National Asphalt Pavement Association Comments to Midwest Regional Planning Organization: Interim White Paper on Candidate Control Measures to Reduce Emissions from Hot Mix Asphalt Plants

INTRODUCTION:

The National Asphalt Pavement Association ("NAPA") appreciates the opportunity to provide input to the Midwest Regional Planning Organization ("MRPO") and to seek ideas designed to assist with MPRO's Interim White Paper regarding asphalt manufacturing candidate control measures related to the reduction of ozone and regional haze within the MPRO region. NAPA represents the majority of Hot Mix Asphalt ("HMA") producers and tonnage of HMA pavement produced in the United States. HMA pavement makes up more than 90% of US paved roads. It is the foundation of the US transportation infrastructure. We are providing input because we believe we have innovative and win-win alternatives for assisting with the objective to control or reduce interstate transport of NOx, SOx, VOCs, and other typical products of combustion from HMA plant operations, that are precursors to ozone and regional haze. As a result of NAPA's input to the Ozone Transport Commission, their Resolution 06-02, controlling the reduction of NOx from HMA plants, has now been amended to allow for best practices considerations, as outlined below.

HMA plants are Minor Sources of Criteria and Hazardous Air Pollutants: Over the last 35 years, the HMA industry has taken discreet and proactive steps to systematically reduce air emissions associated with the production of HMA pavement materials. Early on, state-of-the-art pollution control devices and new technology developments were implemented industry-wide. By 2000, HMA plants were no longer considered as a Major Source of air pollutants under Titles V and III of the Clean Air Act of 1990. Because of the natural constraints on HMA production, including restrictions on available contracts, weather, and hours when paving can occur, combined with effective emissions controls, most plants in the US operate under Synthetic Minor Permit Status. In fact, the US EPA evaluated these factors and de-listed the HMA industry as a target for MACT standards, due to the industry's extremely low HAPs emission rates. No HMA plant in the US runs 24 hours per day, 7 days per week, due to these types of natural constraints.

Perspective on Midwest ozone, NOx, and regional haze from HMA plants: HMA plants have three primary functions: (1) to dry mineral aggregate (rock), that accounts for approximately 95% of HMA pavement mix by weight; (2) to mix the aggregate with liquid asphalt binder (approximately

5% by weight); and (3) to control the mix temperature prior to transporting material to the paving site. NOx emissions are the direct result of fossil fuel combustion during this drying and mixing process. The largest portion of fuel consumption goes toward drying of the aggregate. Typical aggregate moisture contents are in the range of 3 to 7 percent but the aggregate must be dried to below 0.25 percent moisture to result in a quality product. Fuels typically used at an HMA plant include natural gas, No. 2 fuel oil, or on-spec used oil meeting No. 4 fuel oil specifications.

We estimate that the average HMA plant in the US produces about 140,000 tons of HMA per year. However, it is not unusual to find a plant that produces 200,000 tons or more. There may even be a handful of plants producing over 500,000 tons per year. While some of the newer plants have a theoretical capacity to produce upwards of 750,000 tons or more, those actually doing so are a rarity, especially in the MRPO region where weather constraints prevent year-long HMA production. We estimate there are approximately 700 to 750 HMA plants within the MRPO region and agree with MRPO that the number of HMA plants in Ohio is over-estimated. Still, if one evaluates the combined potential of these facilities to emit NOx, it is appropriate to treat this industry as a minor or area source. Our understanding is that the charge to regional planning organizations, similar to MRPO, was to identify categories of sources emitting more than 10,000 tons NOx or other pollutants annually. If one assumes 750 HMA plants in the MRPO region, with an average production rate of 140,000 tons per year, and all of those plants were using oil for fuel (the worst-case scenario), the result, based upon the current US EPA AP-42 emission factors for the HMA industry, would suggest the maximum annual NOx emissions potential, from combined HMA plants throughout the MRPO Region, to be below 2,900 tons NOx per year. In reality, this emission value is lower because not all plants use fuel oil. We are unsure how the MRPO estimates, for total NOx emissions of all HMA plants, have been derived, although we recognize that the value is over-estimated due to the number of estimated Ohio plants, and other assumptions. The value identified above, equivalent to 3.85 annual tons NOx per HMA plant, is a worst-case scenario based on using fuel oil.

