NAIMA
NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

**VIA E-MAIL**

March 31, 2017

Ms. Mary Jane Coombs
Mr. Derek Nixon
California Air Resources Board
1001 I Street
Sacramento, CA 95812

RE: NAIMA Recommendation on Alternative Calculation Method for Mineral Wool Assistance Factors

Dear Ms. Coombs and Mr. Nixon:

INTRODUCTION

The North American Insulation Manufacturers Association ("NAIMA") greatly appreciated the opportunity to meet with you in Sacramento to discuss the California Air Resources Board's ("CARB") expansion of its Cap-and-Trade Program beyond 2020. During that meeting, NAIMA expressed concerns about the complexity of the calculation factors used for determining the assistance factors that would be granted to the mineral wool (fiber glass insulation) industry. CARB indicated that it would consider an alternative proposal from NAIMA as long as it preserved the essential functions of CARB's "regression analysis." This offer is consistent with CARB's public statement that the "Staff remains open to alternate methodologies that utilize the results from the leakage studies."

To take advantage of this opportunity, NAIMA has again engaged The Brattle Group to prepare an analysis of options for modifying the proposed calculation method. The Brattle Group report is attached hereto in its entirety.

ALTERNATIVE CALCULATION METHODS

As set forth in more detail in The Brattle Group report, NAIMA presents options for the consideration of CARB:

- The first option would be to not utilize the CARB regression results for those sectors covered by the studies. This would mean that those sectors covered by the studies would use the assistance factors ("AF") derived from the studies alone. Thus, for the international component the "Raw IMT" variable would provide the AF. For the domestic component there could be two alternatives: 1) the AFs could be based upon the average demand drop from the output and value added metrics, or 2) the maximum value of the two. One drawback to this method could arise from the fact that the adjustment for non-purchased fuel occurs only in the AFs derived in the CARB regression analysis.

However, CARB could derive a comparable adjustment in those cases from the ratios of regression derived AFs with and without the non-purchased fuel adjustments. This would provide a reasonable proxy for non-purchased fuels effects in the study regression results.

- The second option would be to use the maximum (instead of average) value of domestic and international AF values across the alternatives including the CARB regressions, then adding the components together for a total AF. This algorithm was initially suggested in CARB's original proposal (8/2/16), but that was subsequently changed in the next version (10/21/16) and in the last version (12/21/16).[1] This change was never explained nor justified. However, the original proposal reflected a stronger policy to counteract leakage risk.

- A third option, which could be incorporated simultaneously with option 1 or 2, is for CARB to select a lower value for its cutoff threshold for output or value added reductions to derive decile values of AFs. The CARB analysis of the domestic leakage component uses a cutoff threshold for output or value added reductions to derive decile values of AFs. This step produces different values across industries and is necessary because eliminating domestic drop altogether from all industries would require 100% AFs in all cases due to the structure of the demand drop coefficients, which are interpolated between the coefficients derived from the RFF study (implicitly assuming zero AFs and zero demand drop which is by construction at 100% AF). CARB posits a threshold of acceptable declines in output, namely 7%, based on an analysis of representative annual declines in output across the sectors (see pp. 14-15, 12/21/16 document). CARB also scales this 7% factor to 8.954% to account for different price years (the ratio of 2030 to 2025 auction reserve price used in the SRIA analysis).

  It is worth noting that the motivation for that threshold contradicts the underlying estimation methodology; the RFF regression coefficients theoretically hold other causes of output decline constant:

  > *This section describes how we use the estimated coefficients from our main statistical analysis to simulate the short- and long-run effects of imposing a GHG compliance cost on California plants in the estimation sample….Importantly for the simulations, the regressions include year-fixed effects, which hold fixed national output, value added, and employment. Therefore, in the simulations, we hold these outcomes fixed*

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[1] Appendix E "Staff Report: Initial Statement of Reasons, Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-based Compliance Mechanisms Regulation: Emission Leakage Analysis" (August 2, 2016); "Cap and Trade Regulation Industry Assistance Factor Calculation Informal Staff Proposal" (October 21, 2016); and Attachment B "First Notice of Public Availability of 15-Day Amendment Text, Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-based Compliance Mechanisms Regulation: Post-2020 Industry Assistance Factor Calculations" (December 21, 2016).

> *at their actual levels in 2009. That is, the simulations allow us to characterize the extent to which a GHG compliance cost only on California plants may cause manufacturing activity to shift from California to other states, under the assumption that national activity is unaffected.*

The rationale for adopting 7% as a cutoff is not explained in a way that provides a valid foundation for the choice. Apparently, it represents a representative "bad" year-on-year change in all industrial output for macroeconomic reasons. But, since the RFF regressions presumably isolate the impact of leakage only, this implicitly suggests that CARB believes that 7% reduction in output is an acceptable level of leakage. How that squares with the AB 32 direction "to minimize leakage to the extent feasible" is never explained, nor is any theoretical or conceptual basis offered. It's just an average drop in industrial output attributed to reasons that have nothing to do with leakage, and thus is completely arbitrary.

Regardless of the weak motivation for selecting the threshold of 8.954% in its analysis, however, a uniform threshold represents a fairly straightforward way to assign different AF values across industries, in a way that may at least approximate a distribution of AFs that would minimize leakage. In order to illustrate the impact on CARB domestic AF components from changing the assumed threshold, we reduce the threshold by 50% and retain the same averaging technique across the four calculated AFs in the latest CARB proposal. As expected, this change increases all calculated domestic AF values relative to the proposed values, but with some variation owing to the decile selection algorithm. The changes are illustrated in the graph contained in the attached The Brattle Group report.

Given the lack of foundation for the threshold selected by CARB, it would be reasonable to select a lower value in order to minimize leakage to the extent feasible. Alternatively, CARB could examine other bases for setting the threshold in order to determine if a lower threshold was appropriate.

The advantage of these options is that they would modestly increase the assistance factors for those industries most exposed to leakage, such as the fiber glass insulation industry. NAIMA repeats again that CARB has a legal mandate to minimize leakage; NAIMA also sets forth again the compelling case that is made by the map of mineral wool industry plants because it succinctly and effectively demonstrates the domestic leakage risk posed by plants right at California's border and beyond.

CARB HAS A LEGAL DUTY TO MINIMIZE LEAKAGE

AB 32 mandates that CARB minimize leakage "to the extent feasible." *See* California Health and Safety Code § 38562(B)(8). The statutory definition of leakage is not restricted to the international context; rather, it includes any situation where "a reduction in GHG emissions within the state [] is offset by an increase in GHG emissions outside the state." Cal. Health & Safety Code 38505(J). The main body of CARB's "Initial Statement of Reasons" (or "ISOR") for the Cap-and-Trade Program defines leakage in similar terms: "If production shifts outside of California to a region not subject to GHG emissions-reduction requirements, emissions could remain unchanged or even increase."

By modifying the methodology for setting AFs as described herein, CARB would be fulfilling its statutory mandate to minimize leakage.

