Well Level Analysis Summary Memo
Coal Mine Methane Protocol Version 2.0 Protocol Development Process
October 14, 2010

This memo is meant to inform the coal mine methane (CMM) workgroup of the work done to establish a proposal for a well-level performance standard for CMM-to-pipeline sales projects. This work was undertaken by the Reserve, with the support of SAIC, in February 2010 in an effort to develop Version 2.0 of the CMM Protocol, which is intended to create opportunities for pipeline sales projects to be registered with the Reserve. The memo summarizes the results of the data request and analysis of confidential well-level data provided by mine operators in the United States, as well as reflecting upon the application of the proposed thresholds, and proposed additional requirements/constraints that may be necessary to address the risks associated with such well-level determinations.

The Reserve recognizes Chris Minnucci at SAIC as the primary author of the report and analysis that is summarized in this memo.

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Background

The most recent iteration of a proposed performance standard test for the Coal Mine Methane Protocol Version 2.0 was presented to the workgroup in October 2009. As was the case with the original quantity-based common practice standard for pipeline projects, the proposed quality-based common practice standard did not receive the support of the CMM workgroup. In general, the workgroup members expressed the concern that the proposed methane content standard (55%) was too restrictive to serve as a basis for incentivizing CMM-to-pipeline projects. Concerns were also expressed that the data received from the mines may not have been interpreted correctly, although follow-up discussions with the data providers did not reveal any significant misinterpretations.

By the end of 2009, the Reserve concluded that, based on the available data, it was not going to be able to develop a performance standard for incentivizing pipeline sales projects in their entirety. Such projects appeared common amongst mines with drainage systems, and many of these projects were begun before opportunities to earn offset credits existed. While it is recognized that specific individual projects may not always follow the general pattern, the quantity- and quality-based standards designed to identify possible exceptions to the rule had not met with the approval of the workgroup, and the revisions to these standards suggested by the workgroup were not supported by the available data. Furthermore, although a number of other possible variables were considered in consultation with the workgroup in November 2009 (such as distance to the pipeline), it appeared unlikely that any of these variables would provide any more robust a basis than either gas quantity or quality for separating the limited number of additional pipeline sales projects from the majority of non-additional projects.

However, while it did not seem possible to define a performance standard for pipeline sales projects in their entirety, there did seem to be opportunities for *increasing* the quantity of gas captured at these projects. Specifically, two such opportunities seemed to exist from the data analyzed to date. First, based on the data collected for the methane quality analysis, it appeared that, at least at some mines with pipeline sales projects, a portion of the wells were vented rather than connected to the gas collection system. Additional gas could be captured by connecting these wells to the existing project. And second, more gas could be collected by drilling wells on a more closely-spaced pattern.

Thus, rather than attempting to incentivize pipeline sales projects, the performance standard would instead be focused on incentivizing increased gas capture through the extension/ expansion of pipeline sales projects. More specifically, it was decided that a *well-level* as opposed to *mine-level* analysis should be attempted. The goal of such an analysis would be to develop a performance standard to test the additionality of specific wells. The Reserve proposed this new approach to the workgroup in February 2010, where it received general support.

The Reserve did not have publicly available data on which to base the analysis. Mine operators within the workgroup agreed to supply confidential, well-level data in order to conduct the analysis, and the Reserve was also able to gather such data from Jim Walter Resources, a mine owner outside of the workgroup process.

Well-Level Hypothesis and Data Request

Gas quantity was chosen as the underlying basis for the performance standard, as there appeared to be a strong relationship between the quantity of gas drained and the propensity of mine operators to capture the gas for sale to pipelines. The Reserve hypothesized that the relationship, clearly indicated by the mine-level data, would also be found to exist at the well level. Specifically, the hypothesis was that wells producing limited quantities of gas would be less likely to be connected to the methane capture system—and less likely to be drilled in the first place—than wells producing large amounts of gas.

For gob wells, the analysis would focus on establishing a relationship between gas quantity and the decision to vent or capture the gas from each well. However, in the case of pre-mining wells, the Reserve decided to test a proxy for gas quantity rather than quantity itself. One of the workgroup members had proposed the development of a standard based on well life specifically to incentivize the drilling of shorter-lived pre-mining wells located closer to the working face. As shorter-lived wells can be expected to produce less gas than longer-lived wells, all else being equal, it was recognized that well life might serve as a reasonable proxy for the quantity of gas produced by the wells. Furthermore, in addition to the fact that it already enjoyed support from at least one workgroup member, it was also recognized that well life data might be more readily available than quantity data and, further, that a standard based on well life might be easier for mine operators to implement in actual practice than one based on gas quantity (as quantity is less controllable than well life).

