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Background Information and Technical Support Document

for

Proposed Amendments to

310 CMR 7.05: Fuels All Districts

And

310 CMR 7.00: Definitions

Regulatory Authority:

M.G.L. c. 111, Sections 142A through 142N

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I. INTRODUCTION

The Massachusetts Department of Environmental Protection (MassDEP) proposes to revise 310 CMR 7.05: *Fuels All Districts* and 310 CMR 7.00: *Definitions* to lower the amount of sulfur allowed in petroleum-based fuel oils combusted at stationary sources in order to reduce emissions of sulfur dioxide (SO₂), which in turn contribute to increased formation of fine particulate matter (PM_{2.5}). These proposed revisions are part of Massachusetts' plan to reduce visibility-impairing pollutants that contribute to regional haze, as required by the federal Clean Air Act, and to protect public health from the adverse health effects of SO₂ and PM_{2.5} pollution.

Section 169A of the Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to address impaired visibility, also known as regional haze, in 156 national parks, forests and wilderness areas that have been federally designated as Class I areas. In 1999, EPA issued regulations known as the Regional Haze Rule, which requires states to develop State Implementation Plans to reduce haze-causing pollution to improve visibility in Class I areas.¹

EPA established five regional planning organizations across the nation to coordinate regional haze efforts. Massachusetts is a member of one of these regional organizations, the Mid-Atlantic Northeast Visibility Union (MANE-VU), comprised of Mid-Atlantic and Northeast states, tribes, and federal agencies.

In June 2007, the MANE-VU states agreed to pursue several regional strategies to reduce SO₂ emissions², the main contributor to visibility impairment in the MANE-VU region, including lowering the allowable sulfur content in distillate and residual fuel oils to specified levels. In accordance with this commitment, MassDEP included the low sulfur fuel oil strategy in its December 30, 2011 Regional Haze State Implementation Plan (SIP), available at mass.gov/dep/air/priorities/sip.htm#haze.

In accordance with the Regional Haze SIP and ongoing efforts to reduce emissions of SO₂ and PM_{2.5} in order to protect public health, MassDEP proposes to amend 310 CMR 7.05 to lower sulfur content limits for stationary sources to 0.05 percent (500 parts per million or ppm) sulfur by weight for distillate oil and 1 percent (10,000 ppm) sulfur by weight for residual oils beginning July 1, 2014,³ and to further lower the levels to 0.0015 percent (15 ppm) sulfur by weight for distillate oil and 0.5 percent (5,000 ppm) sulfur by weight for residual oils beginning July 1, 2018.

¹ See 40 CFR 51.300-309

² See Statement on Controls in MANE-VU at otcair.org/manevu/document.asp?fview=Formal%20Actions#

³ Power plants would be subject to a lower 0.5 percent sulfur by weight for residual oils beginning July 1, 2014.

II. BACKGROUND

Fuel Oil Combustion and Emissions

The combustion of petroleum-based fuel oils emits various pollutants, including SO₂, particulate matter (PM), nitrogen oxides (NO_x), metals, carbon dioxide (CO₂) and other pollutants. Collectively, these pollutants have direct health impacts and contribute to the formation of regional haze, ozone and fine particulate matter, acid deposition and nitrification of water bodies, and the build-up of greenhouse gasses in the atmosphere.

The most common petroleum-based fuel oils combusted by stationary sources are distillate (Numbers 1 and 2) and residual oils (Numbers 4, 5 and 6). Sources that burn fuel oil include power plants that produce electricity, commercial and industrial businesses, institutions, and residential homes. Distillate fuel oils usually contain less than 3,000 parts per million (ppm) or 0.3 percent sulfur by weight before desulfurization, and are used mainly in domestic and commercial applications for heating and hot water. Residual fuel oils contain up to 25,000 ppm (2.5 percent by weight) sulfur and are used mainly in power plant, industrial, and large commercial applications.

The MANE-VU region, especially the Northeast and upper mid-Atlantic, is heavily reliant on distillate oil for heating and hot water in the residential and commercial sectors. Distillate oil also is used in the industrial and electric power sectors. According to Energy Information Administration estimates, over 5 billion gallons of distillate oil was used in the region in 2009. Massachusetts was the second largest user of distillate oil in the region after New York, using an estimated 723 million gallons in 2009.

