CLIMATE CHANGE REGULATIONS

FORM OF THE STANDARD

1. BACKGROUND

Assembly Bill 1493 requires the ARB to adopt regulations that achieve the maximum feasible and cost-effective reduction of climate change emissions from passenger vehicles, light-duty trucks, and other vehicles used for noncommercial personal transportation in California.

It is estimated that passenger vehicles and light-duty trucks are responsible for about forty percent of the total climate change emissions in the state. The control and reduction of climate change emissions are critical to slow the effects of global warming, which is a matter of increasing concern for public health and the environment within the state.

The regulations prescribed by Assembly Bill 1493 must be adopted by January 1, 2005, and may not take effect before January 1, 2006. The regulations would apply to 2009 and later model year vehicles.

According to the bill, the regulations must:

- Consider technological feasibility;
- Take into account impact on the economy of the state;
- Provide flexibility to the maximum extent feasible and consistent with the bill;
- Grant credits for early emission reductions; and
- Undergo a legislative review process.

The bill stipulates that the regulations can not:

- Impose additional fees or taxes on any motor vehicle, fuel, or vehicle miles traveled;
- Ban the sale of any vehicle category, including, but not limited to, sport utility vehicles and light-duty trucks;
- Require a reduction in vehicle weight;
- Limit or reduce the speed limit on any street or highway; nor
- Limit or require a reduction in vehicle miles traveled.

This paper presents options and possible approaches regarding the climate change emission standards, early reduction credits, and upstream emissions.

2. CLIMATE CHANGE EMISSION STANDARDS

2.1 Details Concerning the Standards

Under the bill, the climate change emissions subject to regulation are identified in subdivision (g) of Section 42801.1 of the California Health and Safety Code, and include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride[1]. Particulate emissions are not included.

Our current thinking is that emission limits should be expressed on a CO_2-equivalent basis. To accomplish this, emissions from each climate change gas would be multiplied by its corresponding GWP (global warming potential relative to carbon dioxide), and then summed to yield CO_2-equivalent emissions. The GWPs would be identified at a later time and are not critical to the discussion at hand.

2.2 Evaluating the Most Suitable Form of the Standard

Before establishing the emission standards, it is critical to evaluate the most effective approach. There are many considerations to factor into such a discussion, and some basic thoughts on the approach are expressed below:

- Should yield real and significant emission reductions;
- Should not seek to restrict manufacturers' product offerings;
- Should not appropriate to penalize manufacturers presently using innovative technology;
- Should be equitable across manufacturers;
- Work trucks should be treated appropriately, as specified within the bill;
- The standard should be compatible with an effective emission credit plan; and
- Should take into account the unique technology strategies that would be required to reduce CO_2-equivalent emissions.

[1] Perfluorocarbons and sodium hexafluoride are associated with stationary sources and are not expected emissions from motor vehicles.

2.3 Possible Approaches for the Standards

A discussion follows for several approaches under consideration.

2.3.1 Manufacturer-Specific Standards

Under this approach, either the same percent or same magnitude of emission reductions would be applied to each manufacturer's baseline level.

Advantage:

- Ensures near-term emission reductions from each manufacturer.

Disadvantages:

- This approach could favor manufacturers lagging in technology that have invested less towards reducing climate change emissions since they would be able to pursue the easier, less expensive reductions relative to manufacturers that have already invested in advanced technology; and
- A manufacturer not selling a full range of products would be limited in its ability to expand its product line into larger vehicles that tend to emit more CO_2-equivalent emissions, placing that manufacturer at a competitive disadvantage.

2.3.2 Attribute-Based Standards

In this approach, allowable CO_2-equivalent emissions would be based on the magnitude of a particular attribute. The selected attribute should correlate well with CO_2-equivalent emissions. Some attributes that have been considered are wheelbase*track width, total interior volume, carrying capacity, horsepower, and weight.

An attribute-based standard could be represented by a continuous line function showing CO_2-equivalent emissions versus the selected vehicle attribute. Vehicles with a higher magnitude of the selected attribute would be allowed to emit more CO_2-equivalent emissions.

Advantage:

- If the correlation between emissions and the selected attribute is strong fleetwide, the correlation can be used to establish emission standards that are equitable for vehicles across the spectrum of attribute values.

Disadvantages:

- For most attributes, except weight, there is currently either insufficient data, or only a limited correlation between these attributes and CO_2-equivalent emissions.