Therefore, based on the above considerations, the Reserve attempted to undertake two separate data requests and subsequent analyses—an analysis of the relationship between gas capture and gas quantity for gob wells, and an analysis of the relationship between gas capture and well life for pre-mining wells (including both surface and in-mine wells).

The data request to support these analyses was submitted to the mines in May 2010. Unfortunately, a key portion of the data that was requested on gob wells was unavailable - specifically, data on the quantity of methane vented (as opposed to captured) does not appear to be collected at this time. Without this data, the Reserve was unable to compare methane quantities for venting wells versus wells that are connected to the methane capture system and thus unable to develop a proposed performance standard for gob well-to-pipeline projects; such a comparison is necessary as a basis for a well-level performance standard.

Summary of Analysis

Useable data on surface and in-mine pre-mining wells was obtained by August 2010 from three coal companies, covering nine different mines. As requested, all of these mines either currently, or at some point in time after 1990, captured methane for sale to pipelines.[1] It is important to note that, even though the Reserve obtained data from only a handful of mine operators, the data set for this well-level analysis is much larger than for any of the mine-level analyses conducted under this process to date.

The Reserve requested data for *all* pre-mining wells meeting the above conditions, regardless of whether they vented their methane or were connected to the gas collection system. Based both

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[1] Since the goal of our analysis was to develop common practice standards for the *extension* of existing pipeline sales projects, we purposely limited our data collection effort to mines with such projects already in place.

on the data received and subsequent follow-up questions directed to the data providers, it was confirmed that *all* of the pre-mining wells at all of the mines with pipeline sales projects were connected to the gas collection system. It should be emphasized that, in the case of pre-mining wells, this limits the opportunity for extending existing projects to the drilling of new, shorter-lived wells—there do not appear to be any pre-mining wells at these projects that vent their gas and that could thus be incentivized to stop venting.

Following a “data scrubbing” effort, there was useable data for a total of 448 pre-mining wells. Although these wells were located at nine different mines, it should be emphasized that three of these mines provided data for only five wells. The vast majority of the well-level data was provided by the remaining six mines. As Table 1 indicates, these six mines are located in two states—Virginia and Alabama. Two of the other three mines (hosting a total of three wells) are located in Pennsylvania, and the third mine (hosting two wells) is in West Virginia.

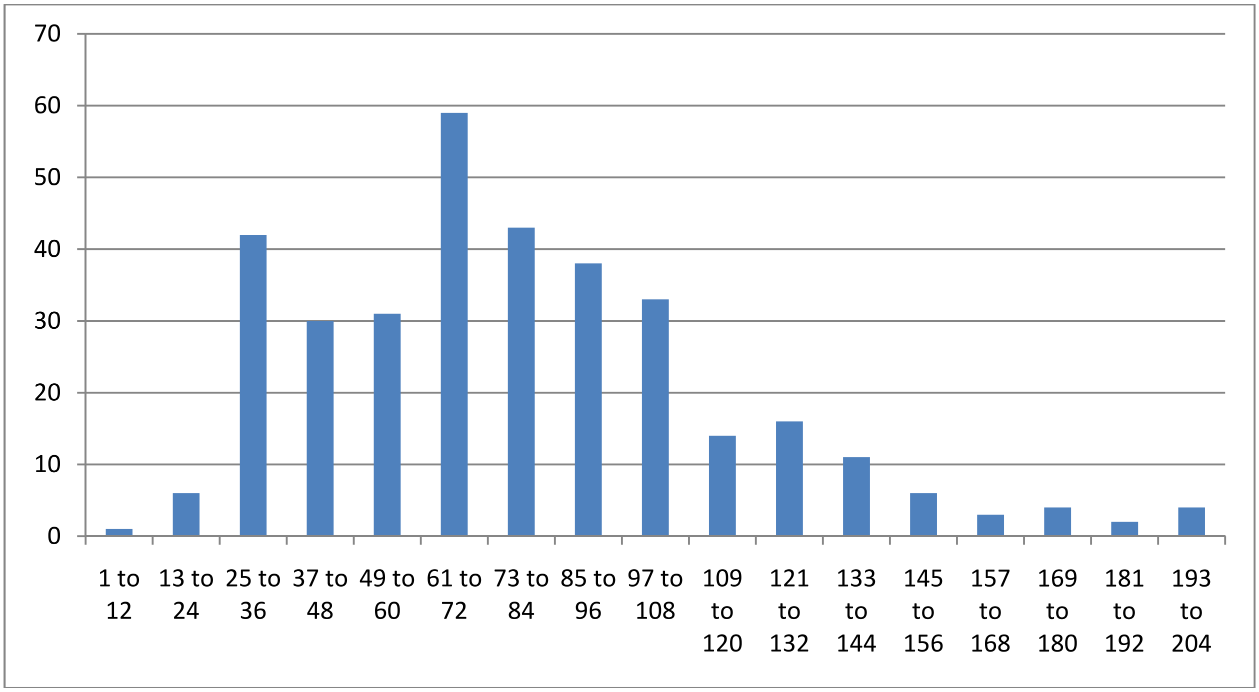
Table 1 – Geographic Distribution of the Sample Mines and Pre-Mine Wells

