APPENDIX A

Environmental Cross-Media Issues: Potential Solutions
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Prepared by:
Allen Dusault, Sustainable Conservation
Greg Kester, California Association of Sanitation Agencies
Karl Longley, California Water Institute and Central Valley Regional Water Quality Control Board
Paul Martin, Western United Dairymen
Dave Warner, San Joaquin Valley Air Pollution Control District

It was my privilege to chair the subcommittee that prepared this paper, *Environmental Cross-Media Issues: Potential Solutions.* The individuals who participated in this effort are very well qualified professionals to discuss cross-media issues and each brought a very important and valuable perspective to our joint task. The result, in my opinion, has been an important contribution to the discussion. This paper is about as close to being a consensus document as is possible. Each member of this subcommittee has differing experiences and perspectives, and which has led to certain reservations regarding this paper. But those varying viewpoints are what make the paper informative and relevant, and fostered a better understanding of the issues. The solutions proposed here may help inform the development of future policies, processes, and rules.

Dr. Karl Longley

Introduction

This paper is the substantive accompaniment to the September 2010 Pacific Southwest Organic Residuals Planning Committee's concept paper, "Organic Residuals Project: Addressing Cross-Media Regulatory Conflicts." It completes the Concept Paper as it looks at potential solutions to cross-media regulatory coordination. This solutions paper presents examples of problems encountered in advancing cross-media projects, identifies potential solutions (technological, legislative and administrative), and closes with a summary of the issues. As we describe each potential solution, a few alternative perspectives are offered by individual subcommittee members to broaden the discussion. Each subcommittee member had his own strong convictions and unique viewpoints to help us look at the issues and solutions more critically. This made for a robust dialogue which certainly made it difficult to come to full consensus on solutions. Perhaps this solutions paper is a starting point for achieving that consensus.

I. ISSUE

The federal Clean Water Act, Clean Air Act, Endangered Species Act, and the Resource Conservation and Recovery Act, were written in "silos," meaning they were written with a single purpose in mind. Each statute does not fully acknowledge, or consider, the environmental consequences caused by implementation of single purpose control measures for the maintenance or improvement of one media (air, land, or water), on the other media. In addition to these federal regulations, California has established its own set of environmental regulations, some more stringent than federal laws, and created its own "silo" approach.

It is essential for California to determine how best to work across these various media programs, or "silos," to implement multi-media federal and state laws and regulations. Some states have a central authority to administer cross-media programs, and to settle any conflict that may arise at the highest agency level (e.g., Massachusetts Department of Environmental Protection). This allows for a "referee'd solution." There was some expectation that CalEPA would serve that purpose. More importantly, if there is recourse to higher level review, it usually leads to better coordinated permitting decisions.

The PORS Concept Paper provides background and defines the problems of cross-media conflict. It points to ample studies and efforts that have addressed or created a dialogue on this rather "inconvenient truth": the complicated maze of regulations that often work at cross purposes, are fragmented and counterproductive, and pose an undue burden on those committed to innovation, and on projects with clear environmental and health benefits.

II. EXAMPLES

The following are four examples illustrating cross-media conflict issues:

A. Disposal of Manure from Dairy Operations

A water quality regulatory agency (e.g., Central Valley Regional Water Quality Control Board) may prefer dry scrape practices (rather than the practice of flushing manure) where the manure is periodically picked up by a vacuum unit and placed at a disposal site that, under the best scenario, is an enclosed digester designed to produce useable bioenergy. Thereby, the manure is kept out of the lagoon which is considered a significant source of the transport of salts, including nitrates, to groundwater. Even so, a recent study[1] has found that lagoons can function to minimize the release to the atmosphere of certain gaseous products (mostly volatile organic compounds, or VOCs), the result of decomposition of aging manure. Therefore, this practice of flushing manure to lagoons may be considered a best management practice by an air quality regulatory authority (e.g., San Joaquin Valley Pollution Control District).