- For attributes with only a limited correlation to CO_2-equivalent emissions, such as size, vehicle classes would need to be created to improve the correlation. Attempts to properly classify vehicles in other regulations have been difficult due to uncertainties (e.g. how to classify crossover vehicles); and
- Yields climate change emissions that are less predictable than with other approaches because the emissions are dependent on attribute values that will vary from vehicle to vehicle and with time.

2.3.3 Uniform Fleet Average Standard

Under this approach, the same fleet average standard (e.g. grams of CO_2-equivalents per mile) would apply to each manufacturer.

Advantages:

- Simple implementation.
- Yields predictable climate change emission reductions.

Disadvantages:

- Not all vehicle manufacturers have the same mix of vehicle types, so setting a single value for the standard might not be equitable to all;
- This approach favors manufacturers with a greater proportion of lighter and/or lower-emitting vehicles in their fleet, and would not provide as strong an incentive for these manufacturers to improve their products as would other approaches; and
- Because the standard would be based on the current fleet mix, it could limit the mix of future vehicle fleets.

2.3.4 Fleet Average with Incremental Caps

Variations can be made to the uniform fleet average standard to address disadvantages to the approach. For instance, caps could be established to limit the incremental emission reductions that would be required of any single manufacturer until the uniform fleet average standard is met. Many permutations can be obtained from this type of variation. Caps could be expressed as limits on the percent reduction from each manufacturer's baseline level, or could be established as limits on the magnitude of reduction. Caps could limit required incremental reductions on an annual basis, or could be applied over multiple years.

Advantages:

- Takes into account the different starting points for different automotive manufacturers, ensuring that the required rate of reduction will be

reasonable for each manufacturer; and

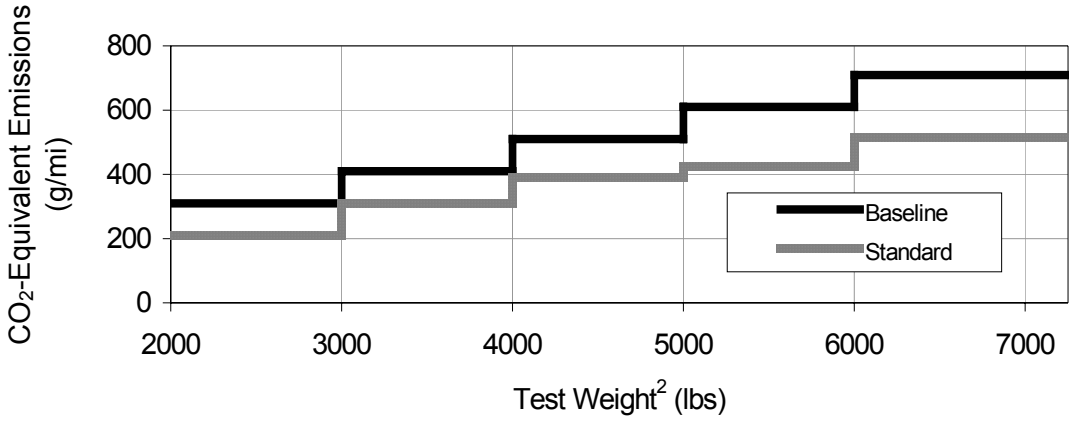
- Yields predictable climate change emission reductions.

Disadvantages:

- Same as for the Uniform Fleet Average Standard.

2.3.5 Segmented Fleet Average Approach

A segmented fleet average is another possible variation to the fleet average standard. Under this approach, vehicle fleets are averaged in a multiple segment setting, as depicted in the example shown below.



Please note that the specific values shown are for illustration only, and do not represent actual proposed levels.

Because there is a strong correlation between CO_2-equivalent emissions and vehicle weight[3], the figure shows emission standards for five vehicle weight segments that are established based on cost effectiveness and technological feasibility. Greater emission reductions would be required from heavier vehicles because it is more cost-effective to obtain reductions from these vehicles.

Advantages:

- Would require an improvement in CO_2-equivalent emissions through technology advancement, and not by limiting vehicle attributes that are desired by consumers; and
- Would not limit product availability. Instead, it produces the best vehicles within each segment.