State	# of Mines	# of Surface Wells	# of In-Mine Wells	Total # of Pre-Mine Wells
Alabama	4	100	105	205
Pennsylvania	2	3	0	3
Virginia	2	238	0	238
West Virginia	1	2	0	2
Total	9	343	105	448

Surface Wells vs. In-Mine Wells

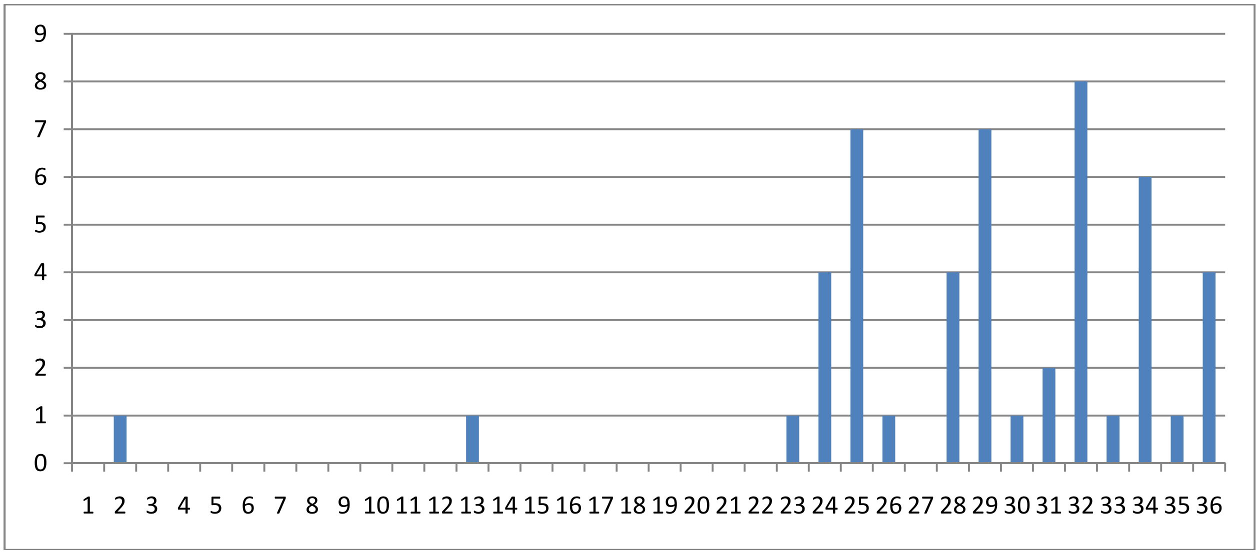
The first question to address is whether the well life distribution for surface wells differs significantly from the distribution for the in-mine wells. Figure 1 presents the distribution of the surface wells by well life. A comparison of these results with the corresponding distribution for in-mine wells reveals that the two distributions are in fact dissimilar *(we are unable to include the distribution of the in-mine wells because of confidentiality concerns)*. Of particular importance, it is important to note that few of the surface wells (only 2 percent of the total) had lives of 2 years or less. In contrast, many in-mine wells were mined through within 2 years. Also surface well life distribution is shown to peak in the 5- to 6-year range, while the vast majority of the in-mine wells had lives of 5 years or less. It should be noted that the length of the longwall panel acts as a limit on the maximum distance that can exist between an in-mine well and the face, whereas no such constraint exists in the case of surface wells. Hence it is not surprising that the surface wells are characterized by longer lives than the in-mine wells. The significant differences in the life distributions for the two pre-mine well types point to the need for separate analyses of, and separate performance standards for, each type.

Figure 1 - Histogram of Surface Wells, by Well Life (in Months)



To establish the proposed performance standards for surface well and in-mine wells, the Reserve "zoomed in" on the sections of the histograms closest to the x-y axis in order to identify a minimum well life for each well type that represents current practice. See Figure 2 for an example of the "zoomed in" data view for surface wells.

Figure 2 - Histogram of Short-Lived (3 Years or Less) Surface Wells, by Well Life (in Months)



Temporal and regional differences within the in-mine and pre-mine datasets were also explored, as well as the effect of existing offset programs that may have incentivized pipeline sales projects in the past. Ultimately, no other factor beyond the surface well vs. in-mine well distinction was found to necessitate a change in the structure of the analysis or performance standard.

