California Environmental Protection Agency

Air Resources Board

Proposed Emergency Regulatory Amendment Delaying the January 1, 2005 Implementation Date for the Diesel Fuel Lubricity Standard

STAFF REPORT

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State of California
California Environmental Protection Agency
AIR RESOURCES BOARD
Stationary Source Division

STAFF REPORT

Public Hearing to Consider Emergency Regulatory Amendment Delaying the January 1, 2005 Implementation Date for the Diesel Fuel Lubricity Standard

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I. SUMMARY

On January 1, 2005, California refiners must meet a new diesel fuel lubricity standard as specified in title 13, California Code of Regulations (CCR), §2284(a)(1). The effect of this standard will likely require an increase in use of lubricity additives in diesel fuel. Industry has evaluated the logistics of transporting diesel fuel containing lubricity additives in the common carrier pipeline. Late in October 2004, industry found that possible jet fuel contamination due to sharing the common carrier pipeline with diesel fuel containing lubricity additives became a more significant concern than previously realized. Potentially, diesel fuel additized with lubricity additive can contaminate subsequent shipments of jet fuel to the extent that the jet fuel being can fail its respective fuel specifications and can present a potential safety concern for use in aircraft engines.

With this increased level of concern in industry, the operator of the common carrier pipeline in California proposed to immediately prohibit the use of diesel lubricity additives in the pipeline to prevent possible contamination issues with jet fuel. However, since much of California diesel fuel currently is additized with lubricity improvers prior to leaving the refinery, a prohibition on diesel fuel containing lubricity additives would cause potential supply issues.

California refiners have used lubricity additives in diesel fuel for at least the last ten years. Diesel fuel containing lubricity additives have been distributed through the common carrier pipeline. During this time, only two instances of contamination have been reported that can be associated with this practice. In these two instances, jet fuel immediately followed low sulfur diesel fuel that was additized with lubricity improvers. This contamination was detected and the fuel was diverted.

Discussions occurred between the common carrier pipeline operator, California refiners, and state agencies regarding possible remedies. As a result of these discussions, the operator of the common carrier pipeline revised its position to allow shipments of diesel fuel with lubricity additives, for a limited time, so long as historical lubricity additization practices are maintained by refiners. Additionally, the pipeline operator will sequence product shipments to minimize the possibility of contamination. The operator of the common carrier pipeline and California refiners have requested that the ARB postpone the implementation date of the diesel lubricity standard to allow the installation of additive injection equipment at loading terminals located at the terminus of the common carrier pipeline so that industry can fully comply with the lubricity standard.

II. RECOMMENDATION

Staff recommends that the January 1, 2005 implementation date of the diesel fuel lubricity standard be delayed 120 days to provide adequate time for the installation of additive injection equipment at terminals while limiting common carrier pipeline diesel fuel shipments with lubricity additives at historic levels. This action would minimize possible diesel supply issues associated with meeting the lubricity standard and would not result in any increase in emissions.

III. BACKGROUND

A. Introduction

Diesel fuel lubricity can be defined as the ability of diesel fuel to provide surface contact lubrication. Adequate levels of fuel lubricity are necessary to protect the internal contact points in fuel pumps and injection systems to maintain reliable performance.

Natural lubricity of diesel fuel is provided by trace levels of oxygen- and nitrogen-containing compounds, and certain classes of aromatic and high molecular weight hydrocarbons in diesel fuels. However, in some instances these may not provide adequate protection. Also, these naturally occurring agents are reduced when diesel fuel is hydrotreated to reduce sulfur content. Lubricity additives have and continue to be used to improve or restore the lubricity performance of diesel fuel to levels adequate of protection.

Diesel fuel lubricity is dependent on the presence of trace components that provide surface-active molecules that adhere to or combine with metallic surfaces to produce a protective film that reduces wear. Rotary or distributor type injection pumps commonly used in light and medium-duty diesel engines, including most agricultural equipment, rely on the fuel for lubrication of the moving parts and are therefore very sensitive to fuel lubricity. This is in contrast to in-line pumps, commonly used in heavy-duty applications, in which some of the components are lubricated by engine oil. New fuel injector systems, including common rail systems and electronic unit injectors, developed to more accurately tailor fuel injection to reduce exhaust emissions, use extremely high pressures and require higher levels of fuel lubricity than older systems. The high injection pressures provide finer fuel atomization that results in improved fuel air mixing, more complete combustion, and lower exhaust emissions.

