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To: Rosalie Winn, EDF

From: Dana Lowell, MJB&A

Date: March 27, 2020

Re: **Review of API NSPS Comments (Docket ID No. EPA-HQ-OAR-2017-0757)**

MJB&A has reviewed the comments submitted to EPA by API on November 25, 2019, relative to Docket ID No. EPA-HQ-OAR-2017-0757; EPA's "Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources Reconsideration; Proposed Rule"; 84 Fed. Reg. 50244 (September 24, 2019). In particular we have reviewed Attachment A to the API comments, which summarizes modeling conducted by Earth System Sciences, LLC (ESS), to evaluate the impact of an "Existing Source Rule" intended to reduce methane emissions from existing onshore oil and gas production sites in the U.S.

The following summarizes our comments on the ESS analysis:

- The results of the ESS analysis are highly sensitive to input assumptions, in particular assumptions made by ESS as to the number of pre-2016 wells that will be shut-in each year, and details of the modeled existing source rule. With respect to estimated benefits the most important parameters of the modeled rule include the start date, the number of wells that would be exempt from the rules, the mandated frequency of required leak detection and repair (LDAR) inspections at existing well sites, and the required turn-over rate of existing pneumatic devices to low- or no-bleed devices.
- ESS does not explicitly state the number of pre-2016 wells assumed to be shut in each year, but these values can be inferred based on data that is presented in Appendix A. ESS appears to assume a very high level of well shut-ins between 2020 and 2028 (~50,000/year, equivalent to the highest levels of shut-ins reported in recent years). This level of annual well shut-ins is significantly higher than longer term historical trends, which were between 20,000 and 30,000 shut-ins per year from 1985 to 2015. The greater the number of annual shut-ins the fewer wells that would be subject to an existing source rule, and the lower the estimated benefits from such a rule.
- Other than start date (2028), ESS provides no detail about the "existing source rule" that they modeled. They do not indicate their assumed LDAR frequency, their assumptions as to required turn-over of pneumatic controllers to low- or no-bleed devices, or their assumptions for the number of wells that would be exempt from any requirements under the rule. Using ESS stated assumptions from Appendix A, MJB&A cannot fully replicate the ESS results, but it is clear that they must have modeled a rule with LDAR frequency no greater than biennial, minimal requirements for turn-over of pneumatic controllers, and a significant number of exemptions, likely for low-producing wells. Estimated benefits from an existing source rule would be higher if ESS had modeled a rule with higher LDAR frequency, greater turn-over of pneumatic devices, and/or fewer exemptions from the rules.

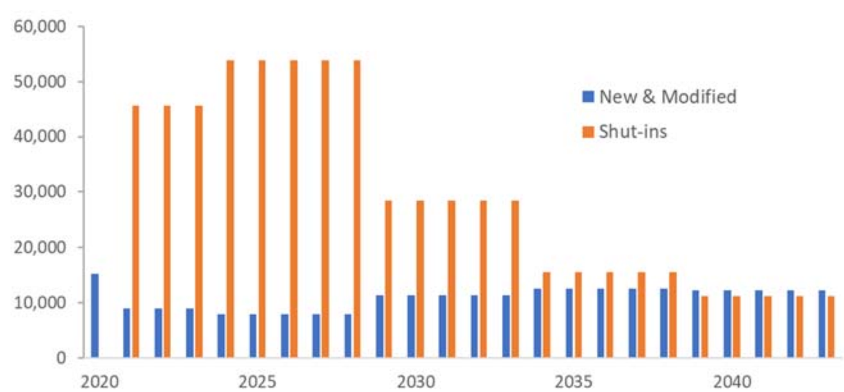
- MJB&A developed our own estimate of methane emission reductions that might accrue from a requirement to conduct LDAR at well sites under an existing source rule, based on ESS stated assumptions from Appendix A for the number of current wells (850,000), average emissions per well from equipment leaks (1.42 metric tons/year), and LDAR effectiveness (40% control for annual LDAR). This MJB&A estimate indicates that, total 15-year benefits (2028 – 2043) from annual LDAR at pre-2016 wells (with no exemptions) would be 1.8 – 2.9 times higher than the benefits estimated by ESS, depending on the assumed number of annual well shut-ins (35,000 – 50,000/year in the near term). This does not include additional benefits that could accrue from a requirement to accelerate turnover of pneumatic devices to low- or no-bleed devices at these pre-2016 wells, and therefore underestimates the full potential for reductions under an existing source rule. The scenario modeled by MJB&A with lower annual well shut-ins indicates that total methane reductions from an existing source rule requiring annual LDAR could exceed 2.6 million metric tons through 2043 for a rule starting in 2028, and could exceed 3.8 million metric tons through 2050 if the rule was implemented as of 2025; potential reductions from a rule that included aggressive turnover requirements for pneumatic devices could be significantly higher. These estimates underscore the dramatic impacts the ESS assumptions have on their overall conclusion that an existing source rule would provide minimal benefits.