Given the above conclusions, the data presented in Figures 1 and 2, and corresponding results for in-mine wells, the proposed performance thresholds are as follows:

- The proposed well life threshold for in-mine wells is 3 months or less
- The proposed well life threshold for surface wells is less than but *not* equal to 2 years

Application of the Proposed Thresholds in Practice

The goal of a pre-mine performance standard based on well life is to influence both the timing, and density, of pre-mine wells. Specifically, such a standard is intended to incentivize mine operators to drill wells closer to the mine face. Since these wells will have relatively short lives before they are mined through (e.g., no more than 2 years for surface wells based on the threshold proposed in the preceding section), production from each well will, in effect, be “cut off” at an earlier date than is the case for the typical pre-mine well drilled today. Thus, all things being equal, any new wells incentivized by a well life standard can be expected to produce less gas than the longer-lived wells drilled absent the standard. To make up the production (or mine drainage) shortfall, the expectation is that operators will drill more wells, on a more closely-spaced pattern, than would otherwise be the case. While the amount of gas produced per well is expected to decline, the total amount of gas collected is expected to increase with the increase in the number of wells. This expected increase in total gas production represents the additional methane capture incentivized by the offset credits. Revenues from the sale of these credits are intended to enable operators to recover the costs of the increased drilling, and earn an appropriate return on the project expansion.

Risks Associated with a Well Life Performance Standard

At this point, it must be emphasized that there are a number of risks to the credibility and integrity of the proposed performance standards associated with the goals and expectations outlined above. These risks fall into two broad categories. First, although a well-life standard can be expected to directly influence the *timing* of wells, the expected influence on the *spacing* of wells is indirect and less certain—and the ultimate effect on total gas production is even less certain. For example, if the effect of a well-life standard at a particular mine is to cut the average well life in half, while at the same time doubling the number of wells drilled per acre, it does not necessarily follow that total gas production will increase. The effect of the reduction in average well life should, to some unknown extent, offset the increase in production resulting from the tighter drilling pattern. The overall effect of both the timing and spacing modifications could be an increase, a decrease, or no change in total gas production, and it will be impossible to know in advance which outcome will prevail at any given mine site. If the standard incentivizes a change in the timing of drilling but not the spacing of wells, total production will almost certainly *decrease* rather than increase. Such a result is possible if, for example, the production from additional wells would be insufficient to cover the costs of the wells (even with the revenues from the offset credits), *and* the uncovered portion of the drilling costs would exceed the costs of modifying the mine’s ventilation system to enable it to handle more methane. In this perhaps unlikely, although possible, worst case, the well-life standard could have the perverse effect of reducing, rather than increasing, the quantity of methane captured at the mine.

Second, even assuming that gas production increases as intended, there exists a significant risk of crediting not only the incremental addition to the collected quantity of gas, but also a significant portion of the gas that would have been collected absent the incentive of offset credits. To better understand this second risk category, let us consider an example. Suppose that, prior to the introduction of a well-life performance standard, a mine operator drills surface drainage wells on a pre-set pattern of 2 wells per longwall panel. Each panel is 1000 feet wide and 2 miles long. Each well is drilled to intersect the coal seam at the center of the 1000 foot wide future face; the wells are drilled one mile apart. Each well is drilled 3 years in advance of the face.[2] This initial situation is illustrated in Part A of Figure 3. Assuming that in January 2011 the longwall face is expected to reach the first planned drilling site in 3 years, Well No. 1 would be drilled in January 2011. Assuming, further, that the longwall face is expected to advance 1 mile per year, Well No. 2 (located one mile from Well No. 1) would be drilled in January 2012.

Now let us suppose that, in response to a new well life performance standard with a 1.5-year threshold, the mine operator decides to reduce the expected life of each well drilled to 1 year. To make up for the lost production per well, the operator intends to drill 3 wells per longwall panel. Under the new pattern, wells will still be drilled in a single line down the center of the panel, but each well will be placed one-half mile, as opposed to one mile, from its nearest neighbor(s). This new drilling pattern is shown in Part B of Figure 3. Using this new pattern and new timing, the first well (No. 1) would now be drilled in January 2013 rather than January 2011. Given that the face is 3 years away from reaching the well drill site as of January 2011 (see above), this would allow the face 2 years to advance prior to drilling, thereby placing it within 1 year of reaching the drilling site. Well No. 2, to be located half a mile further along the longwall panel, would be drilled in July 2013, and Well No. 3 would be drilled in January 2014.