THE FIBER GLASS INSULATION INDUSTRY REPRESENTS A GENUINE LEAKAGE THREAT FOR CALIFORNIA

NAIMA respectfully requests CARB recognize that if the California fiber glass insulation operations are made less economically viable or even unviable as a result of AB 32 and the Proposed Amendments, some of NAIMA's California members might close their plants or significantly reduce capacity. The fiber glass insulation production capacity in other jurisdictions will be able to adequately supply the California market, thereby increasing emissions in those jurisdictions and overall greenhouse gas concentrations, including in California. This fact is particularly relevant at the present moment because industry manufacturing resources are far from fully utilized.

Any demand previously fulfilled by a California plant can be easily and economically supplied from other U.S. plants were production costs to change significantly. This industry does not have to look to offshore facilities to supply the California market. In addition to the increase in greenhouse gas emissions per ton of fiber glass insulation produced at these plants located outside California, the transportation needed to get that material to California markets would have a further negative impact on greenhouse gas emissions.

**Aislantes Minerales, S.A. de C.V.**
1. San Luis Potosi, Mexico

**Armstrong Ceilings**
2. Millwood, WV

**CertainTeed Corp.**
3. Athens, GA
4. Chowchilla, CA
5. Kansas City, KS
6. Ottawa, Ontario
7. Redcliff, Alberta
8. Sherman, TX
9. Tilsonburg, Ontario

**Hollingsworth & Vose**
10. Corvallis, OR

**Industrial Insulation Group, LLC**
11. Phenix City, AL

**Johns Manville**
12. Berlin, NJ
13. Cleburne, TX
14. Defiance, OH
15. Defiance, OH
16. Innisfail, Alberta
17. McPherson, KS
18. Richmond, IN
19. Waterville, OH
20. Willows, CA
21. Winder, GA

**Knauf Insulation**
22. Albion, MI
23. Inwood, WV
24. Kingman, AZ
25. Lanett, AL
26. Shasta Lake, CA
27. Shelbyville, IN
28. Winnsboro, SC

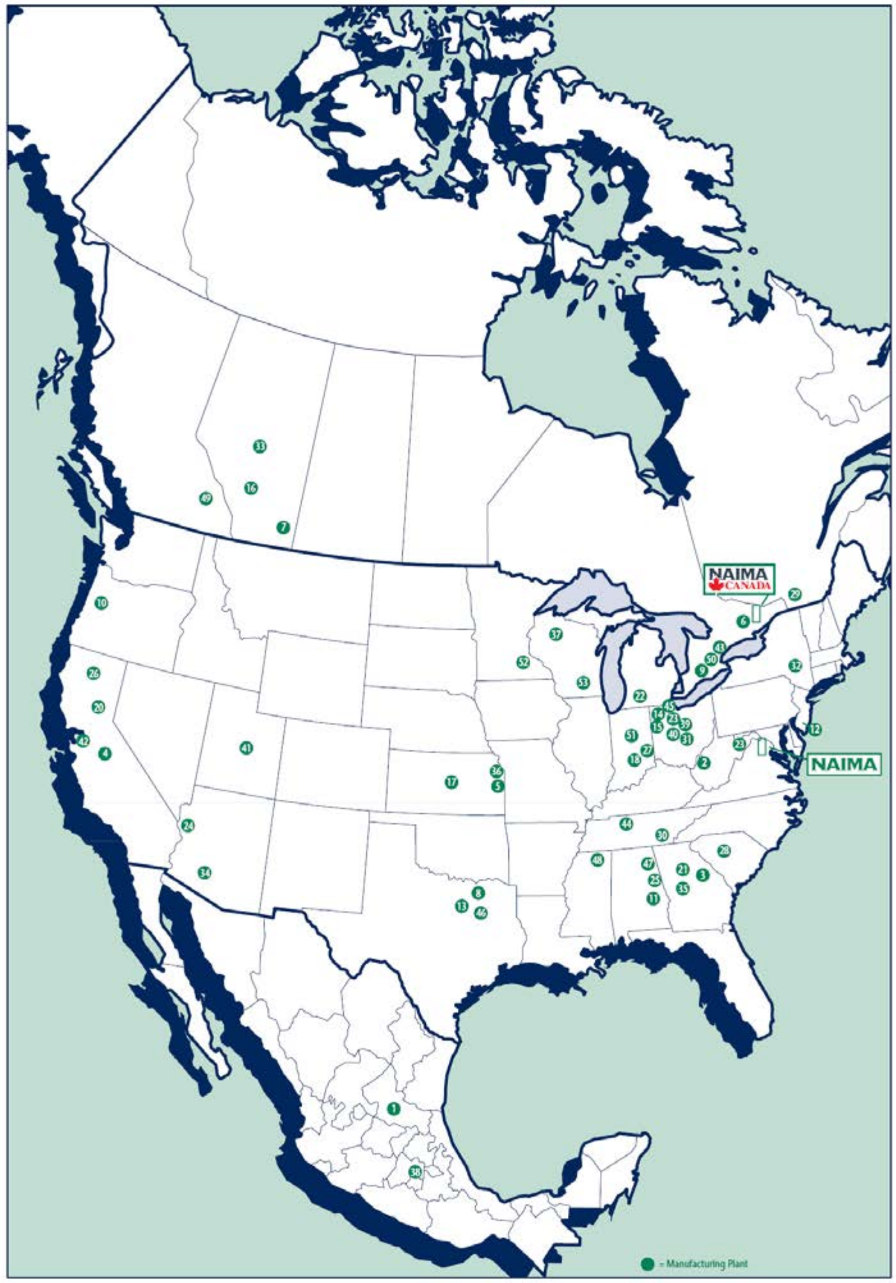
**Owens Corning**
29. Candiac, Quebec
30. Cleveland, TN
31. Columbus, OH
32. Delmar, NY
33. Edmonton, Alberta
34. Eloy, AZ
35. Fairburn, GA
36. Kansas City, KS
37. Ladysmith, WI
38. Mexico City, Mexico
39. Mount Vernon, OH
40. Newark, OH
41. Nephi, UT
42. Santa Clara, CA
43. Scarborough, Ontario
44. Springfield, TN
45. Tiffin, OH
46. Waxahachie, TX

**Rock Wool Manufacturing Co.**
47. Leeds, AL

**Roxul Inc.**
48. Byhalia, Mississippi
49. Grand Forks, British Columbia
50. Milton, Ontario

**Thermafiber, Inc.**
51. Wabash, IN

**USG Interiors, LLC**
52. Red Wing, MN
53. Walworth, WI




A close look at the map of fiber glass manufacturing capacity in North America effectively illustrates why fiber glass companies should be afforded 100 percent assistance factors for the third compliance period and all compliance periods beyond 2020. NAIMA again points out two manufacturing plants right at California's border in Arizona. Two additional plants in Utah also could relatively easily take up the work of supplying the California market. There are also four insulation manufacturing plants in Western Canada.

The fiber glass insulation plants in the states bordering California are far more relevant to assessing the potential for leakage in this industry than 20 plants in Europe or 10 plants in Asia. If CARB is serious about preventing leakage from the State of California, it must carefully weigh the manufacturing potential, as illustrated on the above map of U.S. fiber glass and mineral wool insulation manufacturers. The presence of those 40-plus plants is the most effective argument for giving fiber glass plants 100 percent assistance factors for the third compliance period and beyond 2020.[2]

The fiber glass insulation industry in California does face some competition from plants in Canada and Mexico. There have also been some efforts by Chinese manufacturers to supply the U.S. market. However, the insulation produced was inferior to U.S.-produced product, and to date, China has not caught on as a source of supply for the U.S. market. A reduction of production in California could prompt a renewed effort on the part of Chinese manufacturers to supply this market. Aside from the economic impact of such a development, it could lead to even greater transportation-related greenhouse gas emissions in California and beyond.