The heavier residual oils are used by power plants and in the industrial and commercial sectors, although use of residual oils has been dropping significantly due in part to the lower price of natural gas. In these sectors Massachusetts used 105 million gallons in 2009, down from 205 million gallons in 2008.

SO₂ emissions are generated during the combustion of fuel oil from the oxidation of sulfur contained in the oil. The amount of uncontrolled SO₂ emissions is almost entirely dependent on the sulfur content of the fuel. On average, more than 95% of the sulfur in fuel oil is converted to SO₂. SO₂ is the primary pollutant emitted in the MANE-VU region that causes regional haze.

Reducing sulfur in fuel oil is one of the largest steps MassDEP can take to reduce SO₂ emissions in the Commonwealth. In 2008,⁴ stationary sources burning distillate and residual fuel oils emitted an estimated 45,000 tons of SO₂, which represents 46% of all SO₂ emissions in the state. The proposed regulation, when fully implemented, would reduce those SO₂ emissions to approximately 5,000 tons per year, assuming the same amount of fuel oil burned.⁵ Distillate oil alone contributed nearly 30,000 tons of SO₂ emissions in 2008; the proposed regulations would reduce this amount to less than 1,000 tons in 2018.

⁴ 2008 is the most recent year for which MassDEP has compiled a comprehensive air emissions inventory.

⁵ MassDEP expects that there will be even further reductions in SO₂ emissions since there has been an overall decline in the amount of fuel oil burned in recent years as sources have switched to lower sulfur or less expensive fuels, such as natural gas, particularly for electricity generation.

Regional Haze

The proposed regulations are a key component of the Massachusetts plan for reducing regional haze. Regional haze is pollution that impairs visibility over a large geographic region, and affects many of the nation's national parks, forests, and wilderness areas. The primary cause of regional haze is the scattering and absorption of light by fine particles. Fine particle air pollution (i.e., PM_{2.5}) also adversely impacts human health, especially the respiratory and cardiovascular systems of people at increased risk, including children, the elderly, and people with heart or respiratory conditions. Reducing fine particles in the atmosphere is an effective method of improving visibility and protecting public health.

The fine particles that cause haze may either be emitted directly or formed from emissions of precursors. Sulfate, which is formed from SO₂ emissions, is the dominant contributor to fine particle pollution and the principle cause of visibility impairment across the MANE-VU region. Sulfate typically accounts for over 70 percent of estimated particle-induced light extinction at MANE-VU Class I sites.⁶

In the eastern U.S., the average visual range has decreased from 106 miles (under natural conditions) to 24 - 44 miles today. Examples of impaired visibility in Massachusetts, including the Boston skyline, can be seen at: http://www.mass.gov/dep/air/aq/aq_haze.htm.

Section 169A of the Clean Air Act and EPA's Regional Haze Rule (40 CFR 51 Subpart P) require states to make reasonable progress towards the restoration and maintenance of natural visibility in Class I areas (national parks and wilderness areas) in 10-year increments, reaching the goal by 2064. Although Massachusetts has no Class I areas, emissions from Massachusetts sources contribute to visibility degradation in Class I areas in several other states. These include Lye Brook Wilderness Area (Vermont), Great Gulf Wilderness Area (New Hampshire), Presidential Range-Dry River Wilderness Area (New Hampshire), Acadia National Park (Maine), Moosehorn Wildlife Refuge (Maine), and Roosevelt Campobello International Park (Maine/Canada).⁷

All states are required to submit a Regional Haze State Implementation Plan (SIP) to EPA that demonstrates progress towards the restoration and maintenance of natural visibility in Class I areas. The MANE-VU states committed to propose several regional strategies to reduce haze at MANE-VU Class I areas in their SIPs, including implementation of a low sulfur fuel strategy. MassDEP included the low sulfur fuel oil strategy in its Regional Haze SIP and now proposes to adopt these regulations to implement that strategy.