Note, however, that while the *timing* of the drilling has been delayed in response to the new well life standard, the *positions* of Well Nos. 1 and 3 correspond precisely to where Well Nos. 1 and 2 *would have been* located absent the standard (see Part A of Figure 3). Thus, although all three wells will have a life of 1 year (assuming the face advances at the expected rate of 1 mile per year) and will therefore qualify for credits under a 1.5 year standard, the gas produced by Well Nos. 1 and 3 would have been produced anyway absent the standard. The only well position that has been influenced by the standard is that of Well No. 2, and only this well is likely to produce additional gas.

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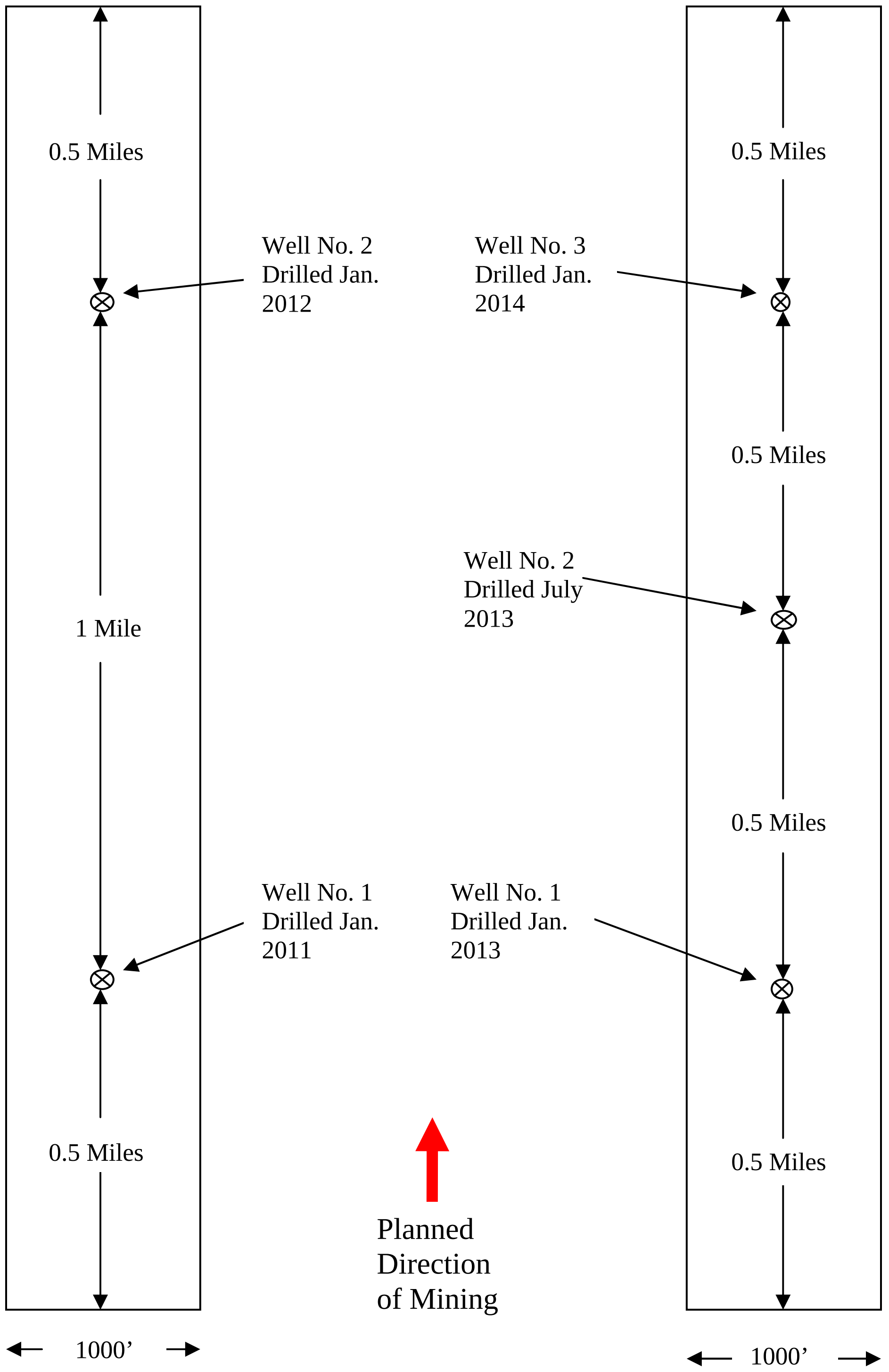
[2] This supposed drilling pattern is purely hypothetical and intended to simplify the example rather than to provide a realistic representation of actual drilling patterns.