[2] Test weight as defined in Title 40 of the Code of Federal Regulations, §86.129-94. This coincides with ARB vehicle tailpipe testing for other criteria pollutants.
[3] Based on emissions data derived by ARB from information provided by our consultant.

Disadvantages:

- Yields climate change emission reductions that are less predictable than with other approaches, because the emissions are dependent on vehicle weight which will vary from vehicle to vehicle and with time;
- An incentive exists to increase vehicle weight as a means to obtain a less stringent standard. However, the incentive is greatly reduced by the segmented aspect of the approach; and
- A significant future shift in the vehicle fleet mix towards heavier vehicles (which have a larger allowance for emissions) could produce an overall increase in fleet CO_2-equivalent emissions.

2.3.6 Dual Fleet Average Approach

A dual fleet average is another possible variation to the fleet average standard. Under this approach, for example, ARB's LEVII[4] vehicle classifications could be used. One fleet average standard would apply to passenger cars and LDT1s, and another fleet average standard would apply to LDT2s.[5]

Advantages:

- Same as for the uniform fleet average standard

Disadvantages:

- Although less pronounced than with the uniform fleet average standard, setting standards for only two vehicle classes might not be equitable for all manufacturers, because not all have the same mix of vehicle types;
- This approach favors manufacturers with a greater proportion of lighter and/or lower-emitting vehicles in their fleet, and would not provide as strong an incentive for these manufacturers to improve their products as would other approaches; and
- Because the standard would be based on the current fleet mix, it could limit the mix of future vehicle fleets.

[4] LEVII - second stage of ARB's Low-Emission Vehicle regulations

[5] LDT1 - a light-truck with a loaded vehicle weight of 0 - 3,750 lbs.
LDT2 - a light-truck with a loaded vehicle weight of 3,751 lbs. to a gross vehicle weight of 8,500 lbs.

3. EARLY REDUCTION CREDITS

AB 1493 directs that emission reduction credits be granted for any reductions in greenhouse gas emissions from motor vehicles achieved prior to the operative date of the regulations. AB1493 also directs that model year 2000 be used to establish a baseline for calculating these credits. The following provides a discussion of several different early credit scenarios and the issues associated with implementing this element of the legislation.

3.1 Considerations

In providing early reduction credits, the program could reward automakers that have already made efforts to reduce climate change emissions and/or provide incentives for automakers who, once faced with a standard in 2009, reduce greenhouse gas emissions before implementation. Staff's goal is to develop an early credit program that meets these objectives without adversely impacting the introduction of technology that will achieve the greatest technically feasible and cost-effective emission reductions.

To keep the credit structure simple and flexible, ARB staff is leaning towards having the credits calculated in a manner consistent with the structure of the 2009 standard. Staff also plans to incorporate provisions within the program to ensure that the system is not "gamed". Finally, staff recognizes that the quantity of credits earned under the early credit provision will affect the "de facto" stringency of the proposed emission standard.

3.2 Credit Structure Options

The most fundamental question regarding an early credits program is whether to compare a manufacturer's pre-2009 reductions to the emissions of its own fleet or to the emissions of the industry as a whole. Staff has evaluated several different credit structures based on these two basic approaches.

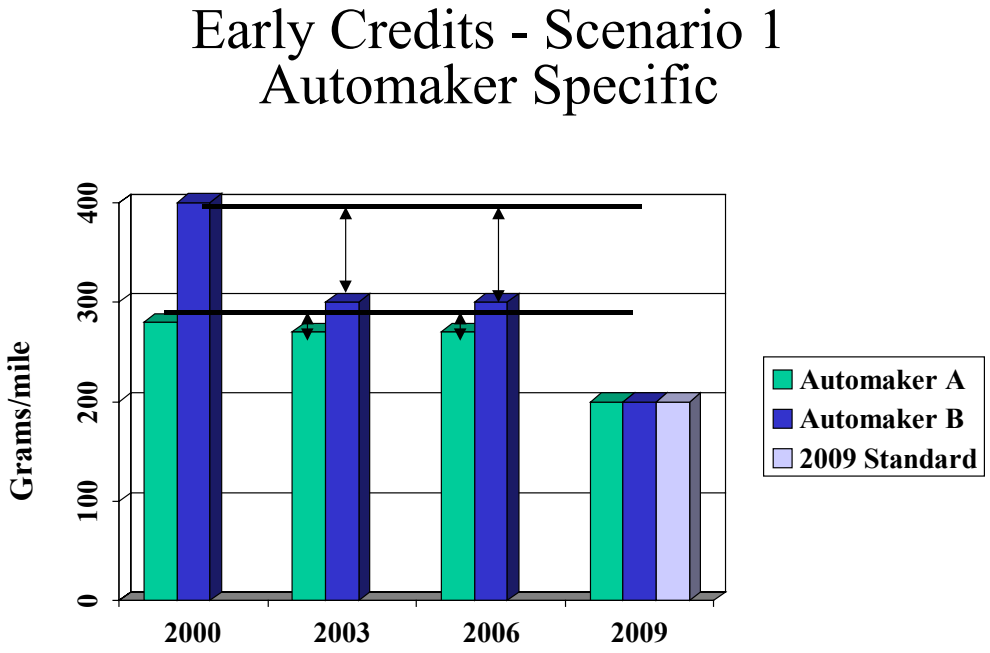
The charts below are intended to illustrate the relative credits for five different scenarios. All scenarios use the same set of fictitious emission data for two automakers that produce vehicles in a particular category. The differences in climate change emissions between automakers are assumed to be the result of both differing technology and differing vehicle attributes within the category.