While the MANE-VU low sulfur fuel strategy calls for the sulfur content of residual oil to be lowered to 0.5% in 2018, in order to obtain emissions reductions "as expeditiously as practicable," as required by the CAA to meet other regional haze requirements, the proposed regulations require power plants to burn 0.5% residual oil by July 1, 2014. This should not be difficult to comply with since 0.5% residual oil is readily available and is being used by many facilities and some power plants in Massachusetts. In addition, other states, such as Connecticut,

⁶ Contributions to Regional Haze in the Northeast and Mid-Atlantic United States. NESCAUM, 2006.

⁷ *Ibid.*

currently require that residual oil contain no more than 0.3% sulfur, further demonstrating the feasibility of requiring 0.5% for power plants in Massachusetts in 2014.

National Ambient Air Quality Standards

The proposed regulations will help ensure that Massachusetts maintains compliance with the National Ambient Air Quality Standards set by EPA, in particular the new standard for SO₂ established in 2010 and the forthcoming standards for PM_{2.5} expected in 2013.

Pursuant to the Clean Air Act, EPA periodically updates health-based National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: ozone; nitrogen dioxide; particulate matter; carbon monoxide; sulfur dioxide; and lead. These pollutants harm human health and the environment and cause property damage. EPA establishes primary standards to protect human health and secondary standards to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

In 2010, EPA revised the primary standard for SO₂ by establishing a new 1-hour standard at a level of 75 parts per billion (ppb). EPA left in place the secondary standard, which is a 3-hour average at a level of 500 ppb. In June 2011, Massachusetts recommended to EPA that Massachusetts be designated as “unclassified” for the new SO₂ standard since Massachusetts does not yet have all the information needed to recommend either attainment or nonattainment (which will require modeling of SO₂ emissions from large sources). Reducing the sulfur content in fuel oil will reduce SO₂ emissions, helping to ensure Massachusetts meets the new SO₂ 1-hour standard.

The current primary and secondary standards for PM_{2.5} are an annual standard of 15 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), and a 24-hour standard of 35 $\mu\text{g}/\text{m}^3$. EPA is in the process of updating these standards and is considering proposing lower PM_{2.5} standards. Massachusetts currently meets the existing PM_{2.5} standards, but experiences one or two days each year that exceed the 24-hour standard. Therefore, to protect public health and to avoid a nonattainment designation under any new lower standards, it is important for Massachusetts to reduce PM_{2.5} pollution. The proposed regulations would contribute to the lowering of PM_{2.5} concentrations, since SO₂ emissions are a key contributor to PM_{2.5} pollution.

State Actions to Implement Regional Low Sulfur Fuel Oil Strategy

MassDEP’s proposed regulations are part of a regional strategy to lower the sulfur content of fuel oils. The MANE-VU states recognized early on that the only effective way to achieve the benefits of lower sulfur oil was for the states to act together in a coordinated fashion. In addition, the petroleum industry has advocated that states should have regionally consistent requirements with sufficient lead time in order to avoid heating oil market disruptions.

Several MANE-VU states already have promulgated regulations or enacted legislation to lower the sulfur content of fuel oil in accordance with the 2007 MANE-VU commitment. Below is a summary of final and proposed state actions.