Figure 3 – Hypothetical Longwall Panel Drilling Patterns Before and After the Introduction of a Well Life Performance Standard (Plan View)

Part A: Well Timing and Spacing Prior to Well Life Standard

Part B: Well Timing and Spacing After Adoption of Standard



Addressing the Risks

To address this risk, the methodology for calculating emission reductions would need to estimate what would have happened absent the well life standard, and adjust the quantity of gas to be credited based on this estimate. One obvious approach would be to establish the counterfactual based on historic drilling patterns at each mine. As a simple example, historic data could be used to determine the average number of wells drilled per acre (or hectare, or other appropriate unit of area) prior to the expansion of the pipeline project. Then, the number of new wells drilled in response to the well life standard would be compared to this historic average, and adjustments would be made to prevent the crediting of non-additional gas.

An example will serve to illustrate this approach. Suppose that, over a pipeline sales project's past life, an average of 10 surface wells have been drilled per acre of mined out area, and none of these wells have had a life less than the proposed 2-year surface well threshold. In response to the opportunity to earn credits from the Reserve, the operator now undertakes to expand the project to include more wells drilled closer to the face. Using the new drilling pattern, the operator now drills 15 wells per acre, including 12 wells with lives less than 2 years and 3 longer-lived wells. In this case, 7 of the 10 original longer-lived wells are in effect being replaced by 12 shorter-lived wells. Therefore, the total number of *additional* wells per acre is estimated as 5 (i.e., 12 minus 7), and the total quantity of gas to be credited would be computed as follows:

$$Q_c = Q_T(5/12) \qquad (1)$$

Where

Q_c = Quantity of collected methane to be credited

Q_T = Total quantity of methane collected from the 12 qualifying wells

Using this approach, the number of qualifying wells per acre is in effect reduced from 12 to 5, to reflect the fact that 7 of the shorter-lived wells are assumed to replace 7 longer-lived wells that would have been drilled absent the opportunity to earn offset credits.

However, while this approach provides a means of addressing the risk of crediting non-additional wells, it does *not* address the possibility that the increase in methane collected by the new wells will be offset, wholly or in part, by the reduced life of these wells. Returning to the preceding example, suppose that, on average, the 10 wells/acre drilled over the life of the pipeline sales project (*prior* to the project's expansion) produced, on average, x Mcf of methane. Thus, each acre drilled had an average total methane production of 10x Mcf. Using the new, expanded drilling pattern, the 3 longer-lived wells drilled per acre are found to average 0.9x Mcf of methane, while the 12 shorter-lived wells average 0.8x Mcf of methane. Thus, the total *additional* quantity of methane produced per acre (Q_a) can be calculated as follows:

$$Q_a = (3)(0.9x) + (12)(0.8x) - 10x = 2.3x$$

The new well life standard has thus, in this case, incentivized the capture of an additional 2.3x Mcf of methane per acre. However, using Equation 1 above, the quantity of methane to be credited would be computed as follows:

$$Q_c = (12)(0.8x)(5/12) = 4x \text{ Mcf}$$

This is nearly double the actual amount of additional methane produced by the expanded project. The error arises largely because Equation 1 does not take into account the extra gas that *would have been* produced by the 7 counterfactual longer-lived wells, by virtue of their longer lives *vis a vis* the new short-lived wells. To correct for this error, it is necessary to adjust the *quantity* of methane in calculating the number of credits to be awarded, rather than the *number of qualifying wells* (as is done in Equation 1). Equation 2 includes the necessary quantity adjustment:

$$Q_c = Q_T - AWQ_C(NCWR) - NLLW(AWQ_C - AWNQ_P) \qquad (2)$$

Where

Q_c = Quantity of collected methane to be credited

Q_T = Total quantity of methane collected from the qualifying wells (e.g., 12 wells x 0.8x per well in our example)

AWQ_C = Average historic quantity of methane collected per well, and assumed to be collected by the longer-lived wells in the counterfactual (e.g., x in our example)

NCWR = Number of wells in the counterfactual replaced by shorter-lived wells in the expanded project (e.g., 7 in our example)

NLLW = Number of wells with lives exceeding the threshold in the expanded project (e.g., 3 in our example)

$AWNQ_P$ = Average quantity of methane collected by those wells in the expanded project with lives in excess of the threshold (e.g., 0.9x in our example)

Using values from our example, Equation 2 would be solved as follows:

$$Q_c = (12 \text{ wells})(0.8x/\text{well}) - (7 \text{ wells})(x/\text{well}) - (3 \text{ wells})(x/\text{well} - 0.9x/\text{well})$$

$$Q_c = 2.3x$$

Equation 2 would be applied separately to in-mine wells and surface wells. If Equation 2 yields a negative quantity, this quantity would be retained and applied against future claims for credits.