ARB staff is now in the process of obtaining and refining actual model-year 2000 data to determine the magnitude of the early credits that would be earned under the various approaches. At this time, staff is seeking comment on the general approaches presented in the scenarios below.

Please note that the specific values shown on the following charts are for illustration only, and do not represent actual proposed levels.

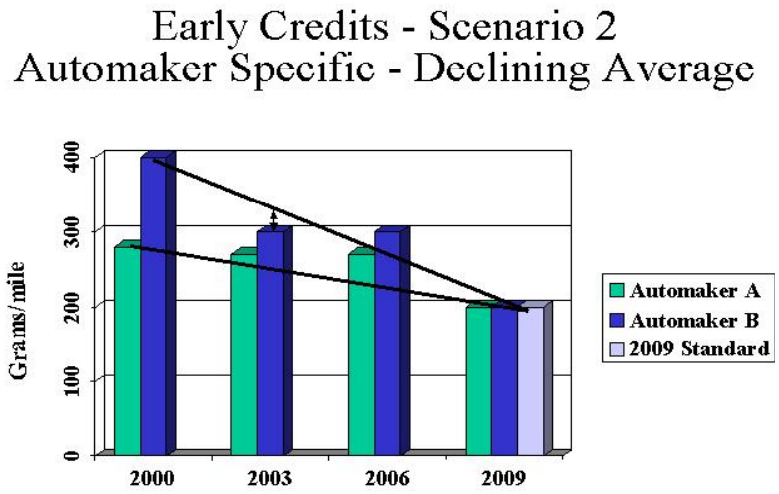
3.2.1 Early credits based on automaker-specific activity.

Scenario 1 illustrates a program that provides credits based on an automaker's own 2000 model year emissions. As shown, using this approach provides greater near-term credits for Automaker B even though it has higher emissions than Automaker A. This could disadvantage the best-performing automakers as improvements to their fleets may be incrementally more costly compared to companies that have not focused on climate change emission performance to date.



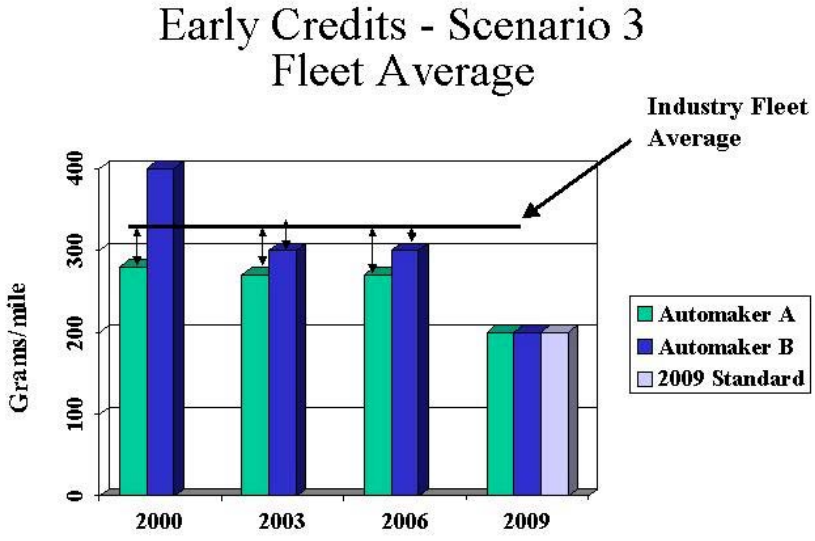
A second factor to consider is the slope of the credit-earning target. A "flat" target as shown in Scenario 1 holds the model year 2000 baseline constant as the benchmark against which improvements are assessed. As compared to the declining target method discussed below, this approach generates greater credit for the same vehicle performance and does not require continual improvement to earn credit prior to 2009.