NAIMA has analyzed the fiber glass insulation industry's capacity to compensate for any reduction in production or closure of one or more of California's fiber glass insulation manufacturing plants. Such reduction of production or plant closures could be likely triggered by the serious deleterious impacts from CARB's implementation of the proposed Cap-and-Trade Program.

First, to effectively assess the ability of North American fiber glass and mineral wool insulation manufacturers to satisfy any gap in the production of fiber glass insulation created by the closure of or reduction in output from California's fiber glass insulation plants, it is necessary to assess the current production of California manufacturing facilities.

The following chart identifies the number of fiber glass production lines available at the California fiber glass facilities:

| **Company** | **Plant Locations** | **Number of Lines** |
|---|---|---|
| CertainTeed | Chowchilla, CA | 2 |
| Johns Manville | Willows, CA | 2 |
| Knauf | Shasta Lake, CA | 1 |
| Owens Corning | Santa Clara, CA | 2 |

The cumulative potential production capacity for the four California plants is estimated at 519,743 tons of fiber per year.[3] The average utilization of this capacity in 2015 is estimated at 85 percent.

[2] It is acknowledged that not all of these plants could produce the specific products being currently manufactured in the California plants.
[3] It is important to realize that all the California plants can, to a certain extent, reduce production output without closing or shutting down an entire line.

The CertainTeed, Johns Manville, Knauf, and Owens Corning facilities are producing residential and commercial insulation products that are used throughout the United States.

If any of the California plants were to reduce production or close due to the increased regulatory burden from the Proposed Amendments, fiber glass production facilities operating in the western part of North America could increase their production to serve the California market. These plants currently produce residential and commercial insulation products that are largely equivalent to those manufactured at California plants; there is no reason why they would not be able to serve the California market if production costs became too high in California. In addition, as the chart below demonstrates, these western U.S. plants have sufficient capacity to meet the demands of its current market plus demands west of its operation:

| **Company** | **Plant Locations** | **Number of Lines** |
|---|---|---|
| CertainTeed | Redcliff, Alberta | 1 |
| Johns Manville | Innisfail, Alberta | 3 |
| Knauf | Kingman, AZ | 1 |
| Owens Corning | Eloy, AZ | 1 |
| Owens Corning | Nephi, UT | 2 |
| Owens Corning | Edmonton, Alberta | 2 |

The cumulative potential production capacity of these western North American manufacturing plants is estimated at 352,840 tons of fiber per year. The average utilization of this capacity in 2015 is estimated at 58 percent.

Many of these western North American manufacturers are currently underutilized because of the residential and commercial building downturn; therefore, these plants have existing capacity to help meet the increased demand occasioned by the reduced production or closure of one or more California plant. In addition, consistent with the westward migration of products described above, any challenge to meet market demands from these western manufacturing facilities could be met by those manufacturing in the middle region of the United States and Mexico:

| **Company** | **Plant Locations** | **Number of Lines** |
|---|---|---|
| CertainTeed | Kansas City, KS | 4 |
| Johns Manville | Cleburne, TX | 3 |
| Johns Manville | McPherson, KS | 2 |
| Johns Manville | Richmond, IN | 2 |
| Knauf | Albion, MI | 4 |
| Knauf | Shelbyville, IN | 6 |
| Owens Corning | Kansas City, KS | 3 |
| Owens Corning | Mexico City, Mexico | 1 |
| Owens Corning | Waxahachie, TX | 3 |

The cumulative potential production capacity of these middle North American manufacturing plants is estimated at 1,235,878 tons of fiber per year. The average utilization of this capacity in 2015 is estimated at 88 percent.

As these charts demonstrate, the further east on the U.S. map, the greater the fiber glass insulation capacity. As illustrated above, the number of plants and the capacity of those plants are significantly greater. These simple geographic facts demonstrate that the current manufacturing capacity within the United States can, with a slight shift westward, accommodate the market demands created by the closure of three of the four California plants.

To further illustrate this point and bring it home, consider the chart below that lists the eastern manufacturing plants that also have the ability to meet any market demands created by the closure of California plants and the demand placed on plants in closer proximity to the California market:

| **Company** | **Plant Locations** | **Number of Lines** |
|---|---|---|
| CertainTeed | Athens, GA | 3 |
| CertainTeed | Ottawa, Ontario | 3 |
| Johns Manville | Berlin, NJ | 1 |
| Johns Manville | Defiance, OH | 13 |
| Johns Manville | Winder, GA | 2 |
| Knauf | Inwood, WV | 2 |
| Knauf | Lanett, AL | 3 |
| Owens Corning | Delmar, NY | 2 |
| Owens Corning | Fairburn, GA | 3 |
| Owens Corning | Lakeland, FL | 2 |
| Owens Corning | Mount Vernon, OH | 3 |
| Owens Corning | Newark, OH | 3 |
| Owens Corning | Guelph, Ontario | 2 |

The cumulative potential production capacity of these eastern North American plants is estimated at 1,094,938 tons of fiber per year. The average utilization of this capacity in 2015 is estimated at 77 percent.

The total cumulative capacity[4] for North America is estimated at 3,203,399 tons of fiber per year. A significant volume of capacity for mineral wool (rock and slag wool) insulation is not represented in this number even though mineral wool can be substituted for fiber glass in many building insulation applications. It is estimated that mineral wool has cumulative capacity for North America of 258,700 tons per year. The total utilization of this capacity in 2015 is

[4] Specific facilities that produce fibers for the production of ceiling tiles, fire proofing products, or specialized insulation production – for example, automotive, aerospace, and battery separators – are not included in this total capacity calculation. This capacity specifically relates to building insulation in residential, commercial, and industrial applications.

estimated at 60 percent. The numbers speak for themselves, and it is plainly evident that any market gap caused by closure of California's plants could be quickly and easily satisfied by existing operations.

It is also worth noting that fiber glass insulation can readily be transported into California from other jurisdictions. Insulation can be shipped economically by truck or by rail (using intermodal trailers). It does not require any special infrastructure, and there are no hard and fast limits on shipping distances. In fact, some manufacturers have in the past and currently do ship products to Australia and Europe. Again, all out-of-state supplies, whether by rail, truck, or ship, would create additional transportation-related emissions in California and beyond.

The above series of charts tell a story of an industry and its ability to supply and meet the North American insulation market demands.

CONCLUSION

Again, NAIMA appreciates the opportunity to provide these suggestions to CARB. Implementation of the options set forth herein will increase the likelihood that NAIMA's companies could continue to operate in California. NAIMA is genuinely interested in having practical and feasible calculation methods that will enable NAIMA's members to continue to operate in California. NAIMA is willing to futher discuss these options in a face-to-face meeting or on a telephone conference.

