CA No. 07-56564
DC No. 06-5094

UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

CITY OF LOS ANGELES, ET. AL.,
Plaintiffs and Appellees,

v.

COUNTY OF KERN
Defendants and Appellants.

ON APPEAL FROM THE UNITED STATES DISTRICT COURT
FOR THE CENTRAL DISTRICT OF CALIFORNIA
(The Hon. Gary A. Feess)
No. CV# 06-5094

BRIEF OF AMICUS CURIAE WATER ENVIRONMENT FEDERATION IN SUPPORT OF APPELLEES AND AFFIRMANCE

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I. Statement of Interest in Case

Amicus Curiae the Water Environment Federation (WEF®) submits this brief in support of Plaintiffs/Appellees and affirmance of the District Court's decision to permanently enjoin Defendant Kern County's biosolids ban, a ballot initiative known as "Measure E." *City of Los Angeles v. Kern County*, 509 F. Supp. 2d 865 (C.D. Cal. 2007). WEF is an association of professionals and groups interested in advancing science and best practices on water quality and wastewater management, including management and reuse of reclaimed water and biosolids. WEF offers this brief to provide the Court with a review of current science demonstrating the benefits and safety of recycling biosolids to land.

A. The Water Environment Federation and Biosolids Recycling

WEF was founded in 1928 and is regarded as the leading technical and educational organization devoted to water quality and water pollution control. WEF's reputation for excellence is founded on its adherence to core values that include a strict ethical code and a commitment to diversity and collaboration in the development of consensus technical products. *See* www.wef.org.

WEF is a 501(c)(3) not-for-profit organization whose mission is to preserve and enhance the global water environment. It has more than 34,000

individual members and 81 affiliated Member Associations representing an additional 50,000 water quality professionals throughout the world. Members include engineers, scientists, wastewater treatment facility operators and managers, and other professionals and skilled workers involved directly in protecting and restoring water quality. WEF members work in state and local government, federal agencies, non-profit organizations, academia, industry, and private practice.

To further its goals, WEF publishes technical books, peer-reviewed journals, monographs, magazines, and newsletters to disseminate science-based information on water quality issues. WEF also sponsors major conferences on water quality topics, including biosolids. Additionally, WEF supports scientific research through the Water Environment Research Foundation (WERF).

WEF possesses a unique insight into biosolids, which the U. S. Environmental Protection Agency (EPA) defines as "nutrient-rich organic materials resulting from the treatment of domestic sewage in a treatment facility . . . that can be recycled and applied as fertilizer to improve and maintain productive soils and stimulate plant growth." EPA, Biosolids: Frequently Asked Questions, http://www.epa.gov/owm/mtb/biosolids/genqa.htm (last visited May 30, 2008), *see also*, EPA, *Biosolids Recycling:*

Beneficial Technology for a Better Environment (1994). WEF annually sponsors the leading best-practices conference on biosolids, the proceedings of which are published, and which this year drew over 800 attendees. Biosolids topics are also a significant component of WEF's Water Environment Federation Technical Exhibition and Conference (WEFTEC®), the world's largest annual water-related meeting typically drawing around 19,000 professionals focused on a wide range of water science and technology topics related to environmental and public health protection.

B. WEF's Interest in Case

WEF has long supported the recycling of biosolids to land and other beneficial uses of this material. When practiced in accordance with federal and state regulations and sound management practices, biosolids recycling is protective of public health, environmentally beneficial, and efficient. Beneficial recycling of biosolids occurs through several practice options, including heat and energy recovery following solids combustion, home use of dried and pelletized products, distressed land restoration, and fertilization and soil conditioning of farmland. It is estimated that in the United States, approximately 40% of the municipally treated wastewater solids are land applied to farmland. This is the practice Kern County sought to ban and the focus of this brief.