Scenario 2 demonstrates a credit program based on automaker specific activity but with a declining target between 2000 and 2009. This approach only provides credit for improvements that go beyond the "trajectory" that would result in meeting the 2009 standard. This would tend to reduce the amount of early credit.

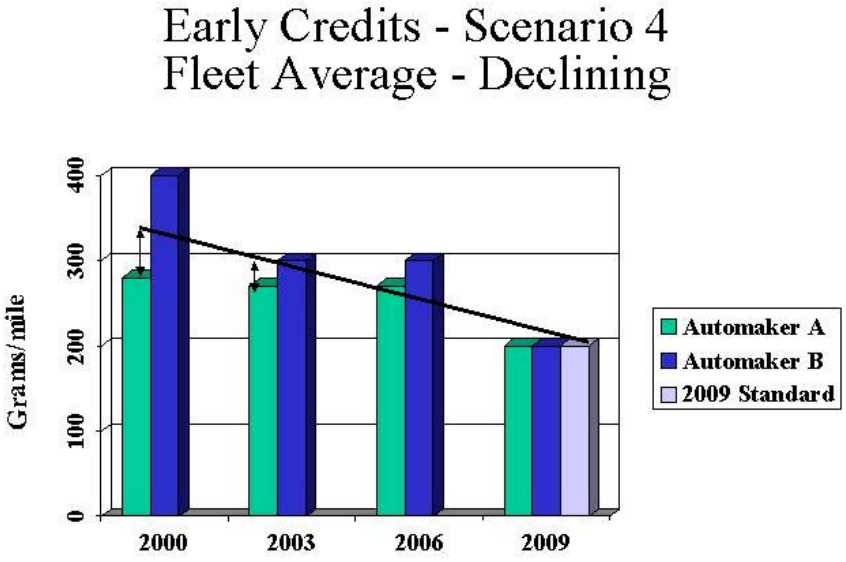


3.2.2 Early credits based on an industry average.

Scenario 3 demonstrates a program that provides credits relative to the industry average for model year 2000. As shown, automakers below the fleet average would earn credit for their relative emission advantage and not necessarily for specific efforts to reduce climate change emissions. This approach has potential for substantial accumulation of early credits even without additional effort on the part of automakers.

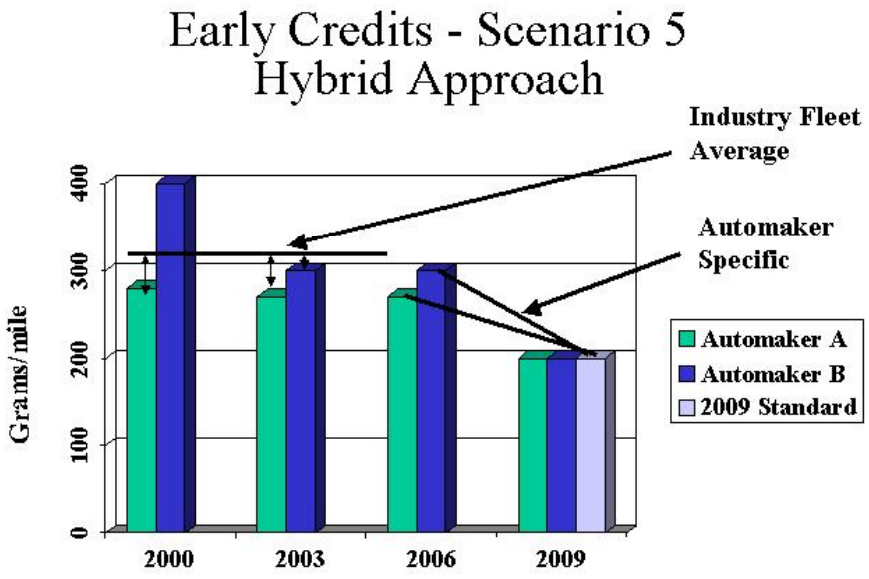


Scenario 4 depicts a program using the fleet average approach but with a declining average. As with Scenario 2, reducing the early emission target tends to keep automakers working toward the 2009 standard but reduces the amount of available early credit.