[1]"Summary of Dairy Emission Factors and Emission Estimation Procedures" June 2009 by Charles E. Schmidt, Ph.D., study for the San Joaquin Valley Air Pollution Control District

B. Biogas Power Production

California's leadership in the areas of control and reduction of greenhouse emissions and the growth of renewable energy resources has created an atmosphere which encourages the use of biogas to produce distributed generation of bioenergy (generally methane from landfills, or from anaerobic digesters at dairies or wastewater treatment plants). Many technologies, however, which convert methane into energy, also produce air pollutants via combustion of methane. Air quality agencies' pollution control requirements for these systems may render them technologically unachievable or non-cost-effective to pursue.

C. Green Waste and Biosolids Composting

Diverting green waste from landfills is required in many parts of the state to comply with recycling diversion credits mandated by AB 939. It helps reduce the volume required, and expands the life of landfills needed to serve the needs of California's growing population. Such diversion of green waste is usually facilitated by composting, either on its own, or combined with biosolids. VOC emissions from composting operations are, however, significant and may contribute to the formation of ozone pollution. This is obviously of interest to air quality regulators because of their mandate to protect public health. Air district regulations designed to control these VOC emissions may hinder growth of the composting industry.

D. Dairy Manure Composting

Dairies are also significant sources of VOC emissions and, in the San Joaquin Valley, operate under specific VOC-reduction regulations. These regulations require VOC reductions from dairy manure composting that may make composting prohibitively expensive. Most dairies in the San Joaquin Valley do not currently compost manure. However, if a more significant number of dairies decide to compost manure, an increase of VOC emissions could negatively affect the Valley's air quality. Alternatively, composting of dairy manure is considered by the regional water boards to be a valuable method for allowing the export of excess nutrients and thereby reduce excess nutrient loads on dairy lands.

III. POTENTIAL TECHNOLOGICAL, ADMINISTRATIVE AND LEGISLATIVE SOLUTIONS

A. Technology-Based Solutions

Most of the examples discussed above are resolvable with technology-based solutions which are compatible with each of the common environmental regulatory areas. Unfortunately, these technologies are generally more expensive to implement, may not be proven effective over the long term, or are problematic in other ways. Therefore, careful attention and consideration should be given to creating

infrastructure and funding opportunities to facilitate and encourage these technological solutions. Some examples of such solutions follow:

1. Effective Utilization of Manure from Dairy Operations (Example IIA)

The first example listed above is an area of potential conflict between the water board's contemplated requirements and air district requirements. Most dairies in the San Joaquin Valley are flush dairies, which are thought to produce less VOC's (precursors to ozone pollution), than dry scrape or vacuum dairies. Flush dairies may be considered responsible for groundwater contamination with nitrates from the more dilute lagoon systems, while dry scrape dairy operations may cause additional diesel particulates and NOx emissions generated from onsite scraping or vacuuming.

Even so, dairies that collect manure by scraping or vacuuming (rather than by flushing lanes with water) are not automatically excluded from consideration by the air district. It may be that a well-designed vacuum dairy can be considered "Best Available Control Technology" for VOCs. In fact, a proposal to process the vacuumed manure in an anaerobic digester, and then inject the gas into a natural gas pipeline, or produce compressed methane mobile fuel, may be a preferred approach from the air district's perspective (see next section for more information).

Water quality research has definitively stated that the greater risk to groundwater from manure is from the large footprint of land application practices rather than from the limited area of manure lagoons. Applying manure with irrigation water allows greater control of agronomically-sound application rates and timing, and allows the use of existing irrigation infrastructure to apply manure to a growing crop. Converting to a slurry system would require additional mechanical equipment with the incumbent diesel and NOx emissions, and would preclude application to growing crops. This makes it more difficult to accomplish appropriate nutrient and salt management.

Whatever the ultimate manure utilization strategy employed by a given dairy farm, a full "whole farm system" analysis must be accomplished in order to effectively maximize overall environmental performance. Unfortunately, at this time, we do not have a sufficiently robust body of science to fully inform decision making, or to determine best practices. We surmise, but do not know for certain, that slurry systems from a scrape or vacuum operation penetrate storage basin liners less than the more dilute lagoon wastewater. Neither do we know with certainty that slurry systems emit more VOCs than lagoons. Without basic data, we are left to make decisions on an intuitive basis, always a risky proposition, and one that dairy producers justifiably mistrust.