- In April 2010, Maine enacted legislation that requires the sulfur content of No. 2 heating oil to meet 50 ppm by January 1, 2014 and 15 ppm by January 1, 2018, and requires the sulfur content of residual oil to meet 0.5% by January 1, 2018.⁸
- In May 2010, Connecticut enacted legislation that requires the sulfur content of No. 2 distillate to meet 50 ppm by July 1, 2011 and 15 ppm by July 1, 2014; however, Connecticut’s law will not take effect until New York, Rhode Island and Massachusetts have similar requirements in place.⁹ Connecticut already limits the sulfur content of residual oil statewide to 0.3%.
- In July 2010, New York enacted legislation that requires the sulfur content of No. 2 home heating oil to meet 15 ppm by July 1, 2012.¹⁰ New York is developing regulations to lower the sulfur content of residual oil statewide. In addition, New York City enacted Local Law 43 to lower the sulfur content of No. 4 residual oil to 1,500 ppm, and in April 2011 enacted legislation phasing out No. 6 residual oil by 2015 and eventually requiring all boilers to burn fuels that meet the equivalent emissions of burning 15 ppm No. 2 oil or natural gas.¹¹
- In September 2010, New Jersey promulgated regulations¹² that require the sulfur content of No. 2 distillate (and lighter grades) to meet 500 ppm by July 1, 2014 and 15 ppm by July 1, 2016. The regulations also require the sulfur content of No. 4 residual oil to meet 0.25% and No. 6 residual oil to meet 0.5% (or lower) by July 1, 2014. In April 2011, New Jersey proposed to allow refiners of distillate oil an extension of the July 1, 2014 deadline for up to one year to meet the sulfur in fuel limit of 500 parts per million (ppm) in a limited circumstance – where a refinery has a repair and maintenance shut-down (referred to as a “turn-around”) scheduled within one year after July 1, 2014.¹³ The proposal does not affect the July 1, 2016 deadline for producing 15 ppm distillate oil for New Jersey.
- In September 2010, Pennsylvania proposed regulations¹⁴ that would require No. 2 home heating oil to meet 15 ppm by May 1, 2012. The proposed regulations also would require No. 4 heating oil to meet 0.25% and No. 6 residual oil to meet 0.5% by May 1, 2012.
- In October 2011, Vermont promulgated regulations¹⁵ that require the sulfur content of No. 2 distillate (and lighter grades) to meet 0.05% by weight (500 ppm) by July 1, 2014 and 0.0015% by weight (15 ppm) by July 1, 2018, and require the sulfur content of No. 4 residual oil to meet 0.25% by weight and No. 5 and 6 residual oils (and heavier oils) to meet 0.5% by weight by July 1, 2018.

⁸ <http://www.mainelegislature.org/legis/statutes/38/title38sec603-A.html>

⁹ <http://www.heatingoil.com/blog/ct-governor-signs-low-sulfur-and-biodiesel-heating-oil-mandates-into-law-0614/>

¹⁰ <http://www.heatingoil.com/blog/gov-paterson-signs-ny-low-sulfur-heating-oil-mandate-into-law-0721/>

¹¹ http://www.nytimes.com/2011/04/22/nyregion/new-york-city-bans-dirtiest-heating-oils-at-buildings.html?_r=1&scp=1&sq=City%20Issues%20Rule%20to%20Ban%20Dirtiest%20Oils%20at%20Buildings&st=cse

¹² www.nj.gov/dep/aqm/1997adop.html

¹³ <http://www.nj.gov/dep/rules/notices/040411b.html>

¹⁴ <http://www.pabulletin.com/secure/data/vol40/40-39/1834.html>

¹⁵ <http://www.anr.state.vt.us/air/hfm/ProposedAmendments.htm#sulfurlimit>

The remaining MANE-VU states (District of Columbia, Delaware, Maryland, Rhode Island, and New Hampshire) are in various stages of developing proposals to implement the low sulfur oil strategy.

These state actions have begun to change the distillate fuel oil market, and eventually will lead it toward a single 15 ppm product for heating oil and vehicle diesel fuel. This market shift will improve distribution efficiencies since terminals, pipelines, and trucks will no longer have to carry separate distillate fuels. For example, Buckeye Pipeline has announced that it will phase-out high sulfur No. 2 heating oil deliveries on its system to comply with the new requirements.¹⁶ To implement the change, Buckeye will ship a single ultra-low sulfur fuel that can be used for heating or transportation. In addition, the Northeast Home Heating Oil Reserve sold its existing stock of higher sulfur home heating oil and replaced it with cleaner burning ultra-low sulfur (e.g., 15 ppm) distillate home heating oil to meet the new state requirements.¹⁷

III. DESCRIPTION OF PROPOSED REGULATIONS

The proposed revisions to 310 CMR 7.05 establish lower sulfur limits for distillate and residual oil in two phases, the first with a July 1, 2014 start date, and a second requirement beginning July 1, 2018, as shown in Table 1. These limits apply to all source sectors, including power plants, industrial, commercial, and institutional boilers, and residences. The proposed regulations allow any existing on-site stocks of higher sulfur fuel oil to be burned past the applicable compliance dates. The sulfur content limits for coal in 310 CMR 7.05 would not be changed, but would be clearly distinguished from the fuel oil limits.