These results are detailed further below.

Annual Well Shut-ins

In Appendix A, ESS provides data on the projected total number of U.S. onshore oil and gas wells each year between 2020 and 2043 (Figure 6, page 14) and the percentage of those wells subject to OOOOa each year (Figure 7, page 15). As only wells newly drilled or modified since 2016 are subject to OOOOa, the change in these values year over year allows one to infer the number of new wells assumed by ESS to be drilled each year, as well as the number of pre-2016 wells assumed to shut-in each year.

Figure 1 ESS Assumed New and Shut-in Wells, by year

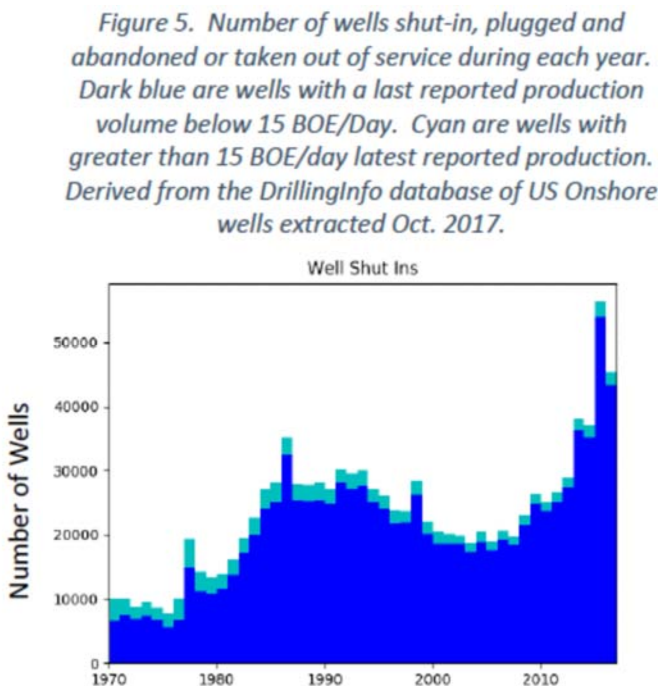


This inferred data on assumed new and shut-in wells is shown in Table 1.

As shown, ESS assumes that an average of about 50,000 wells/year will be shut-in between 2021 and 2028, after which annual shut-ins will fall to 30,000/year or fewer. ESS cites as justification for their shut-in assumptions historical shut-in data from the DrillingInfo database (Figure 5, page 12). This data is reproduced here as Figure 2. As shown, annual well shut-ins were 15,000 – 30,000/year from 1980 to 2010. Since 2010 they have generally increased year-to-year, peaking in 2016 at over 50,000 shut-ins, then falling to just over 40,000 in 2017 (the last year of available data). ESS does not provide a basis for the assumption that this elevated level of annual shut-ins (which has only occurred once in the last 40 years) will continue as the norm for the next eight years before resuming longer-term historical trends.

The assumed number of older wells that will be shut-in each year has a significant impact on projected benefits from any existing source rule, as it affects the number of wells that would be subject to such a rule each year.

Figure 2 Historical Well Shut-ins



Based on their shut-in assumptions, ESS projects that by 2028 (their modeled start date for an existing source rule) just over 300,000 wells would be subject to such a rule, not including about 60,000 wells that are already subject to state rules in California, Colorado, Utah, and Wyoming[1]. ESS further estimates that by 2043 only about 77,000 wells would still be subject to the modeled existing source rule, as the other pre-2016 wells would have already been shut in.

If one assumed an average of only 35,000 shut-ins/year between 2020 and 2028 (in keeping with long-term historical trends), then over 476,000 wells would be subject to an existing source rule in 2028, falling to 162,000 in 2043. This would result in projected benefits from the new source rule at least 70% higher than the ESS estimate, even if keeping all other assumptions the same.

MJB&A Estimate of Existing Source Rule Benefits

Using available assumptions from the ESS analysis, MJB&A developed a simple model to estimate methane reductions from LDAR requirements under an existing source rule[2]. The model allows for different rule designs (start date, LDAR frequency, % of wells exempt), as well as different assumptions as to the number of pre-2016 wells shut-in each year in future years. The major assumptions taken from the ESS analysis are shown in Table 1.