B. 1988 Approval of Diesel Fuel Standards

In 1988, with the ARB adoption of the statewide sulfur and aromatic hydrocarbon standards for diesel fuel, it was recognized that the use of additives may be necessary to ensure the motor vehicle diesel fuel have adequate lubricity characteristics. It was believed that fuel producers could voluntarily maintain the needed lubricity of the complying diesel fuel

C. Governor's Diesel Fuel Task Force

With the introduction of diesel fuel (CARB diesel) meeting the sulfur and aromatic standards in 1993, and concerns about the performance of the complying fuel, the Governor appointed a diesel fuel task force. The task force issued its report in 1994. One of the recommendations was that, on a voluntary basis, motor vehicle diesel fuel should meet a lubricity standard of 3000 grams using the

Scuffing Load Ball-on-Cylinder Lubricity Evaluator (SLBOCLE) test method. A 1994 survey by ARB staff indicated that this recommendation was being complied with. The American Society for Testing and Materials (ASTM) committee responsible for motor vehicle diesel fuel specifications began a review of the lubricity issue at this time.

IV. USE OF LUBRICITY ADDITIVES

A. California – Past and Future

Since the introduction of low aromatic and low sulfur content diesel fuel to meet California's diesel standards in 1993, diesel fuel lubricity has been a concern. This is because refinery processes to lower aromatic and sulfur content have a tendency to reduce the natural lubricity of diesel fuel. ARB efforts to monitor the lubricity of California diesel fuel during a period from October 1993 through the end of 1996 have shown that California diesel fuel maintained an average lubricity level at or near 3000 grams scuffing load of the SLBOCLE test. This level has been considered to be adequate for engine protection.

The measured SLBOCLE values of the fuels improved over the course of the three year study, however it is surmised that this was due to a shift in the formulation of diesel fuel marketed in California rather than increased use of lubricity additives. More California refiners began using alternative formulations to obtain the required emissions benefits rather than reduce the aromatics content of their fuel to ten percent. This reduction in hydrotreating resulted in an increase in the natural lubricity of the fuel. However, with the refiners' voluntary agreement to meet a minimum lubricity level of a SCLBOCLE of 3100 grams, the use of lubricity additives has been considered normal practice over the last ten years. Consequently, since 1993, lubricity additives have been added to CARB diesel fuel at refineries prior to being shipped via pipeline, with little or no observable impact on jet fuel quality with the exception of two instances in which a jet fuel shipment immediately followed an additized diesel fuel shipment.

A staff survey of current practices indicated that eleven of the fifteen refineries in California that produce CARB diesel use lubricity additives to some degree. Of these eleven refineries, there are refineries that additize all of their CARB diesel production and others that additize some fraction of their production. Reported additization rates ranged from 30 parts per million (ppm) to 200 ppm. One refiner indicated that their additization rate would increase by 25 to 50 ppm in order to meet the new 2005 lubricity standard. However, with the additional hydrotreating that will be required to meet the 15 ppm sulfur standard in 2006, additization rates are expected to increase significantly.

B. United States – Past and Future

EPA diesel generally does not experience as much hydrotreating as CARB diesel so consequently the use of lubricity additization is not as prevalent for the production of EPA diesel as for CARB diesel. This is indicated by the higher average sulfur content of EPA diesel (340 ppm) compared to CARB diesel (140 ppm). Additionally, EPA diesel is not subject to a regulated maximum aromatics content. However, it is estimated that as much as 30 to 40 percent of

the current U.S. EPA diesel fuel production would require lubricity improvers to meet the new ASTM lubricity standard. With the implementation of the nationwide 15 ppm sulfur content maximum, the increased hydrotreating required to reduce sulfur levels is expected to result in almost all diesel fuel meeting the 15ppm sulfur specification to require lubricity additives.