Sincerely,

Angus E. Crane

Angus E. Crane
Executive Vice President, General Counsel

Enclosure

# Alternative Methods for Determining Assistance Factors

PREPARED FOR

North American Insulation Manufacturers Association

PREPARED BY

Marc Chupka

March 31, 2017

THE Brattle GROUP

This report was prepared for the North American Insulation Manufacturers Association. All results and any errors are the responsibility of the authors and do not represent the opinion of The Brattle Group or its clients.

*Acknowledgement:* We acknowledge the valuable contributions of many individuals to this report and to the underlying analysis, including members of The Brattle Group for peer review.

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# I. Introduction

On January 19, 2017, the North American Insulation Manufacturers Association (NAIMA) submitted comments to the California Air Resources Board (ARB) suggesting that ARB pursue alternative methods to calculate assistance factors (AFs) that determine the allocation of allowances to industries that are placed at a competitive disadvantage to domestic and international competitors when faced with higher energy prices in California. Following discussions with ARB staff, NAIMA asked The Brattle Group to address some of the ARB issues and to present alternative methods for determining AFs while (1) using the studies ARB commissioned for analyzing industry specific impacts and (2) preserving the use of ARB regression analysis that augmented those studies.[1] This report presents several alternative methods, which either reflect an initial version of the ARB AF calculation methodology (using maximum values instead of averages); the use of AF values directly from the studies for industries covered by the studies while using regression results for industries not covered in the studies; or the use of an alternative threshold for domestic "demand drop" calculations. All these methods are reasonable and consistent with the statutory mandate for minimizing leakage.

# II. Domestic and International Leakage Study Results and ARB Regression Analysis

In order to use the results from the domestic and international leakage studies, ARB constructed a regression methodology to augment the studies in order to construct Assistance Factors (AFs) for all industries.[2] The regressions extend the RFF and Berkeley studies' results in a way that enables ARB to:

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1 Resources for the Future (RFF) produced a study for CARB entitled *Employment and Output Leakage under California's Cap-and-Trade Program* (RFF Study or Domestic Study); Researchers at the University of California Berkeley, Northwestern University, and the University of Texas at Austin produced *Measuring Leakage Risk* (Berkeley Study or International Study).

2 Appendix E "Staff Report: Initial Statement of Reasons, Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-based Compliance Mechanisms Regulation: Emission Leakage Analysis" (August 2, 2016); "Cap and Trade Regulation Industry Assistance Factor Calculation Informal Staff Proposal" (October 21, 2016); and Attachment B "First Notice of Public Availability of 15-Day Amendment Text, Proposed Amendments to the California Cap on Greenhouse Gas Emissions

Continued on next page

- Incorporate non-market fuel use into the AF factor-setting equations
- Incorporate process emissions into the AF factor-setting equations
- Interpolate and extend the RFF and Berkeley study findings to derive AFs for sectors not covered in those analyses

These capabilities are essential tools for completing the full slate of AFs for all industries. *However, the manner in which ARB uses this methodology also alters the AFs from industries that are covered in the domestic and international leakage studies*. The modified AFs from studied sectors have identifiable biases compared with AFs derived directly from the studies, biases that render the resulting AFs inconsistent with the mandate to minimize leakage to the extent feasible. Fortunately, there are a simple ways to correct this flaw, in fact one based on a method that ARB initially proposed in the August 2, 2016 notice.

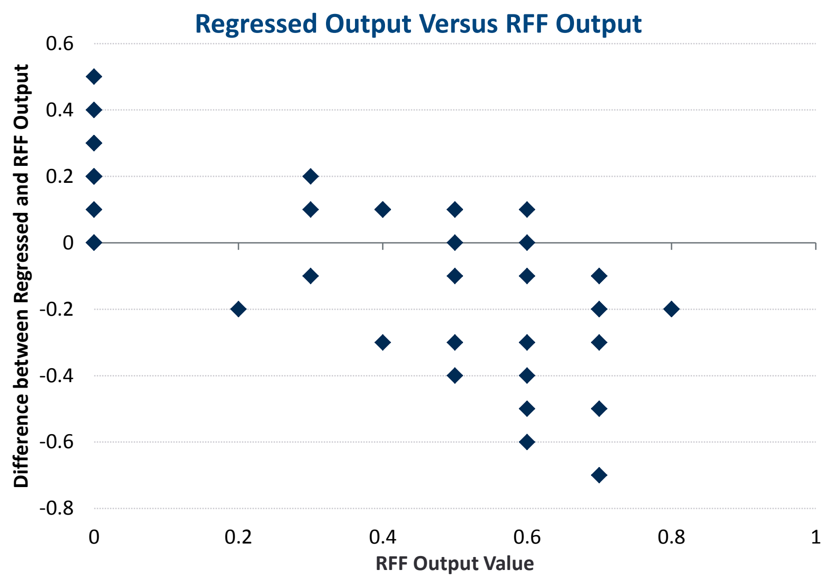
## A. DOMESTIC LEAKAGE REGRESSIONS

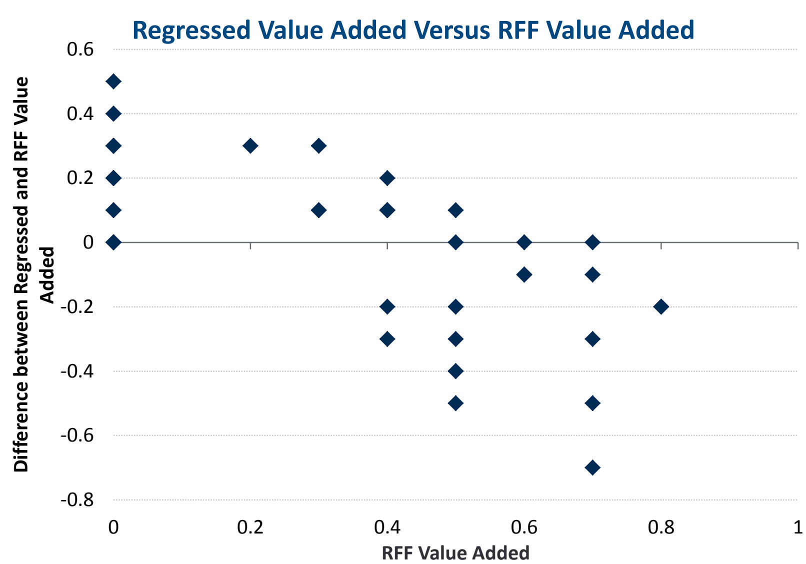
ARB staff has proposed a methodology to convert the RFF findings into the Domestic Assistance Factor (AF) component of the overall AF measure. The method uses the results from the RFF study as data for additional regression analysis. Compared with the results of the RFF studies, the regressions limit the range of AFs through a process of reducing higher AFs and increasing lower AFs estimated by RFF findings.

In fact, the changes are quite pronounced, with 17 out of 49 (35%) of the changes of 0.3 or more in magnitude (both positive and negative changes counted). The figures below show the direction of changes from the original RFF AFs to the regression AFs, both for Output (value of shipments) and Value Added:

Continued from previous page

and Market-based Compliance Mechanisms Regulation: Post-2020 Industry Assistance Factor Calculations" (December 21, 2016).

