0		57	100,000	109,551	150,000	9,551
28	100,000	112,012	150,000	12,012		58	100,000	124,955	150,000	24,955
29	100,000	127,392	150,000	27,392		59	100,000	150,684	150,000	50,000
30	100,000	111,494	150,000	11,494		60	100,000	119,341	150,000	19,341

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The grey area in Table 2 represents the 12-month period selected to calculate projected actual production. The monthly demand exclusion figures in Table 2 can be added for those twelve months to get the aggregate demand growth exclusion. In this case, the demand growth exclusion would be related to the melting of 321,481 tons of scrap.

The final step in determining the demand growth exclusion and the resulting net increase in emissions is to convert tons of scrap eligible for the demand growth exclusion into emissions. This should be possible based on conversion rates established during the original permitting of the plant.

Produced by: Nebraska Department of Environment and Energy, P.O. Box 98922, Lincoln, NE 68509-8922;
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