The proposed regulations eliminate existing exceptions that allow facilities to obtain approval from MassDEP to burn higher sulfur residual oil. Any existing approval that MassDEP has issued allowing a facility to burn higher sulfur fuel oil would remain in effect until July 1, 2014; beginning July 1, 2014, the facility would need to comply with the lower sulfur limits. However, the proposed regulations retain the ability for a facility to burn higher sulfur fuel oil under a MassDEP approval if the resultant emissions would be no greater than the emissions that would result from burning the lower sulfur fuel.

The proposed revisions eliminate the requirement for distributors of fuel oils to register with MassDEP and eliminate the requirement for suppliers of fuel oil and coal to annually submit to MassDEP lists of customers that use certain amounts of oil, coal, and natural gas. MassDEP believes that these requirements are unnecessary due to the availability of fossil fuel market data and because MassDEP tracks similar information through its Air Source Registration reporting program.

The proposed revisions also correct grammatical and typographical errors, including in the 310 CMR 7.00 definition of “Sulfur in Fuel.”

¹⁶ http://oilspot2.dtnenergy.com/e_article002018966.cfm?x=b11,0,w

¹⁷ <http://www.fossil.energy.gov/programs/reserves/heatingoil/>

Table 1: Proposed Low Sulfur Oil Limits

Fuel Oil	Date	% Sulfur in Fuel	% Reduction in SO₂ Emissions from current Max. limits
Distillate	<i>current limit</i>	0.3% (3,000 ppm)	
	July 1, 2014	0.05% (500 ppm)	83%
	July 1, 2018	0.0015% (15 ppm)	99.5%
Residual	<i>current limit</i>	0.5% - 2.2% depending on area	
	July 1, 2014	1%; 0.5% at power plants	55% - 77%
	July 1, 2018	0.5%	77%

The fuel sulfur limits in 310 CMR 7.05 are regulated by Air Pollution Control District (APCD). The proposed sulfur limits for fuel oils shown in Table 1 would apply statewide in all APCDs with one exception. The Berkshire APCD has a 1974 legislative exemption allowing sources in this district to burn up to 2.2% sulfur residual oil.¹⁸ Therefore, the proposed revisions do not require lower sulfur residual oil in the Berkshire APCD due to the existing law. Legislative action would be needed in order for MassDEP to apply the lower sulfur residual oil limits for this district. Despite this legislative exemption, MassDEP expects that the majority of residual oil burned in the Berkshire APCD will have a reduced sulfur content because the suppliers in Massachusetts, and in the surrounding states, will need to supply lower sulfur residual oil for sale in other APCDs and states.

IV. IMPACTS

A. Economic Impacts

MassDEP believes that the proposed revisions to 310 CMR 7.05 are cost-effective and will not result in economic hardship to residential consumers who use distillate heating oil to heat their homes or to businesses and power plants that use distillate or residual fuel oil. Domestic oil refiners have made the capital investments required to produce lower sulfur distillate fuels to comply with EPA's national ultra-low sulfur transportation diesel fuel requirements. As a result of state actions to implement the MANE-VU low sulfur fuel strategy, refiners are making further upgrades to produce ultra-low sulfur home heating oil. Thus, the market is shifting to the lower sulfur levels MassDEP is proposing to adopt. Furthermore, the use of lower sulfur distillate fuels can provide an economic benefit to consumers in the form of reduced maintenance costs and increased heating efficiency. For residual oil, sufficient supplies of lower sulfur oils (e.g., 0.5% sulfur content) are readily available and already are being used by many Massachusetts facilities. Even lower sulfur content residual oil (i.e., 0.3%) already is required in Connecticut and areas in other states.

A number of reports (see below) analyzed the potential costs of the MANE-VU low sulfur fuel strategy. While the costs of the low sulfur oil strategy will vary depending on market conditions, they are reasonable when compared to the costs of controlling other sources of SO₂.

¹⁸ Chapter 353 of the Acts of 1974.