With respect to shut-ins of pre-2016 wells, MJB&A developed two scenarios, a "high shut in" scenario that is generally consistent with the assumptions used by ESS in their analysis, and a "historical shut in" scenario that reflects longer-term historical shut-in trends. These scenarios are shown in Figure 3. The total number of wells that could be subject to a national existing source rule each year between 2020 and 2050 under both scenarios are shown in Figure 4. Consistent with the ESS analysis, the values in figure 4 do not include estimated pre-2016 wells in CA, CO, UT, and WY as these wells are subject to existing state rules.

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[1] ESS assumes that these state rules have similar requirements to the modeled national existing source rule, so there would be no additional benefit from applying a national rule to these wells.

[2] The information provided by ESS in Appendix A to the API comments was insufficient to develop a similar model of methane reductions from pneumatic controller turnover requirements under an existing source rule.

As described above, we developed this analysis to illustrate the sensitivity of the ESS modeling approach to its input assumptions and not to offer our own, independent assessment of the likely benefits of an existing source rule, as this analysis does not include any benefits that could accrue from other existing source requirements such as accelerated turn-over of pneumatic devices to low- or no-bleed type.

Under the historical shut-in scenario, the number of pre-2016 wells that could be subject to an existing source rule fall from 714,000 in 2020 to 566,000 in 2025, 418,000 in 2030 and 184,000 in 2040. Under the high shut-in scenario, the number of pre-2016 wells that could be subject to an existing source rule fall from 714,000 in 2020 to 498,000 in 2025, 306,000 in 2030 and 78,000 in 2040.

Table 2 summarizes the estimated methane reductions that would accrue from LDAR requirements applied to these pre-2016 wells (existing sources) under various design options, based on the number of wells in Figure 4 and the assumptions in Table 1. As noted, all the scenarios summarized in Table 2 assume that no pre-2016 producing wells would be exempt from an existing source rule. If exemptions were allowed, estimated benefits would fall proportionally to the percentage of exempt wells. In Table 2, estimated annual reductions are shown for 2025, 2028, 2030, and 2040. Cumulative reductions are shown for 2028 – 2043, consistent with the ESS analysis. In addition, cumulative reductions for 2025- 2050 are shown, to reflect a potentially earlier start date for an existing source rule, as well as the fact that under some scenarios significant reductions continue beyond the arbitrary end date of 2043 chosen by ESS.

As shown in Table 2, depending on the design of the rule and future annual well shut-in levels, annual methane reductions in 2030 from LDAR at pre-2016 onshore oil and gas wells could range from 174,000 MT to 365,000 MT, and total LDAR-related methane reductions over the effective life of an existing source rule could range from 1.6 million MT to 5.8 million MT.

Table 1 ESS Assumptions Used in MJB&A Model

Metric	Unit	Value	ESS Citation
Equipment Leaks	MT/well/year	1.42	Pg 10; noted as from EPA 2018 OOOOa Proposal TSD
LDAR Effectiveness			Table 5, page 10; noted as from EPA 2018 OOOOa Proposal TSD
Biennial	% reduction	30%	
Annual	% reduction	40%	
Semi-annual	% reduction	50%	
Existing Wells 2020		850,000	Figure 6, page 14
% Wells subject to state rules	%	16%	Table 2, page 7; % of total DI reported wells in CA, CO, UT, and WY