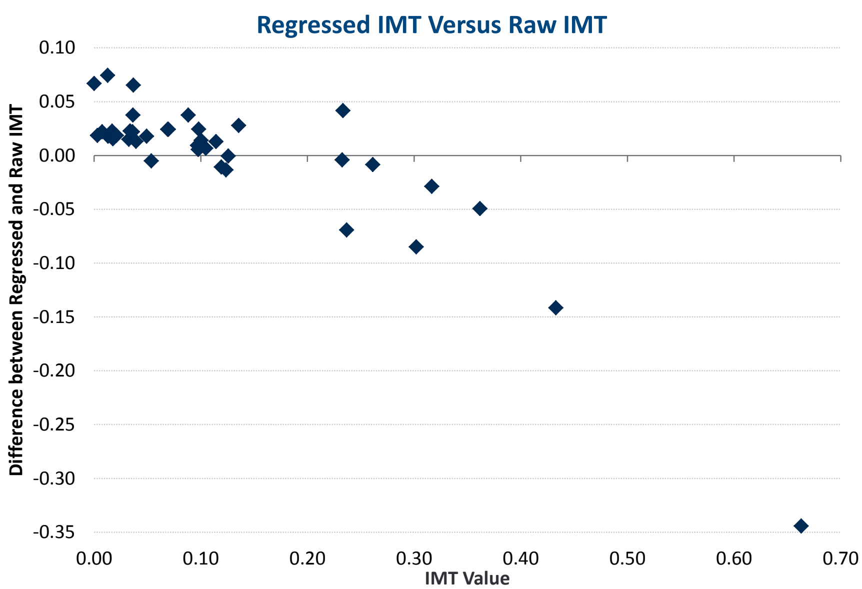



The figures show that for low AF values derived from the RFF study, the regressed values are higher, while for high values of the AF values derived from the RFF study the regressed values are lower. There is no rationale for this leveling of assistance factors from the standpoint of minimizing leakage, which is inherently discriminatory across industries that have varying degrees of vulnerability. That some sectors get zero assistance factors while others get 100% may in fact be the most efficient allocation of allowances to minimize leakage.

### B. INTERNATIONAL LEAKAGE REGRESSIONS

ARB conducts a similar extension of the Berkeley International Analysis, namely creating an alternative regression IMT (International Market Transfer) coefficient based on altering outlier coefficients and then using the original coefficients as data in other regressions that used sectoral data on energy intensity and trade exposure. Again, no genuine motivation is offered except citing some stakeholder concerns about the validity of industry level findings – and a desire to homogenize outcomes to reduce the inter-industry range of IMT values.




As in the case with domestic AFs, the additional of international regression IMTs (which ARB takes as equivalent to the international component of AF) serve to increase the AF of sectors with low AFs and decrease the AF of sectors with higher AFs.

## III. Implications of ARB Regressions in Setting AFs for Studied Sectors

It is reasonable for ARB to utilize the regression analysis for the purposes of extending the leakage study results to non-market fuels, process emissions and non-studied sectors. However, ARB also uses these regression results as a source of alternative AFs for sectors already covered in the leakage studies, and then takes the average between the AFs derived directly from the study results and the AFs produces by the ARB regression analyses. This creates a bias away from the underlying studies, one that boosts the AFs of those sectors which the studies found to have little or no leakage risk while curtailing the AFs for those sectors that the studies identified as having maximum risk of leakage. When ARB averages the regression AFs with the AFs derived directly from the studies, this bias is preserved. ARB offers no substantive rationale for modifying the AFs that are derived directly from the studies.

According to the 12/21/2016 document "Staff remains open to alternate methodologies that utilize the results from the leakage studies." (p. 3). There are two general ways to cure the above defect, both of which are consistent with the statutory obligation of ARB and the appropriate utilization of the leakage studies.

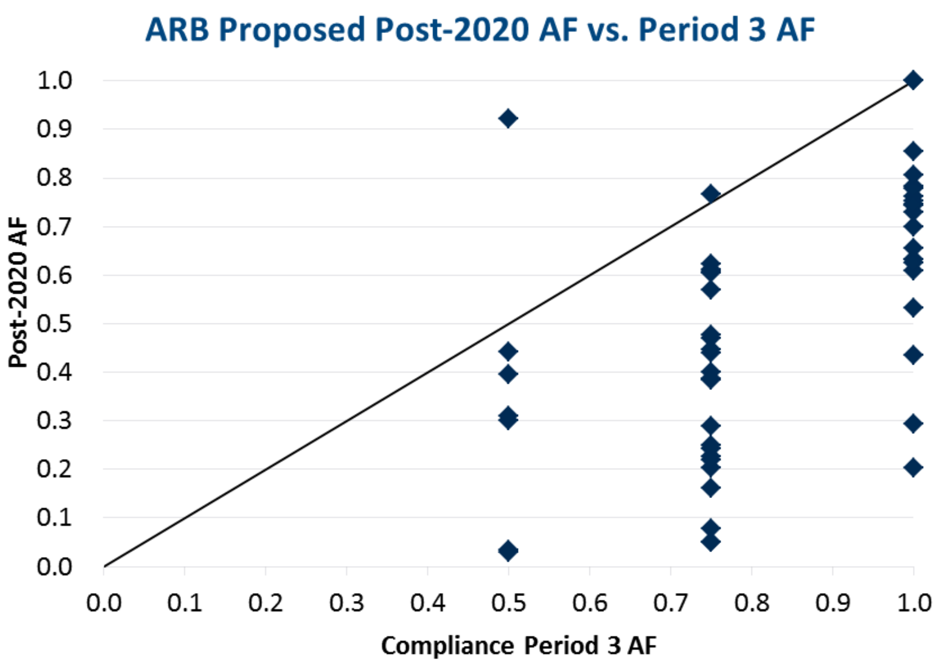
- The first option would be to not utilize the ARB regression results for those sectors covered by the studies. This would mean that those sectors covered by the studies would use the AFs derived from the studies alone. Thus, for the international component the "Raw IMT" variable would provide the AF. For the domestic component there could be two alternatives: the AFs could be based upon the average demand drop from the output and value added metrics or the maximum value of the two. One drawback to this method could arise from the fact that the adjustment for non-purchased fuel occurs only in the AFs derived in the ARB regression analysis. However, the ARB could derive a comparable adjustment in those cases from the ratios of regression derived AFs with and without the non-purchased fuel adjustments. This would provide a reasonable proxy for non-purchased fuels effects in the study regression results.

- The second option would be to use the maximum (instead of average) value of domestic and international AF values across the alternatives including the ARB regressions, then adding the components together for a total AF. This algorithm was initially suggested in the original proposal (8/2/16) but that was subsequently changed in the next version (10/21/16) and in the last version (12/21/16). This change was never explained nor justified. However, the original proposal reflected a stronger policy to counteract leakage risk.

## IV. Examining Alternative AF Algorithms Using the Results of Leakage Studies

The options outlined above would modestly increase the AFs for those industries most exposed to leakage compared to the methodology that ARB currently proposes for utilizing the leakage studies. The first option(s) would slightly reduce those AFs for industries that are not prone to leakage according to the studies as the averaging method in the current proposal raises these AFs as a function of including the regression AFs into the averaging formula.

In order to examine the effect of these options, we have modified the Excel file that ARB provided to present its overall analysis ("post-2020-af.xlxs"). All of the data needed to explore these alternative methods of using the studies appear on "results" tab worksheet. As an initial exhibit, we look at the relationship between compliance period 3 assistance factors (column D) and the ARB proposed post 2020 assistance factors (column E). The scatterplot of the two is shown below, and shows the overall substantial decline in assistance factors post 2020.