In addition to its leadership in scholarly and professional publishing and education, WEF works directly with local wastewater agencies to improve their management practices through the National Biosolids Partnership (NBP). The Partnership, created in 1997 by WEF, EPA, and the National Association of Clean Water Agencies (NACWA), has developed an environmental management system (EMS) for biosolids through which wastewater agencies benchmark their biosolids program against best practices, and undergo third-party audits to receive certification. Many leading agencies, including two of the three public agency Plaintiffs in this case, have adopted the biosolids EMS. *See* www.biosolids.org.

Recycling of treated wastewater solids has been successfully practiced in the United States and other parts of the world for over 75 years, and every year thousands of farm acres benefit from use of biosolids as a fertilizer and soil amendment. Land application of biosolids to farmland is subject to strict state and federal regulatory oversight and, when carried out in compliance with these regulations, is a sound and efficient management practice.

WEF supports the primacy of EPA and state regulatory agencies in regulation and oversight of land application programs. WEF also encourages local government involvement through science-based regulations

that support safe land application of biosolids and do not conflict with EPA and state programs—for example, regulations that authorize additional local oversight and monitoring. WEF recognizes that misperceptions and misinformation about biosolids may unduly alarm communities and lead to uninformed decisions. In this regard, WEF 's experience with well-managed land application programs supports the statement by the District Court in this case when it entered a preliminary injunction allowing land application of biosolids to continue: "In short, while applying sewage sludge to agricultural land may provoke a visceral response in lay observers, the available evidence suggests that the practice has been undertaken safely throughout the United States without any indication of detrimental environmental or health impacts . . . ." *City of Los Angeles v. Kern County*, 462 F. Supp. 2d 1105, 1107-08 (C.D. Ca. 2006). WEF files this brief to summarize the scientific evidence and practical experience that supports the Court's conclusion.

II. Overview of Current Land Application Practices

Extensive research has yielded many studies that provide scientific support for biosolids land application practices. Additionally, EPA and most states have studied and regulated land application of biosolids since the 1970s, including major federal rulemakings in the 1980s and early 1990s

that produced the current federal structure for land application of biosolids. After promulgation of the federal biosolids rule in 1993, 40 C.F.R. Pt. 503, the National Academy of Sciences' National Research Council (NRC) twice reviewed the safety of land application of biosolids. This history will be briefly reviewed as an introduction to the current literature on biosolids.

A. Use of Sewage Sludge as Fertilizer

It is widely recognized that the advent of basic wastewater collection and treatment in the twentieth century resulted in direct benefits to public health in the United States and other developed countries. Anon., *Medical Milestones Celebrating Key Advances Since 1840,* British Medical J. Suppl: S1, S17 (M. Chew and K. Sharrock eds., 2007). In the early 1970s, the Clean Water Act spurred construction of wastewater treatment facilities across the country, and the stringent effluent pollutant limits and sophisticated treatment technologies mandated by the Act have yielded significant improvements in public health and the condition of the nation's waters. EPA, *National Benefits of the Clean Water Act: Progress Made in the United States through the Secondary Treatment of Municipal Wastewater* (1993). Wastewater treatment facilities produce high-quality effluent for discharge to water bodies or for reuse. As a byproduct of the treatment process, these facilities also produce solid residues (sewage

sludge) that, with further treatment, can yield biosolids suitable for beneficial reuse.

Based on historical experience from major cities, EPA promulgated its first regulation in 1979, mandating chemical or heat treatment of biosolids to reduce the potential for survival of disease-causing organisms (pathogens). 40 C.F.R. Pt. 257 (1979). The regulations were revised in 1993, with the promulgation of the Part 503 Biosolids rule, which specifies the parameters for land application. *See* Part II.B, *infra*. 40 C.F.R. Pt. 503.