Inappropriate use of AP-42 or similar emission values as a base for NOx emissions limitations: While AP-42 emission factors can be useful for regional air modeling, using them for emission limit determinations, such as specifying a 25 percent reduction from an average emission value, is an inappropriate use of these types of databases. As US EPA indicates, ". . . emission factors frequently may not provide adequate estimates of the average emissions for a specific source. The extent of . . . variability that exists . . . can be large depending on process, control system, and pollutant" (http://www.epa.gov/ttn/chief/ap42/c00s00.pdf). Also, "[b]ecause of the uncertainties inherent in the use of average emissions factors for facility-specific . . . determinations, emissions . . . are characterized incorrectly . . .. The emissions reductions determined during regulatory standard setting done without regard to the uncertainty in emissions factors will be open to question. For these reasons, we recommend against use of source category emissions factors . . ." (http://cfpub.epa.gov/oarweb/index.cfm?action=fire.main).

Specifically, the HMA industry NOx AP-42 values identified in US EPA's database range as much as 500 percent, almost an order of magnitude difference between the low and high NOx emissions value for a particular type of plant using a specific fuel source. This high degree of variability is typical when looking at NOx emissions because NOx is the second most variable combustion product emitted from HMA burners (CO is the first). The AP-42 values represent a wide range of plant operating circumstances, some employing best practices, some employing burner control technologies, some using different plant configurations or designs, and some running different mix production formulations. To identify a 25 percent reduction in the average AP-42 NOx emission value, would, in essence, be identifying the lower 25th percentile of all currently operating plants – a true reduction of 75 percent NOx emissions.

Below, we propose an alternative approach foundation for assisting with the objective to control or reduce interstate transport of NOx, SOx, VOCs, and other typical products of combustion from HMA plant operations; and this approach can demonstrate appropriate pollutant reductions without relying on imprecise emissions factors and values.

REQUIRING LOW NOX BURNERS ON ALL HMA PLANTS MAY NOT REPRESENT THE BEST ALTERNATIVE FOR NOX REDUCTION:

The HMA industry recognizes the need to reduce NOx emissions in the attempt to minimize ground-level ozone formation, regional haze, and transport of ozone and ozone precursors across state boundaries. However, the proposed control mechanism for HMA plants, specifically low NOx burner ("LNB") combustion modification technology outlined in MPRO's Interim White Paper, has some downsides as compared to other, more thoughtful and practical alternatives, especially for existing facilities. Specifically, downsides of requiring LNB technology include:

- de-rating hourly production capacity of HMA plants;
- its expensiveness, outside the scope of reasonable economic controls, while other more economic alternatives are available for existing plants;

- potentially lowering NOx emission rates at the detriment of increased fuel usage, and increased emission rates for other pollutants such as SOx, VOCs, CO, and CO2.

However, there are practical alternatives, presented below, that would allow a significant reduction in potential NOx emissions, along with a reduction in all other air combustion-related pollutants.

De-rating hourly production capacity: The implementation of LNB technologies on existing plants has the potential to substantially de-rate plant production if those plants are operating near capacity. This is due to the requirement for increased air-flow and the need for an up-sized bag-house – a very expensive proposition. In this situation, implementing LNB control technologies would likely require extending plant production hours to meet DOT contract terms and paving demands; in many areas this is not legally possible – due to restrictions on operating hours. Similarly, the incorporation of LNBs would require an existing facility to run longer, burn more fuel, and be potentially limited in its fuel selection, while producing the same amount of material required to meet a DOT contract. Current examples of incorporating LNBs on existing plants, show a potential plant de-rating up to about 20 or 25 percent, as a plant operates near capacity. This does not include the extra fuel required to operate under LNB technologies due to the influence of those technologies on combustion efficiency. The bottom line is that forcing LNB technology on existing plants has substantial downsides and false economies to meet the objective of reducing ozone and regional haze.

Economic impact: Implementation of LNB technologies can be broken-down into four categories: capital costs, additional fuel costs associated with operating the more inefficient LNB technologies, additional fuel costs associated with plant de-rating, and the economic impact to a plant's total net worth.

Base costs are identified for an average plant implementing LNB technologies that result in a 25 percent reduction in NOx emissions (per MPRO's Interim White Paper). Based on an annual emission rate of 3.85 tons NOx, using oil as fuel, LNB technologies would result in an annual reduction of approximately 1.0 tons NOx per plant [140,000 tons HMA x 0.055 lbs NOx/ton HMA (from AP-42) x 0.25 (percent reduction)].