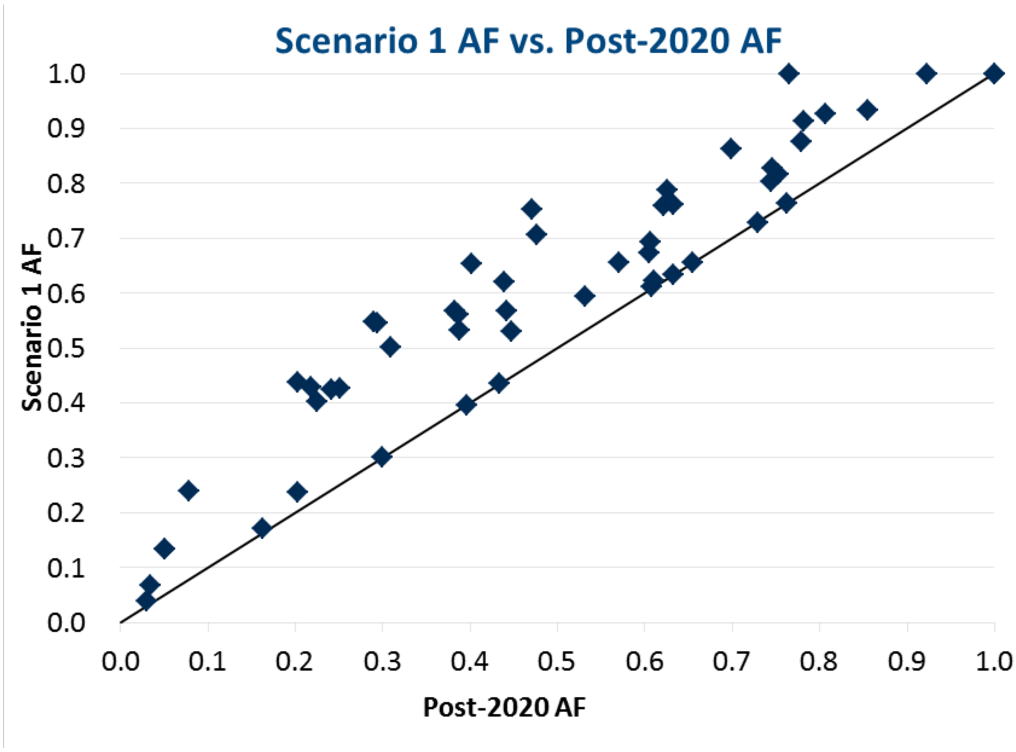

The table below displays the results of three alternative different AFs on all sectors. For sectors not covered by the international or domestic study, the three alternative AFs are identical to the post-2020 AF in the ARB proposal. In all cases where the sum of the domestic and international AF component was greater than 1.0 the resulting value was truncated at 1.0, i.e., a 100% AF.

- Scenario 1 is the sum of (a) the maximum of four domestic and (b) maximum of two international AF values from the ARB studies and the ARB regression results.
- Scenario 2 uses the "raw IMT" score for international AF the maximum of the output and value added domestic AF scores (regression results excluded).
- Scenario 3 uses the "raw IMT" score for international AF the average of the output and value added domestic AF scores (regression results excluded).