V. LUBRICITY STANDARDS

A. California

In December 2000, ARB staff initiated an effort to determine the necessity of a lubricity standard with the advent of more advanced engine technology and 15 ppm sulfur diesel fuel to be effective in 2006. The more severe hydrotreating necessary for reducing the fuel sulfur level is expected to reduce the natural fuel lubricity.

Staff proposed and the Board approved the adoption of a diesel fuel lubricity standard in July 2003 with an implementation date of August 2004. This standard is based on the High Frequency Reciprocating Rig (HFRR) test method with a maximum wear scar diameter (WSD) of 520 microns and is considered more protective than the voluntary SLBOCLE standard of 3100 grams. At the request of industry, the implementation date was modified to January 2005 to coincide with the effective date of the identical proposed ASTM lubricity standard discussed below.

In July 2004, ASTM adopted a standard identical to the ARB standard with the same January 2005 effective date. This standard is included as an item within the diesel fuel specification ASTM D 975. The California Department of Food and Agriculture, Division of Measurement Standards (DMS) is required by title 4, CCR, § 4143, to adopt and enforce the specifications set forth by the ASTM in the latest version of D 975.

The ARB regulation includes a provision to sunset the ARB lubricity standard if the DMS adopts and enforces a standard, including the ASTM standard, which is at least as stringent. DMS has indicated that in order to allow time for terminal additization to be implemented, enforcement discretion of this lubricity specification can be given to individual producers or terminal operators if requested. This discretion would require a letter of application from each producer or terminal operator requiring it.

ASTM issued a ballot on October 22, 2004 that, if passed, would modify the effective date of the ASTM D 975 lubricity standard from January 2005 to January 2006. The closing date for the ballot is November 22, 2004. It is expected that this ballot will receive some negative votes that will need to be voted on to determine if they are persuasive or non persuasive during the December ASTM meetings. The Alliance of Automobile Manufacturers has issued a letter that expresses strong opposition to this delay. The letter states that some vehicle manufacturers are planning to market new diesel-powered vehicles in 2005 and have depended heavily on future diesel fuel meeting the new ASTM lubricity standard. The letter also opposes the suggestion that state and local government agencies refrain from enforcing the standard.

B. Other States Implementing ASTM Standard

As of October 18, 2004, twenty other states, in addition to California, had adopted the current version of the diesel fuel specification ASTM D 975 that includes the lubricity specification. These states are Arkansas, Connecticut, Delaware, Idaho, Illinois, Iowa, Kansas, Louisiana, Michigan, Mississippi, Montana, New Hampshire, New Mexico, North Caroline, Oklahoma, South Carolina, Tennessee, Washington, West Virginia, and Wyoming. Some state agencies are considering delaying enforcement of the lubricity standard to provide additional time to implement additization at the terminals. The North Carolina Department of Agriculture and Consumer Services has suspended enforcement of the ASTM D 975 lubricity standard until October 1, 2005. They are requiring terminal suppliers to submit a list of terminals from which they make sales into North Carolina and an implementation plan demonstrating compliance with the lubricity standard. They also will require that for all diesel fuel that does not meet the ASTM D 975 lubricity standard, customers receive written notification that the fuel is not certified as meeting the standard.

C. Others

1. Europe

The European diesel fuel specification, EN590, issued by CEN (Comite´ Europeen de Normalisation) - European Committee for Standardization, includes a lubricity specification based on the HFRR test. This standard specifies a maximum WSD of 460 microns and states that the fuel may contain lubricity agent in order to achieve this result. This standard has been in effect since 1998. Compliance with this standard has been met with a pipeline protocol.

2. Canada

The Canadian General Standards Board has developed diesel fuel lubricity standards that require that base fuels with cloud point operability temperatures of -20°C or lower be additized for lubricity. Low cloud point diesel fuels, necessary for operation in extreme cold weather, are a lighter distillate with lower viscosity and density, which are known to have poor lubricity. Acceptable additization, based on a representative fuel sample, may be determined based on several optional criteria. These criteria include pump wear in either a vehicle fleet test, with a Bosch pump or with a Stanadyne pump, or meeting the following standards in a bench test: an HFRR maximum WSD of 460 microns or a SLBOCLE scuffing load of greater than 2800 grams.