2. Biogas Power Production (Example IIB)

Anaerobic Digestion

Anaerobic digesters with power-producing engines have the potential to significantly reduce methane emissions from a dairy, but internal combustion engines without emissions controls can produce large amounts of nitrogen oxides (NOx). Wastewater treatment plants also generate biogas through the anaerobic digestion process and, in fact, are increasing production by injecting fats, oils, and grease (FOG), and /or food waste directly into the digester. The release of NOx is a crucial component of the main air pollutant issues in some parts of the state, such as the San Joaquin Valley (ozone and inhalable particulate). Plans for achieving clean air (as mandated by the Clean Air Act) are strongly focused on achieving NOx reductions. AB 32 recognized this issue and stated quite clearly that public health issues should not be exacerbated by efforts to reduce greenhouse gases. In addition to NOx, there is also concern about emissions of VOCs and CO from stationary engines.

Another Perspective: There are, however, dairy digester technology alternatives available that can deliver methane reductions and minimize NOx increases:

- The best alternatives from an air quality perspective are those that directly displace existing fuel-use. Injection of digester gas into the natural gas pipeline and the production of mobile fuels (compressed methane) are two processes that have been proven to work on dairies in the San Joaquin Valley. Because they merely displace other fuel that is already used, without increasing emissions, the San Joaquin Valley Air District fully supports these types of projects.

- Well-controlled internal combustion engines are also approvable. There are at least four different technologies that can be used to lower NOx emissions to acceptable levels. All have been proposed for installation in the San Joaquin Valley. Two of these technologies are currently operating at local dairies, and the other two are expected to be operating shortly. (Note: some will say that internal combustion engines driving an on-farm electrical generator are just displacing power plant emissions, but engines, even well controlled engines, are many times more polluting than today's large power plants. That's why pipeline injection and mobile fuel production are preferred from an air district's perspective.)

Counter Perspective: The above four engine NOx control technologies referenced are still in various stages of evaluation. Compared to the old "rich burn" uncontrolled engines, which were being used up until 2006, they are much cleaner and designed to capture 98 to 99% of the NOx emissions. That compares to lean burn engines with air-fuel ratio controllers which get about 94 to 95%. The California Energy Commission was willing to fund, with matching grant money, these lean burn engines with air-fuel ration controllers. It is the last 4 to 5% of NOx that is tricky to remove. The one dairy running with Selective Catalytic Reduction (SCR) has shown progress in meeting the latest standard set by the air district, but has an inconsistent track record over the last year in staying under the 11 ppm standard. It likely becomes more

challenging with time as catalyst age, but hopefully these limits are possible with more time and money.

There are other NOx solutions under development that may be more cost-effective than SCR for internal combustion engines (e.g., carbon adsorption, hydrogen injection, and the next generation exhaust gas recirculation). They show some promise but won't be operating on dairy biogas until later this year. As such, it may be premature to conclude that the NOx problem has been solved for this fuel category (i.e., biogas), and class of engine. Note that fuel cells, which can be effective at mitigating NOx, need significant grant funding to make them commercially viable for most applications, but is particularly challenging in the farm environment.

Municipal Digesters
Retaining existing stationary engines at wastewater treatment plants may be feasible but would require installation of pretreatment and post-combustion treatment in order to comply with emission limits. This means that gas cleanup will be required to remove siloxane and hydrogen sulfide. A post-combustion catalyst will be required to reduce the levels of NOx, but in turn, will increase the levels of VOC and CO emissions. Thus, a follow-up CO catalyst would also be required to reduce both of these emission levels to meet the emission limits. The effectiveness and lifespan of the catalysts are unknown at this time and could add significant ongoing costs for this option. Moreover, the ability of these devices to provide continuous compliance with air emission standards is unknown.