Importantly, a January 2008 Public Health Benefits study prepared by NESCAUM¹⁹ shows that the low sulfur fuel strategy will result in billions of dollars in public health benefits for the region. Controlling the fuel-sulfur content of distillate oil to 500 ppm leads to health benefits of almost \$3.4 billion in MANE-VU and controlling the fuel-sulfur content to 15 ppm could lead to an additional \$431 million in benefits, bringing the total benefits to \$3.7 billion, which corresponds to more than \$20,000 of benefit per ton of SO₂ removed based on expected SO₂ emissions reductions.

No. 2 Distillate Fuel Oil

No. 2 distillate heating oil and highway diesel fuel oil are essentially the same refinery-produced liquid. In Massachusetts, heating/hot water in homes and businesses accounts for about 63% of distillate fuel oil consumption. In comparison, transportation diesel accounts for about 36%.²⁰ Beginning in 2006, the permissible level of sulfur in highway diesel fuel (ultra-low sulfur diesel, or ULSD) was lowered to 15 ppm. Prior to that, highway low sulfur diesel fuel was refined to contain 500 ppm sulfur (low sulfur diesel). Consequently, refineries have already made the capital investments required for the production of low sulfur diesel and ULSD fuel oil. Based on U.S. Energy Information Administration (EIA) data for the week of March 18, 2011 domestic production of ULSD fuel oil accounted for about 85% of all distillate oil in the United States. Due to these refinery investments, requiring additional use of low sulfur fuel in the heating oil sector should result in minimal impact on the price and availability of lower sulfur distillate heating oil, especially given the lead times in the proposed revisions (2014 and 2018) for achieving the required levels.

In December 2005, the Northeast States for Coordinated Air Use Management (NESCAUM) published a report entitled “Low Sulfur Heating Oil in the Northeast States: An Overview of Benefits, Costs, and Implementation Issues,” which noted that the incremental cost of low sulfur (500 ppm) highway diesel fuel historically had averaged about 1.5 cents per gallon more than the cost of heating oil. However, the report went on to state that any increased cost in producing low sulfur home heating oil would be more than offset by the avoided maintenance costs resulting from the reduced rate of equipment fouling when using low sulfur oil.²¹

In July 2007, MANE-VU published a report entitled “Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas: Methodology for Source Selection, Evaluation of Control Options and Four Factor Analysis,” which estimated that on average low sulfur distillate oil would be expected to cost 0.8 cents per gallon more than regular heating oil.²²

A March 2008 study by Hart Energy Consulting for the National Oilheat Research Alliance estimated that the cost of producing 15 ppm heating oil could be as high as 8.9 cents per gallon more than regular heating oil, but could be less than 5 cents per gallon for refineries that have existing desulfurization facilities that could be revamped to produce 15 ppm product.²³ Note that

¹⁹ Public Health Benefits of Reducing Ground-level Ozone and Fine Particle Matter in the Northeast U.S., A Benefits Mapping and Analysis Program (BenMAP) Study. NESCAUM, January 15, 2008

²⁰ U.S. Energy Information Administration, 2009.

²¹ Low Sulfur Heating Oil in the Northeast States: An Overview of Benefits, Costs, and Implementation Issues. NESCAUM, December 2005.

²² Assessment of Reasonable Progress for Regional Haze in MANE-VU Class I Areas. MACTEC, July 2007.

²³ Northeast Heating Oil Assessment, Hart Energy Consulting, March 2008.

these are estimated costs to refiners and do not necessarily translate to prices ultimately paid by consumers, which are influenced by factors in addition to the cost of reducing the sulfur content in crude oil.

An April 2010 study prepared for the National Oilheat Research Alliance²⁴ evaluated the potential for suppliers to bring 15 ppm sulfur content heating oil into widespread use in the Northeast by 2018. While the study acknowledges that additional refining capacity is needed to meet the increased demand in 2018 and beyond, it concludes that, given appropriate advance notice, the refining industry can supply the necessary fuels with minimal market disruptions and price impacts. In the short-term, excess production capacity of ULSD exists in the region and could be shifted to the home heating market. In the longer term, the transition to ULSD in the transportation sector, combined with clear signals from regulatory agencies that similar requirements will be widespread for heating oil in the coming years, will support a move toward greater availability of 15 ppm sulfur content heating oil.