Strong support for land application of biosolids also exists outside the United States. According to a 2007 Imperial College of London scientific review of biosolids practices:

> The opinion of the European Commission is that use of sewage sludge on agricultural soils as a fertiliser is the best environmental option provided that it does not pose any threat to the environment as well as to animal and human health. The European Parliament reports that there are no cases of human, animal or crop contamination due to the use of sludge on agricultural soils following the provisions of Directive 86/278/EEC.

Steven R. Smith, Centre for Envtl. Control and Waste Mgmt., Imperial College, *The Implications for Human Health and the Environment of Recycling Biosolids on Agricultural Land*, Executive Summary (2007).

B. Current Regulation of Biosolids under the Part 503 Rule and State Programs

The Clean Water Act Amendments of 1987 directed EPA to research and promulgate rules to govern land application of biosolids. Water Quality Act of 1987, Pub. L. No. 100-4, § 406, 101 Stat. 7, 72 (1987) (codified at 33 U.S.C. § 1345). EPA initiated a comprehensive rulemaking to study and update land application practices and other biosolids uses such as land reclamation and incineration. Based on the results of its assessment of the risks associated with numerous constituents, EPA identified and set numeric limits for nine trace elements (heavy metals) that may be found in biosolids. To control pathogens, the Part 503 rule mandated that treatment facilities use at least one of several alternative technologies that significantly decrease concentrations of pathogenic microorganisms in biosolids. Before finalizing the Part 503 rule in 1993, EPA conducted a risk assessment that included outside peer reviews and notice and comment proceedings. EPA, *Standards for the Use or Disposal of Sewage Sludge*, 58 Fed. Reg. 9,248 (Feb. 19, 1993)[1]

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[1] Several works summarize the extensive record of EPA's development of the Part 503 Rule and its risk assessment for chemicals in biosolids. EPA, *A Guide to the Biosolids Risk Assessments for the EPA Part 503 Rule* (1995); EPA, *A Plain English Guide to the EPA Part 503 Rule* (1994).

EPA's Part 503 rule also addresses biosolids quality, management practices, and data collection and reporting. For example, depending on the pathogen reduction process chosen, safety may be further ensured by following Part 503's agricultural-practice and access restrictions. These restrictions, which apply for varying time periods depending on site characteristics and the biosolids composition, provide further assurance that pathogens die off naturally before human exposure can occur. 40 C.F.R. § 503.32(b)(5) (2008). Other restrictions for bulk application of biosolids include setbacks to prevent contact with waterways and agronomic limits to prohibit applying more biosolids than necessary to meet the nitrogen requirements of a particular crop.

Biosolids that are treated to achieve significant (i.e., 99%) pathogen reduction and subject to site use and access restrictions are categorized as "Class B" biosolids. Biosolids disinfected to a level that inactivates pathogens are subject to fewer site-specific controls and are called "Class A" biosolids. If, in addition, heavy metal concentrations are sufficiently low, Class A biosolids can be bagged and distributed for home garden use without further regulation (referred to as Class A, EQ (exceptional quality)

biosolids). 40 C.F.R. § 503.10(g) (2008).[2] Part 503 requires additional protections for all classes of biosolids, including recordkeeping of (non-EQ) biosolids applications to a site for monitoring of cumulative loading of trace metals in the soil.

After the final Part 503 rule was issued in 1993, most states implemented complementary land application programs to strengthen oversight and safety of the practice. *See* North East Biosolids and Residuals Association, *A National Biosolids Regulation, Quality, End Use, and Disposal Survey—Final Report* 23 (2007) [hereinafter *National Biosolids Report*] (only nine states have no biosolids-specific regulations and rely exclusively on Part 503). WEF assisted in the development of these programs by sponsoring training on the Part 503 regulations. In many states any entity seeking to land-apply biosolids must first secure a site-specific permit or approval from state or local authorities. Obtaining a permit typically involves a detailed review of a location's suitability for biosolids application and the quality of the biosolids to be applied. *See* Gary Pierzynski et al., *Soils and Environmental Quality* 282 (3d ed. 2005). Many