3. Green Waste and Biosolids Composting (Example IIC) and Dairy Manure Composting (Example IID)

Composting operations are recognized sources of significant VOC emissions yet technology exists to dramatically reduce those emissions, especially from new operations. Recent proposals have included aerated static piles, or some type of emissions containment system, vented to a VOC control device (generally a biofilter that uses microbes to destruct the VOCs). As with all of the technology-based solutions identified in this document, there are substantial costs associated with installing and operating these devices. Current air quality regulations require such controls without consideration of cost as they are considered "achieved-in-practice." Because of this requirement, and given that the requirement is based on federal law designed to protect the public's health, consideration should be given to investigating and developing financial assistance options for those interested in helping the state meet its diversion goals by proposing new and necessary composting operations.

Another Perspective: Most dairies store collected "dry" manure in large piles. Those piles visibly emit gases as they heat up and "passively" compost. Most of the emissions are moisture but also include ammonia and, likely, VOCs. It is not clear that there would be a net increase in VOCs or ammonia if dairymen instead "actively" compost the manure. To assume there is, the latest published research suggests that most of the VOCs emitted are of very low reactivity. As such, by discouraging

composting by regulating this "new activity," there may be no net improvement in air quality while there are adverse repercussions for water quality. For non-dairy composting operations, an important question is, if these facilities cannot afford to install the required VOC controls, will the air quality impact be shifted to mobile source emissions with associated PM, VOC, HC, NOx, and other emissions? The effect of the requirement could be further deterioration of air quality. This problem could be avoided if the California Air Resources Board, which is responsible for mobile source emissions, and the local air districts, which are responsible for stationary emissions, better coordinate rulemaking implementation to avoid pollution shifting. Other states have shown this can be done.

4. Challenges to Implementing Technological Solutions

It must be stressed that serious challenges exist to implement any and all, of the technological solutions mentioned. Project proponents often have serious and honest doubts about the technical feasibility of leading-edge technologies, and such technologies are almost always more expensive to implement and/or operate.

For instance, the less-polluting dairy digester engine technologies are more expensive than an uncontrolled engine. They are not well understood in the dairy digester community, and therefore, there are more unknowns related to the technology, permitting, installing and operating. These uncertainties along with the additional costs are strong disincentives for project proponents, especially those who view digesters as a means to achieving an environmental goal or benefit.

Similar concerns can be expressed about each of the options discussed above. Injecting biogas into a pipeline requires costly biogas clean-up technologies, hard-to-obtain interconnect agreements with the utility, and proximity to a natural gas transmission pipeline. Compost facilities that have implemented biofilters are finding it necessary to replace the biofilter more frequently than projected. Waste-gas burning engines may be more susceptible to catalyst failure than natural gas burning engines, due to impurities in the gas, and the added cost of replacing failed catalysts is difficult to project.

B. Administrative Solutions

Currently there is little recourse, short of an expensive and time consuming lawsuit, when an agency's permitting decision is in error or contradictory. This is particularly an issue when an agency reaches a different conclusion from some other agency, given the same data or science that was the basis for their decision. If the decision is precedent setting, it can have a profound effect on new facility development. One solution is to require the agencies to use consistent information and science in their determinations and to coordinate their positions or decision making. That doesn't necessarily mean they set the same standards. Regional differences often require different limits on emissions or discharges. What it does mean is that one agency reviewing the same science, engineering or economic data, should not reach opposing

conclusions from another agency given the same objective information. An Executive Order may be the mechanism for requiring agency-to-agency coordination, cooperation and communication. Many or most States already have this coordination without having to change state or federal laws.

The most important change the administration should consider is one that changes the "silo" culture and requires each agency to be responsible for the "environmental outcome" of its decision (i.e., pollution shifting), not just the "regulatory" outcome. There are a number of ways that this can happen and there is a paper to be released soon detailing some of these options. But until the administration and its agencies recognize that the status quo isn't working, potential solutions will remain just that.

C. Solutions at the State and Federal Level

One concept is to provide California Environmental Protection Agency the requisite authority to manage identified environmental cross-media issues to achieve "balanced environmental measures necessary for the attainment of the best overall environmental quality." Actions carried out under this authority must result in substantial environmental, public health, and economic benefits.