In Equation 2, the first term (Q_T) is simply the total quantity of methane produced by those wells qualifying for credits under the well life threshold. In the example, there are 12 such wells within a one-acre area of the mine. In actual applications of Equation 2, it is not necessary to limit the number of wells considered to a specific unit of area, such as an acre, although it *is* necessary to ensure that whatever area is used is applied consistently to all terms of the equation.

The second term of Equation 2 is a quantity adjustment to remove the methane that *would have been* captured anyway by those counterfactual wells replaced by the qualifying wells. Here, it is important to ensure that the area covered by the qualifying wells is equal to the area covered by the replaced counterfactual wells. Suppose, for example, that the quantity of credits are to be computed for all wells drilled within a mined out longwall panel, and the dimensions of the panel are 1000 feet wide by 2 miles long. The area covered by the panel (AP) is thus:

AP = (2 miles)(5280 ft/mile)(1000 ft) = 10,560,000 sq ft, or 0.379 sq miles

Supposed 4 qualifying short-lived surface wells, and 2 long-lived surface wells, were drilled within the panel. Based on an analysis of historic data for this same mine, the average number of wells drilled prior to the project expansion was 8 wells per square mile, and all of these wells were long-lived.[3] In this case, the number of counterfactual long-lived wells that were replaced by the shorter-lived wells (NCWR in Equation 2) would be estimated as follows:

NCWR = (0.379 square miles)(8 wells/sq mile) – 2 = 1.032 wells

Note that in addition to adjusting the counterfactual well count to “fit” the dimensions of the mined-out longwall panel, the above equation also subtracts the number of non-qualifying, longer-lived wells still included in the project expansion from the well count. If in actual application NCWR is computed as zero or negative, then the second term of Equation 2 would be set to zero.

Finally, the third term of Equation 2 is designed to adjust the amount of credits awarded to reflect any reduction in the amount of methane captured by non-qualifying, longer-lived wells included in the project expansion. In the prior example, 2 longer-lived wells were drilled in the longwall panel. Because wells are more numerous and closely spaced in the expanded project, it is possible that the zones of influence of these two wells will be penetrated by the zones of influence of the other, shorter-lived wells, thereby reducing the quantity of methane collected by the two wells. The third term of the equation will capture such impairments in the performance of non-qualifying, longer-lived wells resulting from the project expansion, and adjust the number of credits awarded accordingly.

Much of the data required to solve Equation 2 should be readily available. Specific project data that would need to be collected include:

- The number of surface or in-mine wells qualifying for credits under the well life standard within a given mined out area (e.g., a longwall panel), and the total quantity of methane collected by these wells over their life;
- The number of surface or in-mine wells *not* qualifying for credits under the well life standard within the same mined out area as above (e.g., the same longwall panel), and the average quantity of methane collected by these wells over their life; and
- The area covered by the qualifying wells (e.g., the number of acres in the longwall panel).

It is important to recognize that Equation 2 is essentially an area-based formula, designed to determine the amount of credits to be awarded for a specific mined-out area. This being the case, it will not be possible to award credits to individual wells as they are mined through;

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[3] In the event that the historic (pre-project expansion) data for a mine includes any short-lived wells, these wells should be subtracted from the number of qualifying wells prior to the calculation of credits. For example, if a mine previously drilled one well with a life less than 2 years per acre, and now, with the project expansion, drills 10 short-lived wells per acre, the number of qualifying wells per acre should be limited to 9. The quantity of methane collected by these nine wells should be computed as equal to 9 times the *average* quantity of methane collected by all 10 wells.

instead, it will be necessary to wait until a group of wells, covering some specific area, have been mined through. However, as noted previously the area covered need not be set to a constant value either across or within mines. Application of the equation on a panel-by-panel basis is an possible approach, since the concept of the panel is clear and universally understood within the coal mining community, and each longwall panel is well-defined in terms of its dimensions (although these dimensions may themselves change from one panel to the next). Other approaches might also possible; for example, to speed up the crediting of wells, fractions of panels might be used (e.g., a panel might be divided in half at the midpoint of its length, with the first half credited as soon as this midpoint is reached and the second half credited once the entire panel is mined out).

In addition to the above-defined data on the expanded project, Equation 2 requires a limited amount of data covering the counterfactual. Specific data required are as follows:

- The average number of surface or in-mine wells with lives *above* the threshold per unit of area (e.g., per acre, per square mile, etc.), and the average quantity of methane collected by these wells (any wells that vent rather than capture methane should be excluded from the count); and

- The average number of surface or in-mine wells with lives *below* the threshold (if any) per unit of area (e.g., per acre, per square mile, etc.), and the average quantity of methane collected by these wells (any wells that vent rather than capture methane should be excluded from the count).