Compliance with these standards has been met through different methods depending on the location in Canada. In Western Canada, jet fuel pipeline contamination is avoided by additizing at the fuel terminals. In Eastern Canada additization occurs at the refinery. Contamination issues have been experienced in Eastern Canada and this has been attributed to the sequencing of the fuels. A

large portion of the jet fuel is processed through clay treaters to filter out surface active chemicals but this does increase costs.

VI. IMPLEMENTATION ISSUES

With either the enforcement of a lubricity standard by DMS or the implementation of the ARB standard, California diesel fuel producers will need to verify that their fuel meets this standard. It is expected that the concentration of lubricity additives will increase in diesel fuel. Projected treat rate increases to meet the January 2005 lubricity standard are expected to be modest. However, when 15 ppm sulfur diesel is introduced, treat rate increases could be as high as two or three times the current treat rates. Current treat rates are generally in the 30 to 200 ppm range.

Historically, additizing the fuel at the refinery is usually the most efficient and cost-effective method. However, when shipped through multi-product pipeline after it leaves the refinery, there is a possibility of contaminating subsequent fuel shipments with additive retained on the pipeline walls, sometimes referred to as trailback. Some airline companies and jet engine manufacturers have expressed concerns about contamination of jet fuel with lubricity additives. Their concerns focus on the unknown effects of these additives in the jet fuel and possible impacts on jet engine safety, performance and durability.

Since the lubricity requirement was added to ASTM D 975, several oil, additive, and pipeline companies have conducted studies to examine many possible results of shipping diesel fuel treated with lubricity additives. The studies include possible trailback with subsequent contamination of jet fuel shipments. There have also been some investigations of the effects of selected lubricity additives on key properties of jet fuel such as thermal stability, conductivity, and water separability.

A meeting of the ASTM joint Subcommittee J / Subcommittee E Task Force was held on October 22, 2004 to discuss the potential for lubricity additive contamination of jet fuel. Presentations were made at this meeting on investigations being made regarding this issue. Some of those investigations have shown additive trailback; however, the details of the studies were not available at the meeting. ChevronTexaco preliminary data was presented that showed detrimental effects with the addition of some additives to some fuels. The effect varies with the fuel and the additive. Properties that were affected include thermal stability, water separability, and fuel conductivity. The study is not yet complete.

There was also a report from ExxonMobil that some lubricity additives can deactivate airport fuel water coalescer/separators at a concentration of 35 ppm in the jet fuel. The deactivation was reversible when the lubricity additive was removed from the jet fuel. It is unclear whether this concentration of lubricity additive could be produced by trailback. However, because of these results, most multi-product pipelines have decided not to allow diesel fuel treated with

lubricity additives in their pipelines. This means that fuel will have to be treated at the terminal if additization is required to meet the specification. However, terminal additization is not currently available at most locations. Additionally, the inventory of additive injection equipment within the United States (U.S.) is inadequate to equip all U.S. terminals by January 1, 2005.

VII. ACTION BY COMMON CARRIER PIPELINE OPERATORS

On October 26, 2004, Kinder Morgan, California's primary common carrier pipeline operator, notified shippers on its pipeline that, effective immediately, they would no longer accept shipments of diesel fuel that contained lubricity additives. This was significant in that, while not required by regulation, most California (CARB) diesel fuel needs additives to provide adequate lubricity properties to diesel fuel. This decision did not affect CARB diesel fuel shipped through proprietary (refiner owned) pipelines. However, it was anticipated that this restriction on the shipment of additized fuel in the common carrier pipeline would result in significant shortages of diesel fuel in the immediate future.

Discussions ensued at once between oil producers, regulatory agencies, and the pipeline operators. As a result, on November 5, 2004, Kinder Morgan notified shippers that in order to avoid a disruption in the supply of compliant fuel to terminals served throughout California, they will permit the transport of CARB diesel fuel treated with the type and amount of additive that has been a regular practice in the past years. Additionally, on an interim basis, Kinder Morgan will coordinate product shipments such that jet fuel will not follow additized diesel fuel. These provisions are in effect until fuel additization blending equipment can be installed at the terminals.