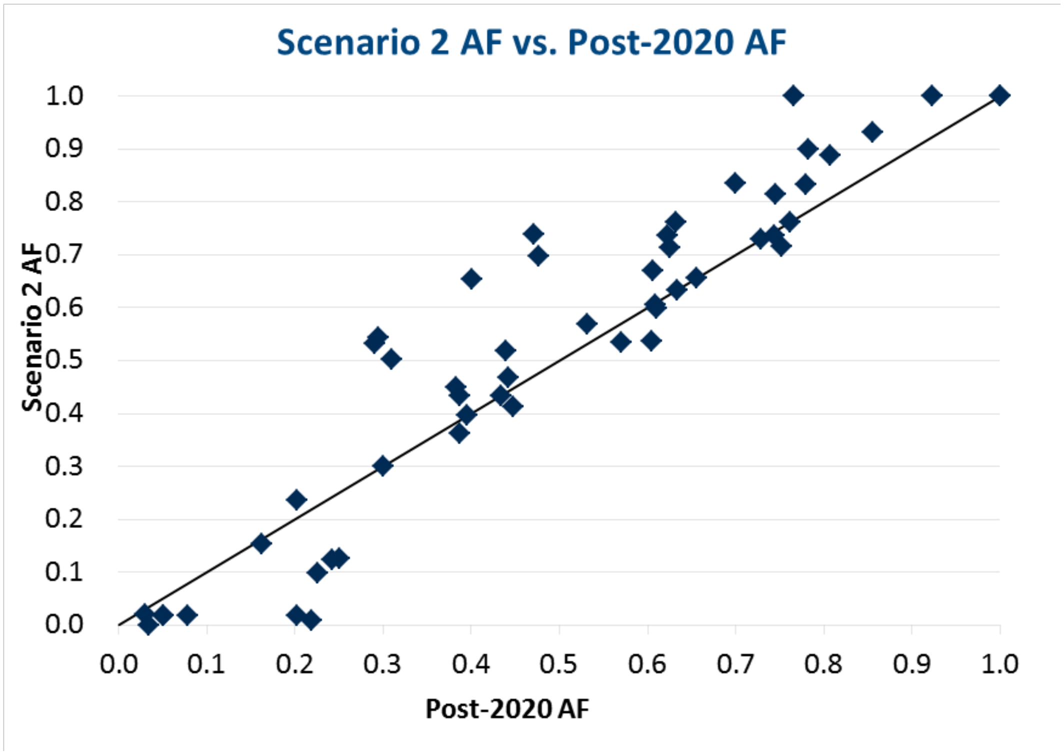
| NAICS Sector Definition | NAICS Code | Compliance Period 3 AF | Post-2020 AF | Scenario 1 AF | Scenario 2 AF | Scenario 3 AF |
|---|---|---|---|---|---|---|
| Support Activities for Air Transportation | 4881 | 0.50 | 0.30 | 0.30 | 0.30 | 0.30 |
| Crude Petroleum and Natural Gas Extraction | 211111 | 1.00 | 0.76 | 0.76 | 0.76 | 0.76 |
| Natural Gas Liquid Extraction | 211112 | 1.00 | 0.43 | 0.43 | 0.43 | 0.43 |
| All Other Metal Ore Mining | 212299 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Borate Mining | 212391 | 1.00 | 0.63 | 0.63 | 0.63 | 0.63 |
| Potash and Soda Ash Mining | 212391.1 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| All Other Nonmetallic Mineral Mining | 212399 | 1.00 | 0.66 | 0.66 | 0.66 | 0.66 |
| Wet Corn Milling | 311221 | 1.00 | 0.61 | 0.61 | 0.60 | 0.60 |
| Beet Sugar Manufacturing | 311313 | 0.75 | 0.61 | 0.62 | 0.60 | 0.60 |
| Fruit and Vegetable Canning | 311421 | 0.75 | 0.25 | 0.43 | 0.13 | 0.13 |
| Dried and Dehydrated Food Manufacturing | 311423 | 0.75 | 0.23 | 0.40 | 0.10 | 0.10 |
| Fluid Milk Manufacturing | 311511 | 0.75 | 0.16 | 0.17 | 0.15 | 0.15 |
| Creamery Butter Manufacturing | 311512 | 0.75 | 0.40 | 0.65 | 0.65 | 0.60 |
| Cheese Manufacturing | 311513 | 0.75 | 0.08 | 0.24 | 0.02 | 0.02 |
| Dry, Condensed, and Evaporated Dairy Product Manufacturing | 311514 | 0.75 | 0.24 | 0.42 | 0.12 | 0.12 |
| Poultry Processing | 311615 | 0.75 | 0.47 | 0.75 | 0.74 | 0.74 |
| Roasted Nuts and Peanut Butter Manufacturing | 311911 | 0.75 | 0.29 | 0.55 | 0.53 | 0.48 |
| Other Snack Food Manufacturing | 311919 | 0.75 | 0.05 | 0.13 | 0.02 | 0.02 |
| Snack Food Manufacturing | 311919 | 0.75 | 0.05 | 0.13 | 0.02 | 0.02 |
| Breweries | 312120 | 0.75 | 0.48 | 0.71 | 0.70 | 0.65 |
| Wineries | 312130 | 0.75 | 0.20 | 0.24 | 0.24 | 0.24 |
| Paper (except Newsprint) Mills | 322121 | 1.00 | 0.53 | 0.59 | 0.57 | 0.52 |
| Paperboard Mills | 322130 | 1.00 | 0.78 | 0.91 | 0.90 | 0.90 |
| Petroleum Refineries | 324110 | 0.75 | 0.44 | 0.62 | 0.52 | 0.32 |
| Asphalt Paving Mixture and Block Manufacturing | 324121 | 0.75 | 0.22 | 0.43 | 0.01 | 0.01 |
| All Other Petroleum and Coal Products Manufacturing | 324199 | 1.00 | 0.29 | 0.54 | 0.54 | 0.49 |
| Industrial Gas Manufacturing | 325120 | 0.75 | 0.61 | 0.67 | 0.54 | 0.54 |
| All Other Basic Inorganic Chemical Manufacturing | 325188 | 1.00 | 0.75 | 0.82 | 0.72 | 0.72 |
| Ethyl Alcohol Manufacturing | 325193 | 0.75 | 0.62 | 0.76 | 0.74 | 0.69 |
| Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufactu | 325194 | 1.00 | 0.73 | 0.73 | 0.73 | 0.73 |
| All Other Basic Organic Chemical Manufacturing | 325199 | 1.00 | 0.63 | 0.76 | 0.76 | 0.66 |
| Nitrogenous Fertilizer Manufacturing | 325311 | 1.00 | 0.78 | 0.88 | 0.83 | 0.68 |
| Pharmaceutical and Medicine Manufacturing | 325412 | 0.50 | 0.31 | 0.50 | 0.50 | 0.40 |
| Biological Product (Except Diagnostic) Manufacturing | 325414 | 0.75 | 0.39 | 0.53 | 0.43 | 0.43 |
| Flat Glass Manufacturing | 327211 | 1.00 | 0.86 | 0.93 | 0.93 | 0.88 |
| Glass Container Manufacturing | 327213 | 1.00 | 0.81 | 0.93 | 0.89 | 0.89 |
| Cement Manufacturing | 327310 | 1.00 | 0.74 | 0.80 | 0.74 | 0.69 |
| Lime Manufacturing | 327410 | 1.00 | 0.62 | 0.79 | 0.71 | 0.66 |
| Gypsum Product Manufacturing | 327420 | 0.75 | 0.57 | 0.66 | 0.53 | 0.48 |
| Mineral Wool Manufacturing | 327993 | 1.00 | 0.75 | 0.83 | 0.81 | 0.81 |
| Iron and Steel Mills | 331111 | 1.00 | 0.70 | 0.86 | 0.84 | 0.84 |
| Rolled Steel Shape Manufacturing | 331221 | 1.00 | 0.20 | 0.44 | 0.02 | 0.02 |
| Secondary Smelting and Alloying of Aluminum | 331314 | 0.75 | 0.45 | 0.53 | 0.41 | 0.36 |
| Secondary Smelting, Refining, and Alloying of Nonferrous Metal (Exc | 331492 | 0.75 | 0.38 | 0.57 | 0.45 | 0.25 |
| Iron Foundries | 331511 | 0.75 | 0.61 | 0.69 | 0.67 | 0.67 |
| Nonferrous Forging | 332112 | 0.50 | 0.44 | 0.57 | 0.47 | 0.37 |
| Hardware Manufacturing | 332510 | 0.75 | 0.39 | 0.56 | 0.36 | 0.36 |
| Turbine and Turbine Generator Set Units Manufacturing | 333611 | 0.75 | 0.77 | 1.00 | 1.00 | 1.00 |
| Automobile Manufacturing | 336111 | 0.50 | 0.92 | 1.00 | 1.00 | 1.00 |
| Other Motor Vehicle Parts Manufacturing | 336390 | 0.50 | 0.40 | 0.40 | 0.40 | 0.40 |
| Aircraft Manufacturing | 336411 | 0.50 | 0.03 | 0.07 | 0.00 | 0.00 |
| Guided Missile and Space Vehicle Manufacturing | 336414 | 0.50 | 0.03 | 0.04 | 0.02 | 0.02 |

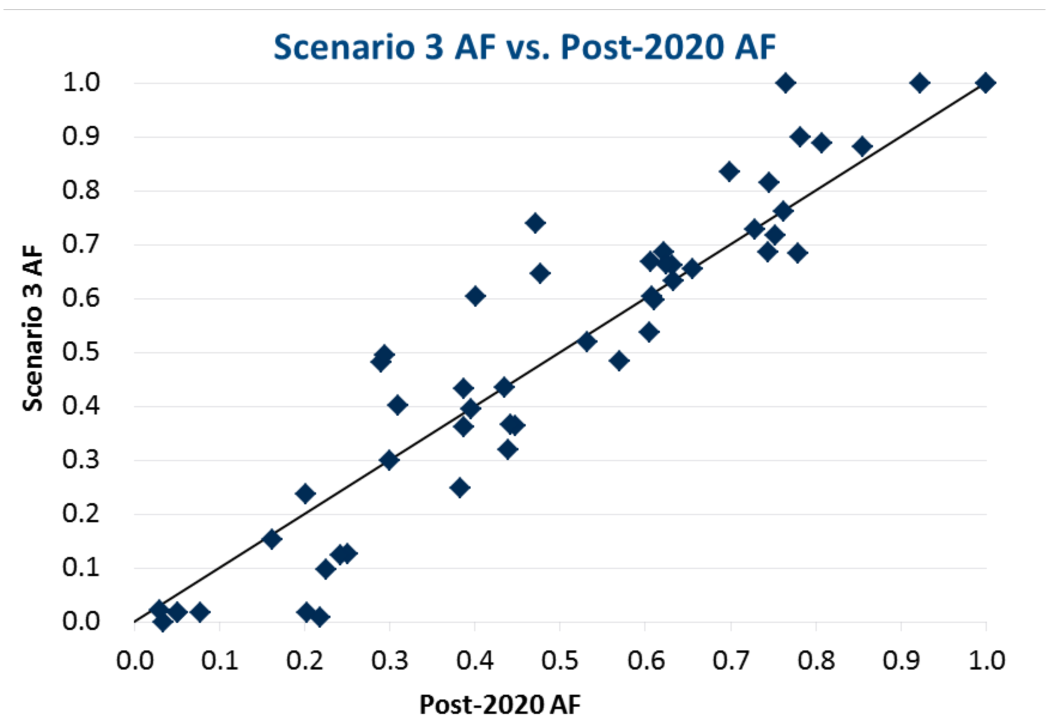
Notes:
Scenario 1: Max of international components + max of domestic components
Scenario 2: raw international + max of domestic components (excluding regressed)
Scenario 3: raw international + average of domestic components (excluding regressed)