The study projects a volume-weighted average wintertime wholesale price differential between ULSD and higher sulfur heating oil of 1-3 cents per gallon, suggesting that the incremental cost of providing 15 ppm sulfur content heating oil will not be significant compared to normal price fluctuations. The study also notes that the incremental cost to consumers will be more than offset by cost savings associated with lower maintenance costs and higher fuel efficiency. For example, a typical consumer who uses 800 gallons of fuel per year would spend an additional \$24 per year if per-gallon fuel costs increased by \$0.03. However, the same consumer could expect to save approximately \$50 per year in avoided maintenance costs (cleaner fuel reduces the frequency with which equipment must be serviced) and another \$48 in avoided fuel costs from higher efficiency. This is because existing equipment generally operates more efficiently with lower sulfur fuels (by 1-2% per year between services²⁵), so less fuel is required to produce the same amount of heat. In addition, lower sulfur fuel oils will enable the use of more efficient, condensing heating equipment. The current cost of condensing heating units is expensive due to the need for stainless steel parts for protection from sulfuric acid, which forms from the sulfur in fuel oil. If the sulfur in fuel is reduced, then manufacturers will be able to use less expensive steel. This will in turn reduce the costs of these very efficient appliances. More efficient and less costly furnaces/boilers could encourage more residential users to replace inefficient, older units.

Residual Fuel Oil

The sulfur content of residual fuel oils burned by power plants and other large sources also can be cost-effectively reduced. Residual oil is a byproduct of the refining process, and is produced in several grades that can be blended to meet a specified fuel sulfur content limit. In April 2011, MANE-VU published an Addendum²⁶ to its 2007 “Assessment of Reasonable Progress” Report that evaluated residual oil. The report averaged monthly price averages to compute annual prices and price differentials in cents per gallon for the years 2006 – 2009. For these years in the Northeast, lower sulfur No. 6 residual oil ($\leq 1\%$) ranged from 8.9 to 12.9 cents per gallon more

²⁴ Ultra-low Sulfur Diesel Fuel/Heating Oil Market Study, Kevin J. Lindemer, LLC, prepared for the National Oilheat Research Alliance, April 2010 (<http://www.nora-oilheat.org/site20/uploads/lowstudy.pdf>).

²⁵ Low Sulfur Home Heating Oil Demonstration Project Summary Report, Energy Research Center, Inc., and Brookhaven National Laboratories, BNL-74956-2005-IR, June 2005.

²⁶ <http://otcair.org/manevu/Document.asp?fview=Reports#>

than higher sulfur No. 6 residual oil (> 1%). The additional expense would be at least partially offset by reduced maintenance costs with the use of lower sulfur oil. Low sulfur oil is cleaner burning and emits less particulate matter than higher sulfur oil; this reduces the rate of fouling of heating units substantially and permits longer time intervals between cleanings. The decreased deposits also would enable a more efficient transfer of heat, thereby reducing fuel use. Thus, there are potential costs savings for switching to lower sulfur residual oil. Reducing the sulfur content of residual fuel is a cost-effective SO₂ reduction strategy; a simple calculation using a price differential of \$0.089 – \$0.129 suggests that a 78% reduction in SO₂ emissions (by converting from 2.2 percent to 0.5 percent sulfur residual oil) is achievable at an approximate cost of \$800 - \$1,100 per ton of SO₂ removed. This cost per ton removal compares favorably to the costs of other pollution controls typically required by environmental agencies and is well within the range considered to be cost-effective.

B. Agricultural Impacts

Pursuant to Massachusetts General Law, Chapter 30A, Section 18, state agencies must evaluate the impact of proposed programs on agriculture within the Commonwealth. The proposed revisions will require that all distillate and residual oil burned in Massachusetts, including by agricultural users, meet lower sulfur content limits. Therefore, agricultural users of fuel oil may incur a slight increase in the cost of fuel; however, these costs would be offset by reduced boiler maintenance costs and increased boiler efficiency as described under Economic Impacts. Due to reduced SO₂ emissions that will result from the proposed amendments, agricultural crop production in Massachusetts could improve due to less acid deposition, which is partly caused by SO₂ emissions.