VIII. PROPOSED AMENDMENT TO DELAY THE IMPLEMENTATION DATE FOR THE LUBRICITY STANDARD FOR DIESEL FUEL

This chapter describes the staff's proposed amendment to title 13, CCR, § 2284, "Lubricity of Diesel Fuel." The proposed amendment to the implementation date for the diesel fuel lubricity would delay the implementation of the standard for 120 days. This delay would not apply to diesel fuel marketed as having a maximum sulfur content of 15 ppm.

The text of the proposed amendment is presented in Appendix A.

A. Requirements for Adopting an Emergency Amendment

Under the California Administrative Procedure Act and state regulations, state agencies are normally required to submit a hearing notice to the Office of Administrative Law (OAL) at least 55 days before a hearing to amend a regulation, so that it can be published in the California Notice Register at least 45 days before the hearing. However, an agency is authorized to amend a regulation on an emergency basis without following the regular procedural requirements upon a finding that the amendment "is necessary for the immediate preservation of the public health and safety or general welfare." OAL has an abbreviated 10-day period to review the amendment after it is submitted by the adopting agency, and the amendment may go into effect immediately after it is approved by OAL and filed with the Secretary of State. An amendment adopted on an emergency basis may remain in effect for no more than 120 days unless the adopting agency complies with the procedural requirements for a normal amendment. (Government Code section 11346.1.)

B. Proposed Amendment to Delay the Implementation Date for the Diesel Fuel Lubricity Standard

The current phase-in dates for the lubricity standard are January 1, 2005 for diesel fuel being supplied from the production or import facility, February 15, 2005 for diesel fuel being supplied from terminals, and April 1, 2005 for diesel fuel being sold at fueling facilities or supplied from bulk plants. Staff proposes that the Executive Officer or her designee adopt an amendment delaying these implementation dates for 120 days, until May 1, 2005. Diesel fuel marketed as having a maximum sulfur content of 15 ppm will be exempt from this delay.

As discussed above, a finding of emergency must be made in order to amend the implementation date for the diesel lubricity standard on an emergency basis. Staff proposes that the Executive Officer or her designee make a finding of emergency based on the disruptions in supplies of diesel fuel if refiners are unable to ship additized diesel fuel through the Kinder Morgan pipeline system at

the beginning of 2005, before additive injection equipment can be installed and used at all terminals where the equipment is needed.

C. Rationale for Proposed Delay for the Implementation Date for the Diesel Fuel Lubricity Standard

ARB staff has made an evaluation of the need to delay the implementation of the lubricity standard on an emergency basis based on the potential of product contamination, the status of the implementation of terminal additization capabilities, and the potential impact on diesel supply.

ARB staff has found that jet fuel contamination in the pipeline due to following additized diesel fuel is a real but manageable issue. Lubricity additives have been added to CARB diesel fuel at refineries prior to being shipped via pipeline since 1993, with only two known instances of jet fuel contamination. In both instances a jet fuel shipment immediately followed an additized low sulfur diesel fuel shipment. Sequencing fuel shipments so that additized diesel is not followed by jet fuel has been a successful protocol for preventing jet fuel contamination.

Discussions with California's primary common carrier pipeline operator in late September 2004 indicated that the minimal increase in lubricity additive treatrates resulting from the January 1, 2005 diesel fuel lubricity standard would not warrant a modification of historical pipeline practices in California. However, in late October, the heightened level of concern regarding possible jet fuel contamination caused the pipeline operator to re-evaluate this position in order to minimize potential problems. Their decision to disallow any increase in lubricity additization treatrates for diesel fuel transported in their pipeline created a requirement for terminal additization in order for a significant fraction of CARB diesel to meet the ARB lubricity standard. Up until this time, it was expected that terminal additization would not be required until the 2006 implementation of the 15 ppm maximum sulfur standard for diesel fuel. Consequently, terminal additization will not be available in the vast majority of California terminals by the current implementation date of January 1, 2005.