These alternative algorithms for determining assistance factors differ slightly from the post-2020 AFs proposed by CARB, primarily higher although not every sector in every case. In Scenario 1 all AFs are either slightly higher or equal to the proposed post-2020 values, as shown in the scatterplot below:




Scenario 2 and Scenario 3 are very similar, with most AFs higher and some AFs lower than in the post 2020 AFs proposed by ARB, with the lower AFs primarily in range of small AF values (e.g. AF < 0.3). These are shown in the graphs below:




Any of these alternative algorithms would produce AFs that reflect the RFF and Berkeley studies more faithfully for those sectors that are considered in those studies, and still enable the ARB to use the regression analysis to augment the studies' results to extend to non-covered sectors and non-purchased fuels.

## V. The Arbitrary Demand Drop Threshold

The ARB analysis of the domestic leakage component uses a cutoff threshold for output or value added reductions to derive decile values of AFs. This step produces different values across industries and is necessary because eliminating domestic drop altogether from all industries would require 100% AFs in all cases because of the structure of the demand drop coefficients, which are interpolated between the coefficients derived from the RFF study (implicitly assuming zero AFs and zero demand drop which is by construction at 100% AF). ARB posits a threshold of acceptable declines in output, namely 7 percent, based on an analysis of representative annual declines in output across the sectors (see p. 14-15 12/21 document). ARB also scales this 7% factor to 8.954% to account for different price years (the ratio of 2030 to 2025 auction reserve price used in the SRIA analysis).

It is worth noting that the motivation for that threshold contradicts the underlying estimation methodology; the RFF regression coefficients theoretically hold other causes of output decline constant:

> *This section describes how we use the estimated coefficients from our main statistical analysis to simulate the short- and long-run effects of imposing a GHG compliance cost on California plants in the estimation sample….Importantly for the simulations, the regressions include year-fixed effects, which hold fixed national output, value added, and employment. Therefore, in the simulations, we hold these outcomes fixed at their actual levels in 2009. That is, the simulations allow us to characterize the extent to which a GHG compliance cost only on California plants may cause manufacturing activity to shift from California to other states, under the assumption that national activity is unaffected.*[3]

The rationale for adopting 7% as a cutoff is not explained in a way that provides a valid foundation for the choice. Apparently, it represents a representative "bad" year-on-year change in all industrial output for macroeconomic reasons. But, since the RFF regressions presumably isolate the impact of leakage only, this implicitly suggests that ARB believes that 7% reduction in

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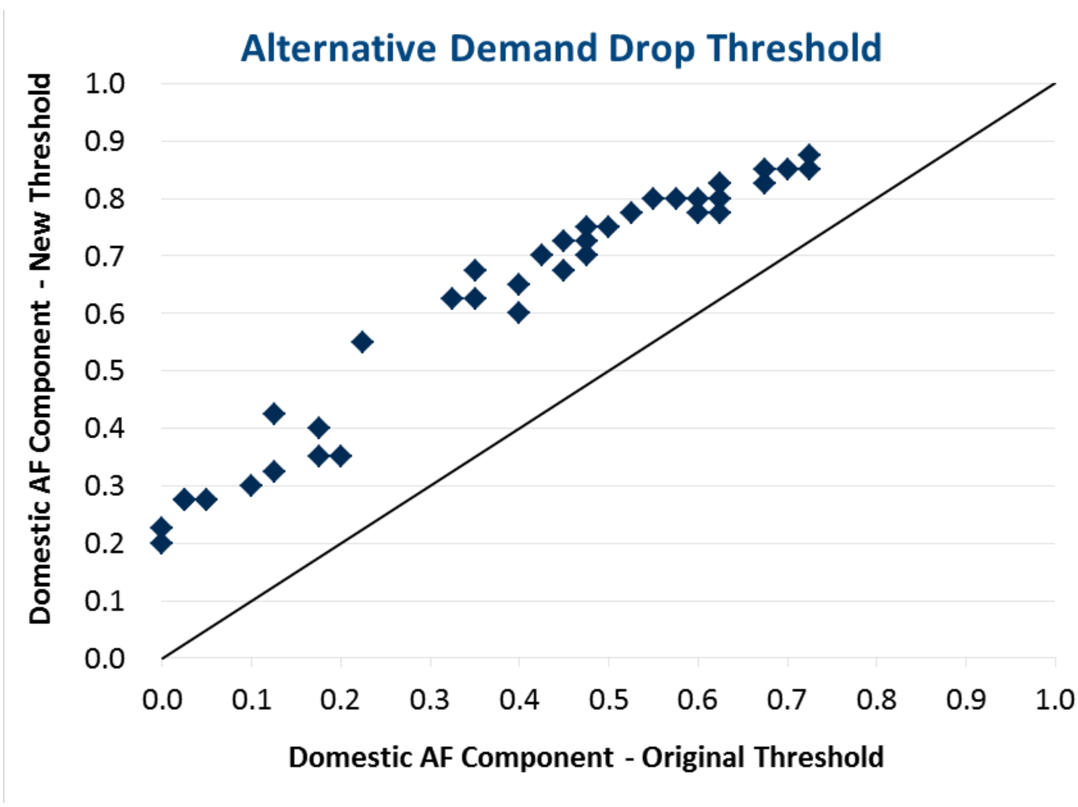
3 RFF Study p. 15.

output is an acceptable level of leakage. How that squares with the AB32 direction "to minimize leakage to the extent feasible" is never explained, nor is any theoretical or conceptual basis offered. It's just an average drop in industrial output attributed to reasons that have nothing to do with leakage, and thus is completely arbitrary.

Regardless of the weak motivation for selecting the threshold of 8.954% in its analysis, however, a uniform threshold represents a fairly straightforward way to assign different AF values across industries, in a way that may at least approximate a distribution of AFs that would minimize leakage. In order to illustrate the impact on ARB domestic AF component from changing the assumed threshold, we reduce the threshold by 50% and retain the same averaging technique across the four calculated AFs in the latest ARB proposal. As expected, this change increases all calculated domestic AF values relative to the proposed values, but with some variation owing to the decile selection algorithm. The changes are illustrated in the graph below.




Given the lack of foundation for the threshold selected by ARB, it would be reasonable to select a lower value in order to minimize leakage to the extent feasible. Alternatively, ARB could examine other bases for setting the threshold in order to determine if a lower threshold was appropriate.

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