Capital costs, of LNB technologies, can range from $100,000 - $200,000 installed, depending on the type – without up-scaling the bag-house (up to another $400,000 additional). The HMA industry typically looks at 10 years as an acceptable time-frame for depreciation of capital costs. This is equivalent to a range of $10,000 - $20,000 per ton NOx annually reduced, and is consistent with MRPO's estimated costs – without up-scaling the bag-house (up to another $40,000 per ton NOx annually reduced).

Annual LNB operating costs, account for the extra amount of fuel consumed due to LNB combustion inefficiency, generally identified at 2.5 percent. This equates to approximately $17,500 per ton NOx reduced – and is an annual operating cost that is not capitalized (140,000 tons HMA x 2.2 gal. oil/ton HMA x $2.25/gal.) x 0.025 (percent excess fuel).

Additional operating costs associated with plant de-rating, are dependent on how close a plant operates to capacity under normal circumstances. As plant de-rating escalates over 20 percent, the annual fuel consumption cost exceeds $135,000, to operate longer to produce the same amount of material needed to meet state and federal contracts (140,000 tons HMA x 2.2 gal. oil/ton HMA x $2.25/gal.) x 0.20 (percent de-rated). The alternative to the additional operating costs associated with plant de-rating is a capital expenditure of up-sizing the bag-house (up to $400,000).

Total Operating Costs, of incorporating LNB technology on existing HMA plants, is well above $30,000 per ton NOx reduced per year – without accounting for plant de-rating or up-scaling the bag-house. Accounting for either a 20 percent plant de-rating or the necessity to up-scale the bag-house, the total operating costs, using LNB technology, are much higher than originally estimated by MRPO, and fall within a range of $70,000 - $150,000, per ton NOx annually reduced.

Economic impact to a plant's total net worth also must be evaluated. It is not uncommon for smaller HMA plants, that typically operate on a highly seasonal basis (e.g., summer months only), in more remote locations, to be worth less than $250,000. Unless there is an overwhelming economic incentive, these types of plants cannot sustain a capital investment of over 50 percent of their net worth, let alone over 100 percent of their net worth, especially if that investment makes the plant run less efficiently.

Increased fuel consumption and pollutant emissions: As identified above, implementing LNB control technologies on existing plants would increase fuel consumption by about 2.5 percent, and depending on potential plant de-rating, could reach 20 to 25 percent. This would concurrently increase all pollutant emissions, including NOx and SOx, due to the consumption of the extra fuel needed to meet current production schedules. The true reduction of NOx, SOx, and regional haze, from implementing an LNB technology that reduces NOx by 25 percent, after taking into account the added fuel consumption due to a plant's de-rating, is a fraction of the original reductions envisioned; in fact, this type of technology would potentially increase other pollutants, including SOx.

A PRACTICAL ALTERNATIVE –
FOSSIL FUEL REDUCTION AS A MEANS OF REDUCING NOX:

As energy costs continue to escalate, the HMA industry has looked toward innovative ways to control production costs. Over the last two years, a great deal of focus nationwide has been expended toward lowering HMA plant fuel consumption. The reduction of fuel-use saves the individual plant and industry money, and at the same time, it reduces the emission of all combustion-related air pollutants. Well known in the HMA industry, the greatest single energy requirement to produce quality pavement mix, is drying the aggregate (rock) while maintaining adequate material temperatures (on the order of 300°F). Dry aggregate is required in order to meet state specification for HMA pavements. To ensure drying the aggregate completely during the HMA manufacturing process, fossil fuel burners provide the latent heat for evaporation. Best practices that reduce fuel consumption and provide efficient time-temperature-turbulence configuration, will produce less NOx, SOx, and other combustion-related air pollutants that affect ozone and regional haze.

Best Practices to Reduce Fuel Consumption and/or Lower Air Emissions:

HMA industry leaders have identified a number of Best Practices that, if implemented, allow for substantial reduction in plant fuel consumption and the corresponding products of combustion. In today's business environment, there is significant incentive to reduce fuel usage. For this reason, the allowance for implementing best practices to reduce fuel consumption and emissions of pollutants contributing to regional haze and ozone, forms the basis of a sustainable strategy for overall emissions reduction.