To illustrate the wide variety of possible early credit programs, staff has also developed a scenario that combines both an automaker-specific and industry average approach. As shown in Scenario 5, an automaker would receive credit based on its performance relative to the industry average through 2005. During this timeframe, credits would be provided for automakers already performing better than average.

During the 2006 to 2008 timeframe, however, early credits would be based on an automaker's performance relative to its own fleet. This would provide credits to manufacturers who introduce new emission reducing technologies in advance of the 2009 standards. In this scenario, the slope of the credit target in 2006 through 2008 would start at the projected level of emissions for the company had there been no climate change regulations and end in 2008 at the 2009 emission standard.



Discussion Items

1) Although there is value in rewarding credit for early action, staff is concerned that if these credits are too generous, the overall effectiveness of the 2009 standards may be compromised. To address this concern, should steps be taken such as capping the total credit that can be earned, discounting or expiring credits as they age, or limiting the use of credits for demonstration of compliance?

2) Early credits will be available for compliance. Should these credits be offset if an automaker exceeds the target level in a later year but before 2009 (e.g. in Scenario 2, Automaker B earns credit in 2003 but is over the target level in 2006)? The benefit of including deficits is that it provides a more complete picture and rewards automaker activities proceeding 2009.

4. UPSTREAM CLIMATE CHANGE EMISSIONS

This section discusses staff's efforts to include upstream or fuel cycle emissions as part of the climate change emission program. There are two reasons for addressing these emissions as part of this regulation. First, accounting for upstream emissions is necessary to provide an appropriate relative climate change treatment for alternative fuel vehicles that have upstream emissions that are substantially different than gasoline. Second, quantifying these emissions is necessary to ensure that alternative methods of compliance result in the equal or improved overall emission impact.

4.1 Considerations

Unlike other ARB vehicle regulations that are designed to reduce urban ozone precursor emissions, the intent of this regulation is to reduce climate change emissions that are global, not local. As a result, staff believes that it is appropriate to include upstream emissions as part of the vehicle regulation instead of treating upstream emissions in a separate regulatory system.

To emphasize the relative importance of upstream emissions, considering only tailpipe emissions from vehicles using gasoline would result in undercounting total well to wheels emissions by approximately 22 percent. And in the case of hydrogen fuel cell vehicles, considering only tailpipe emissions would neglect 100 percent of the total well to wheels emissions.

4.2 Initial Direction

4.2.1 Alternative Fuels

Staff's current thinking is to incorporate an "upstream emission factor" within the emission standards portion of the regulation that would be used to adjust tailpipe climate change emissions to include upstream fuel cycle emissions. Since the vast majority of vehicles currently use gasoline, the factor would be normalized to gasoline. Thus, for gasoline vehicles, this value would be 1.00. For all other alternative fuels, the total emissions would be calculated by multiplying the tailpipe climate change emissions by the upstream emission factor.

The ARB's Clean Fuels Program requires that alternative fuels must be provided at retail fueling outlets once 20,000 vehicles using that fuel are brought to market in California. Staff is considering not including upstream emissions for alternative fuels (e.g. the factor would be 1.00) until the Clean Fuels Program trigger point is reached.

After the Clean Fuels Program trigger point is reached for a particular alternative fuel, that alternative fuel will be assigned a compensation factor to be determined by a periodic ARB analysis. Implementation of this factor could be implemented 3 years after the trigger point year.

It may be appropriate for dual-fuel vehicles to be assessed under the assumption that 100 percent of the fueling is taking place with the worst-case climate change emission fuel. In cases like plug-in hybrids, where both fuels may be necessary for operation, staff is considering including a clause for petitioning the Board for a different treatment of the upstream emissions from the two fuels.

4.2.2 Alternative Methods of Compliance

Any alternative method of compliance would need to offset both upstream and downstream emissions. The upstream emission factors described earlier would be used to estimate upstream emissions. Note that these factors would be periodically reviewed to ensure that they reflect current estimates.