C. Impact on Massachusetts Municipalities

The proposed revisions will require that all distillate and residual oil burned in Massachusetts, including by municipalities, meet lower sulfur content limits. Therefore, municipalities may incur a slight increase in the cost of fuel; however, these costs would be offset by reduced boiler maintenance costs and increased boiler efficiency as described under Economic Impacts.

In addition, some Massachusetts municipalities operate electric generating units (EGUs) that burn fuel oil and thus may incur some additional fuel costs. However, ownership and operation of a power plant, which some municipalities voluntarily undertake, is not a mandated municipal service. Therefore, costs associated with operation of a power plant would not be considered mandated costs subject to the restrictions of Proposition 2 ½ (Town of Norfolk v. Department of Environmental Quality Engineering, 407 Mass 233 (1990)).

D. Impacts on Other Programs – Air Toxics

Air toxics are a group of chemical air contaminants that are associated with significant environmental impacts or adverse health effects such as cancer, reproductive effects and birth defects. The federal Clean Air Act requires EPA to promulgate source-specific controls based on Maximum Achievable Control Technologies (MACT) to address air toxics. MassDEP implements major source MACT standards as EPA promulgates them. In addition, MassDEP controls air toxics through other air quality programs and reduces the use of toxics through its Toxics Use Reduction

Program. The proposed amendments will decrease air toxics emissions by requiring cleaner fuel oil to be burned and by increasing the efficiency of combustion equipment.

E. Small Business Impact Statement

Small businesses that purchase distillate oil for heating are likely to experience slightly higher per-gallon prices for oil as a result of this regulation. However, as discussed above in Section IV.A Economic Impacts, these costs would be offset by reduced boiler maintenance costs and increased boiler efficiency. In addition, some compliance costs to small fuel distributors and suppliers may be reduced due to the elimination of requirements for registration and filing of customer lists.

V. PUBLIC PARTICIPATION AND COMMENT

F. Stakeholder Input

Between 2004 and 2010, MassDEP participated in several stakeholder meetings coordinated by NESCAUM and MANE-VU to solicit input on how to effectively implement a regional low sulfur heating oil strategy. Attendees included representatives of state environmental agencies, representatives from the heating oil industry (including retail distributors, wholesalers and refiners), environmental groups, EPA, NESCAUM, MANE-VU and the Ozone Transport Commission. In addition, the proposed low sulfur fuel strategy and commitment to propose these amendments were included in MassDEP's January 2011 draft Regional Haze SIP, which went through notice and public hearing. MassDEP received comments on its draft Regional Haze SIP from the Massachusetts Oilheat Association that were very supportive and from the Massachusetts Petroleum Council, which had one minor technical comment, and the requested change was made.

G. Massachusetts Environmental Policy Act

The proposed regulations are exempt from the "Regulations Governing the Preparation of Environmental Impact Reports," 301 CMR 11.00, in that no MEPA review threshold set forth in 310 CMR 11.03 is met or exceeded. In addition, these proposed regulations do not reduce standards for environmental protection, nor do they reduce opportunities for public participation in review processes or public access to information generated or provided in accordance with the regulations. (See MEPA review threshold pertaining to promulgation of regulations at 301 CMR 11.03(12).)

M.G.L. Chapter 30A requires MassDEP to give public notice and provide an opportunity to review the proposed amendments to 310 CMR 7.05 and 310 CMR 7.00, including the background document and any technical information, at least 21 days prior to holding a public hearing. Since the proposed regulation is in response to federal law and will be submitted to EPA as part of MassDEP's Regional Haze SIP, formal notice will be issued 30 days before the public hearing. The hearing will be held in accordance with the procedures of M.G.L. Chapter 30A. The public hearing notice and proposed amendments are available on MassDEP's website at: www.mass.gov/dep/public/publiche.htm.

If there are any questions regarding this document, please contact Glenn Keith, 617-292-5874, Glenn.Keith@state.ma.us, at MassDEP's Boston Office.