Effective stockpile management to reduce aggregate moisture content: Current information indicates that effective stockpile management can reduce aggregate moisture content by about 25 percent with a corresponding reduction in fuel consumption. There are a number of ways to reduce aggregate moisture: covering stockpiles, paving under stockpiles, and sloping stockpiles are all ways that prevent aggregate from retaining moisture. Best Practices are plant- and geographic locale-specific.

Burner tune-ups: Burner tune-ups have been documented to improve efficient fuel combustion and may be helpful at reducing NOx emissions through improved combustion efficiency. The

Ozone Transport Commission identifies that burner tune-ups may reduce NOx emissions by up to 10 percent. From a contractor's perspective, burner tune-ups are also helpful in reducing fuel consumption.

Lowering mix temperature: Looking toward the future, a Technical Working Group of FHWA is currently investigating a number of newer formulation technologies, to understand the practicality and performance of lowering pavement mix temperatures. Substantial reductions in mix temperatures appear to be plausible. Lowering mix temperatures may also reduce fuel consumption, as less heat is needed to produce the mix. To the extent mix temperatures can be lowered, reducing fuel consumption reduces overall emissions.

Fuel switching: The MRPO has identified that switching fuels from oil to gas may reduce SOx (and potentially NOx) emissions. From our perspective, this is a short-term fix to a long-term problem. We all know how volatile the fossil fuel scenario is today in the US. The cost and accessibility of switching fuels is location- and market-dependent. However, the solution to reduce combustion emissions is to reduce and control fuel consumption, regardless of the fuel used. Not only is this the right thing to do from an energy conservation standpoint, it is the right thing to do from an environmental sustainability standpoint. We propose to build on this objective within the HMA Industry. To the extent we are successful, this represents a sustainable and win/win alternative.

Other maintenance and operational best practices: Additional practices can be employed throughout the plant to help optimize production and operations. For example, regular inspection of drum mixing flites and other measures can be taken – all in the effort to make a plant operate more efficiently, thereby using less fuel.

Documenting Fuel Reduction

Plant fuel consumption is typically based on gallons of oil or cubic feet of gas per ton HMA produced. These values can be converted to BTUs per ton HMA produced. Typical midwest US values of burner fuel consumption would approach approximately 308,000 BTUs per ton HMA produced (@ 2.2 gal. No. 2 fuel oil/ton HMA) – not accounting for the application of best practices. Plant production run records keep track of mix production rate, total mix produced, and fuel consumption. This provides a good base from which to monitor and control progress.

HMA INDUSTRY PROPOSAL TO REDUCE OZONE AND REGIONAL HAZE EMISSIONS:

USING BEST PRACTICES TO REDUCE FUEL CONSUMPTION

Our proposal to reduce NOx, SOx, and other combustion-related area source emissions from HMA plants would deploy using one or more best practices / technologies, to reduce overall plant fuel consumption, thereby reducing all combustion-related pollutants that may form ozone and regional haze. The most practical and beneficial practice may be to control aggregate moisture. However, there are other practices that will reduce fuel use. It is important to note that each practice or technology must be tailored for the individual plant, as the situation varies from plant to plant, and state to state. It is much more practical and economical to build LNB technologies into a new plant than to attempt to retrofit an existing plant. Still, LNB technologies may not be the optimal solution if we are prudent about reducing all emissions, even for new plants. We propose the following:

New and Existing Plants:

- Encourage implementation of Best Practices that reduce fuel consumption from a base of 308,000 BTUs per ton HMA produced

  (2.2 gal. No. 2 fuel oil per ton HMA x 140,000 BTUs per gal. No. 2 fuel oil);

SUMMARY:

The HMA industry prides itself on its ability to meet exceedingly low levels of emissions from HMA plants and have taken purposeful steps to accomplish that goal. We recognize the importance of continually striving for the reduction of all air emissions that are involved in regional haze and ozone transport, while operating more efficiently and competitively – as this makes environmental and economic sense. Our proposal above, identifies a number of Best Practices that may substantially reduce fuel consumption at an HMA plant, and concurrently reduce all combustion-related emissions including NOx, SOx, and others, for this minor area source category. Although there are direct capital and operating costs associated with the proposed approach, from our perspective, and the contractor's perspective, this is a win-win proposition that is reasonable, appropriate, and makes economic and environmental sense.