Another concept, is to have related federal legislation to authorize Environmental Protection Agency Region 9 to participate in a pilot program to modify pollution control measures across media, in concert with the CalEPA, with the purpose of achieving "balanced environmental measures necessary for the attainment of the best overall environmental quality and public health protection." Similarly, regulatory flexibility could be utilized where appropriate, when it is authorized. For example, EPA could allow a local air district to take an alternative approach to VOC emissions in ozone non-attainment areas. Currently, local air districts are required under the Clean Air Act, to reduce VOC emissions that are released from compost operations on a mass basis. The CAA does not differentiate the ozone formation potential of each VOC on an individual basis. Recent research by UC Davis has shown that the speciation of VOCs and determination of their specific reactivity as precursors to ground level ozone formation, may provide an alternative approach to regulation. Such an approach would focus on a VOC equivalence basis whereby, individual VOCs would be monitored, and emission rates coupled with reactivity, calculated to arrive at an equivalence-based reduction of harmful VOCs.

This approach is analogous to climate change mitigation efforts through which greenhouse gases are measured at Carbon Dioxide Equivalents (CO2e). This combines technological and regulatory innovation to improve air quality while allowing composting operations to continue. The preliminary research has shown that more than 90% of the VOCs released from green waste compost are very minimally responsible for ozone formation and, thus illustrates, the need to reduce and regulate the few VOCs which contribute the most to air quality problems. Evaluating biosolids compost is underway but the hypothesis is that the same results will be found as in the green waste compost study. New locally-relevant peer reviewed science should always

be used to inform regulations. It is fully agreed that both USEPA and the local air districts must be engaged and agree with the conclusions from a scientific basis. The CAA allows the incorporation of such an alternative approach but the scientific basis must be sound and unequivocal.

There are other actions that can be taken at the state level that do not require any changes in federal law. Californians may forget that we are relatively unique in how our permitting agencies are organized. We have fundamentally created autonomous agencies operating independently of other agencies. Not true of other states, who implement the same Clean Air Act, Endangered Species Act, Resource Conservation and Recovery Act, and Clean Water Act. Many states have created "super agencies" which integrate the air and water media programs. Regulatory permits are often coordinated or issued as one combined agency permit rather than individually as an air or water permit. Each program office cannot ignore potential impacts to other media in making permitting decision. If permits are issued separately, there is recourse to the agency "director" where "pollution shifting" occurs from stationary to mobile, or air to water. Perhaps most importantly, having the opportunity for recourse, even if it is not often used, makes the permitting staff much more aware, informed, proactive, and accountable for the impacts of their decisions. This may prevent problems from happening and can be more protective of public health than California's current system of permitting where there is little cross-media sensitivity. Empowering CalEPA, or another entity, to act as a "super agency" would require legislation. There are plenty of precedents to model such legislation from other states.

IV. SUMMARY

The above examples are but a few of the many situations where implementing regulatory measures to comply with environmentally protective standards for one media can create environmental conflicts in another media. These situations occur because environmental standards are developed in "silos" and are usually enforced by agencies having responsibility for only one media. Regulatory agencies have little choice but to implement and enforce these statutorily mandated programs to protect public health and the environment, with little flexibility, funding and incentives. Though public review and comment periods are often incorporated into the regulatory rulemaking process, this does not appear to be an effective means to mitigate issues of cross-media compliance issues.

If the accruing benefits are justifiable for a particular action which will have cross-media impacts, administrative mechanisms and/or oversight measures, should be developed. This would facilitate the review of the regulatory measures for the various media, and would result in the approval of those measures determined to result in the greatest environmental benefit.

A second complementary approach is to provide technical and financial assistance to develop and implement technologies and control measures to reduce conflict between air and water quality control measures.

This paper has presented a number of potential solutions to the very challenging, arduous, and often troublesome issue of addressing environmental regulations with conflicting cross-media impacts. These solutions, however, will not self-implement. Implementation depends on the hard work, dedication and cooperation among the participants of the Pacific Southwest Organic Residuals Symposium.