Additization levels are expected to increase with the implementation of the ARB lubricity standard. Since California's primary common carrier pipeline operator has prohibited any increase in additization rates, it will be necessary to additize diesel fuel at the pipeline terminus rather than the refinery to comply with the lubricity standard. Adding lubricity additives at fueling facilities as an ongoing practice is not permitted by the regulation, since the diesel fuel normally has to meet the lubricity standard by the time it is supplied from the terminal or bulk plant. Manually adding lubricity additives at the fuel terminals with splash blending into the trucks is not a viable option due to safety concerns. This option would require that personnel climb to the top of the trucks, open a cover, and add multiple gallons of additive to the tank prior to fueling. Transporting all additized fuel by truck was another option considered, however it is not reasonable due to

the large volume of fuel that is impacted. Consequently, because terminal additization is not yet available, the supply of compliant CARB diesel will be disrupted if the diesel fuel lubricity standard implementation date remains as January 1, 2005.

A 120 day delay in the implementation of this standard will allow CARB compliant additized diesel fuel to be shipped in multi-use pipelines until fuel additization blending equipment can be installed at the terminals.

D. Alternatives

Staff considered the following alternative to the proposed amendment:

- Do not delay the implementation date and allow the diesel fuel lubricity standard to become effective January 1, 2005.

If the ARB did not amend the regulation and delay the implementation date of the diesel fuel lubricity standard then diesel fuel requiring additional additization beyond current practice in order to meet this specification could not be shipped in the common carrier pipeline fully additized. It would be necessary to designate this fuel as non-compliant when shipped and then be further additized at the pipeline terminus or the fully additized fuel would require transportation by truck. This would disrupt the supply of compliant CARB diesel fuel.

IX. POTENTIAL IMPACTS OF THE PROPOSED AMENDMENT ON THE PRODUCTION OF DIESEL FUEL BY CALIFORNIA REFINERIES

The objective of the amendment is to avoid disruptions of diesel fuel supplies. The delay in the implementation date of the diesel fuel lubricity standard will allow California refineries to continue to produce, additize, and ship CARB diesel fuel without modifying their practices while terminal additization is installed in preparation for complying with the lubricity standard.

X. ENVIRONMENTAL IMPACTS OF THE PROPOSED AMENDMENT

The ARB staff does not expect the emergency amendment would have any significant adverse environmental impacts. The 120-day delay in implementation of the new ARB standard will not cause an increase in emissions due to increased fuel system wear in existing vehicles since historic lubricity levels will be maintained. Although this minimum lubricity level may be adequate for the short term, it is not adequate for enabling and maintaining future low emissions technology.

XI. ECONOMIC IMPACT OF THE PROPOSED AMENDMENT

The ARB staff does not believe the proposed emergency amendment will have any adverse economic impacts on businesses or individuals. The objective of the amendment is to avoid disruptions of diesel fuel supplies, which could have adverse economic impacts. In light of the fact that the lubricity of diesel fuels in the state is expected to continue to meet the voluntary standard recommended by the diesel fuel task force, the short-term delay is not expected to have any adverse impacts on diesel engines. Ultra-low sulfur diesel fuel is likely to have a greater need for lubricity additives due to the more severe hydrotreating to reduce the sulfur content. Some 15 ppm diesel fuel is currently marketed in California, especially for use in diesel vehicles with advanced emission controls. All of this diesel fuel is currently being transported by truck from the refinery terminal to the user, and it is accordingly feasible for the fuel to be adequately additized to meet the new ARB standard Because of this, diesel fuel represented as having a sulfur content not exceeding 15 ppm will remain subject to the preexisting phase-in schedule in the lubricity regulation.

The ARB staff has determined that the proposed regulatory action will not create costs or savings to any state agency or in federal funding to the state, costs or mandate to any local agency or school district whether or not reimbursable by the state pursuant to Part 7 (commencing with section 17500), Division 4, Title 2 of the Government Code, or other nondiscretionary savings to state or local agencies.

XII. REFERENCES

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APPENDIX A

PROPOSED EMERGENCY REGULATION ORDER

Emergency Regulatory Amendments Delaying the January 1, 2005 Implementation Date for the Lubricity Standard for Motor Vehicle Diesel Fuel