Figure 3 MJB&A Modeled Shut-in Scenarios, pre-2016 wells shut-in per year

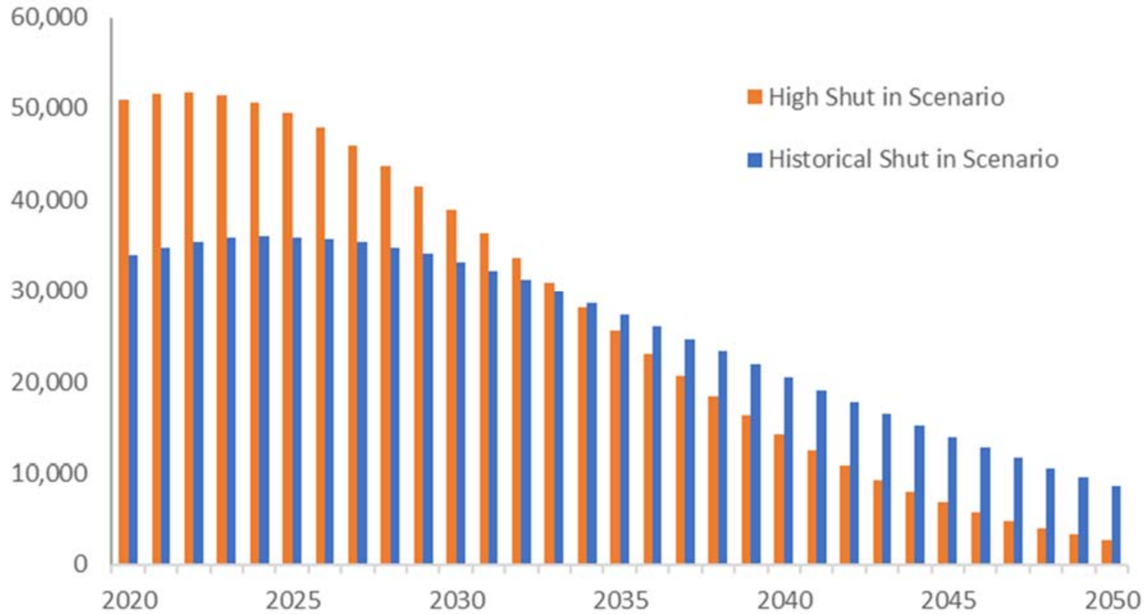

Figure 4 MJB&A Modeled Number of Wells Subject to National Existing Source Rule

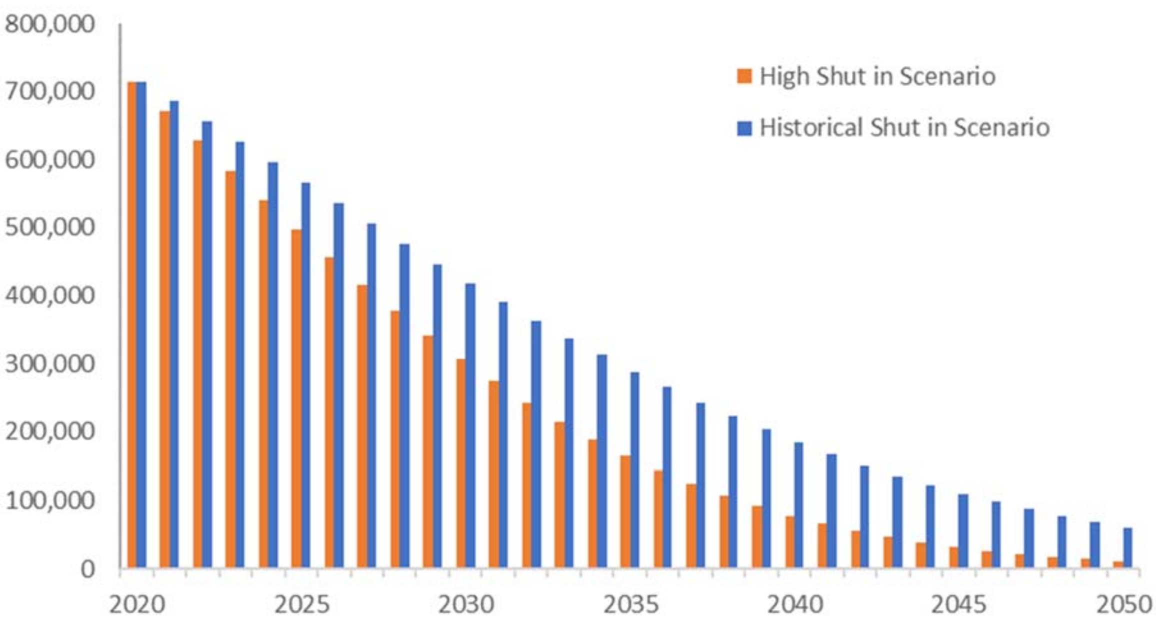

Table 2 MJB&A Estimate of Methane Reductions from LDAR at pre-2016 Oil and Gas Wells[3]

Shut-in Scenario	High Shut-in		Historical Shut-in	
LDAR Frequency	**Annual**	**Semi-Annual**	**Annual**	**Semi-Annual**
Exemptions	**None**	**None**	**None**	**None**
Annual Reductions in 2025 (MT)	283,115	424,672	321,580	482,369
Annual Reductions in 2028 (MT)	214,751	322,127	270,521	405,781
Annual Reductions in 2030 (MT)	174,076	261,114	237,678	356,516
Annual Reductions in 2040 (MT)	44,366	66,549	104,714	157,071
Cumulative Reductions 2025 - 2050 (MT)	2,477,065	3,715,598	3,883,419	5,825,129
Cumulative Reductions 2028 - 2043 (MT)	1,605,443	2,408,164	2,615,649	3,923,473

[3] This analysis was developed to illustrate the sensitivity of the ESS modeling approach to its input assumptions and not to offer our own, independent assessment of the likely benefits of a full existing source rule which could include other requirements beyond LDAR.