The above-required data would be computed simply by determining (1) the total number of mined-through surface, or in-mine, wells connected to the pipeline over a historic time period, and (2) the total quantity of methane collected by these wells, and (3) dividing these totals by the area covered by the wells (e.g., the area covered by all the longwall panels drilled with wells). Because both the number of wells and the quantity of methane collected per well is likely to depend heavily on site specific conditions, the above-described “baseline” data would need to be developed separately for each mine desiring to register an expanded project with the Reserve. The sample data exhibits enormous variation in the number of pre-mine wells across different mines. This variability, combined with the very limited population of pipeline projects currently in existence, precludes the possibility of developing national or regional estimates of well counts and methane quantity averages that could be reasonably applied to individual mines. It is recognized that well counts and methane quantity averages may also exhibit high levels of variability *within* individual mine sites. However, the site-specific variability should, in general, be much more limited than the variability across mines, and the inherent uncertainties of the method are necessary if the risks of crediting non-additional methane collection are to be addressed.

Given the need to develop baseline data for each individual mine contemplating a project expansion, it follows that the application of the well life standard would need to be limited to pre-existing projects with a reasonable time series of historic data. The Reserve proposes that at least 5 years worth of historical data be available.

When the initial concept of a well life standard was first considered, the Reserve believed it would be possible to apply it to individual wells at new as well as existing projects. However, a deeper analysis of the risks attendant with this approach, and possible means of addressing these risks, has persuaded us of the need to limit the approach to pre-existing projects. While this limitation in the practical applicability of a well life standard was unanticipated, it nonetheless conforms to the basic purpose originally envisioned for the standard. The goal of the standard has always been to incentivize the *expansion* of existing projects and, more specifically, the drilling of pre-mine wells on a more closely-spaced pattern. Given this goal, it is reasonable if not necessary to require that the quantity of methane produced by the expanded project be compared against the quantity of methane that *would have been* produced by the original project.

The Reserve's fundamental assumption, supported by the data analyses conducted during the work to develop Version 2.0 of the CMM Protocol to date, is that pipeline sales projects are largely non-additional, but that opportunities may exist for improving the performance of these projects. Given this assumption, the Reserve would expect new pipeline sales projects to continue to be developed to the extent that new, gassy longwall mines are opened near existing natural gas pipelines. The goal of the proposed pre-mine well life standard is not to incentivize the initial development of these projects – based on our assumption the opportunity for selling the natural gas should serve as a sufficient initial incentive. Rather, the goal here is to incentivize the collection of additional methane from such projects, once they have been put in place. For this purpose, limiting the applicability of this proposed standard to pre-existing projects that have been in operation long enough to establish a reasonable baseline seems both necessary and appropriate.

Summary of Proposed Performance Standards and Other Requirements

The analysis led to the following proposed performance standard tests for pre-mine wells:

- Only in-mine wells with a well life of 3 months or less are eligible[4]
- Only surface wells with a well life of less than 2 years are eligible[4]

Additional proposed requirements:

- Projects are limited to mines with pre-existing pipeline projects and at least 5 years of historical data on:

    1. the total number of mined-through surface, or in-mine, wells connected to the pipeline over a historic time period, and the life of these wells
    2. the total quantity of methane collected by these wells
    3. The surface area covered by these wells (e.g., the surface area covered by the longwall panels drilled)

- Mines will have to estimate a mine-specific baseline deduction using the above data
- There will be a mine-specific deduction to emission reductions based on the established mine-specific baseline

Project Potential Based on Proposed Performance Standards

Assuming the historic data detailed above is available, the opportunity for potential pipeline projects is currently limited to the following existing mines that have pre-mine wells and existing pipeline projects (based on publicly available data; not confirmed with mines):

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[4] Because data used to set thresholds is very geographically limited, the Reserve may consider adjusting the thresholds to be conservative before applying them beyond the regions they currently cover (eastern US only).

	Mine Name	**State**	**Mine Owner**
1	Oak Grove Mine	AL	Cleveland-Cliffs
2	Blue Creek No. 4	AL	Walter Industries
3	Blue Creek No. 7	AL	Walter Industries
4	San Juan	NM	BHP Billiton
5	Emerald	PA	Alpha Natural Resources
6	Cumberland	PA	Alpha Natural Resources
7	Buchanan Mine	VA	CONSOL
8	Pinnacle	WV	Cleveland-Cliffs
9	Blacksville No.2	WV	CONSOL
10	Federal No. 2	WV	Patriot Coal Corp

Future pipeline projects with pre-mine wells at other existing or new longwall mines would also be potential projects, once the historical data detailed above becomes available. Based on previous analyses, pipeline projects at room and pillar mines would also be eligible, regardless of drainage type.