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[2] The biosolids applied to farm land in Kern County are Class A, EQ biosolids, as required by the Kern County ordinance in place prior to the Measure E ban.

states impose additional controls that go beyond Part 503, such as setbacks from property lines, roads and residences; weather-related restrictions; controls on field storage of biosolids; and treatment requirements. *National Biosolids Report*, *supra*, at 23 (reporting that 37 states have more stringent management practice regulations, 16 states have stricter pollution control regulations, and four states have stricter pathogen and/or vector attraction regulations than the federal rule). States allow land application of biosolids because of its role in nutrient recycling and value as an organic fertilizer and soil amendment.

Finally, best management practices (BMPs), such as those encouraged by the NBP, are widely embraced by biosolids generators, contractors, and farmers to ensure benefits and minimize risks. For example, BMPs encourage proactive communication and response strategies to share information with neighbors of land application sites. See National Biosolids Partnership, *National Manual of Good Practices for Biosolids* (2005).

C. Additional EPA Initiatives and Scientific Reviews of Land Application of Biosolids

EPA, the states, municipalities, and academic researchers have continued to build the knowledge base for land application of biosolids in the fifteen years since promulgation of the Part 503 Rule. For example, under § 405(d)(2) of the Clean Water Act, 33 U.S.C. § 1345(d)(2), EPA

must conduct regular reviews to determine whether regulation of additional constituents found in biosolids is warranted. Pursuant to this mandate, EPA undertook a risk assessment of dioxin compounds found at parts per trillion concentrations in biosolids and in 2003 issued a final rule concluding that the risks presented by dioxins were low enough that no numerical limits were needed. EPA, *Standards for the Use or Disposal of Sewage Sludge: Decision Not to Regulate Dioxins in Land-Applied Sewage Sludge*, 68 Fed. Reg. 61.084 (Oct. 24, 2003); *see also*, EPA, *Standards for the Use or Disposal of Sewage Sludge; Final Agency Response to the National Research Council Report on Biosolids Applied to Land and the Results of EPA's Review of Existing Sewage Sludge Regulations*, 68 Fed. Reg. 75,531, 75,533 (Dec. 31, 2003). Currently, EPA is reviewing nine compounds screened from a list of 803 candidate pollutants for consideration for further regulation. 68 Fed. Reg. 75,550-51.

Two reports of the National Research Council (NRC) of the National Academy of Sciences have considered whether land application of biosolids is safe and beneficial. In 1996, NRC published *Use of Reclaimed Water and Sewage Sludge in Food Crop Production*. The report concluded that the application of biosolids to farmland,

> when practiced in accordance with existing federal guidelines and regulations, presents negligible risk to the consumer, to

> crop production, and to the environment. Current technology to remove pollutants from wastewater, coupled with existing regulations and guidelines governing the use of reclaimed wastewater and sludge in crop production, are adequate to protect human health and the environment.

Id. at 12. In 2000, EPA asked NRC to review the science and methods supporting Part 503 to address concerns regarding human health impacts of land application of biosolids. As a result of its "search[] for evidence on human health effects related to biosolids," the NRC's 2002 report reached several important conclusions:

- "There is no documented scientific evidence that the Part 503 Rule has failed to protect public health."
- "[A] causal association between biosolids exposures and adverse health outcomes has not been documented."
- "There are no scientifically documented outbreaks or excess illnesses that have occurred from microorganisms in treated biosolids."

NRC, *National Biosolids Applied to Land: Advancing Standards and Practices* 2-4, 205 (2002) [hereinafter NRC, *Biosolids Applied to Land* (2002)]. The NRC also observed that "persistent uncertainties" regarding the safety of land application necessitate more scientific research, but it did not call for any specific changes to Part 503. As noted above, EPA continues to reevaluate the adequacy of the Part 503 regulations and has not

found a need to establish more stringent requirements or regulate additional pollutants.

EPA formally responded to the 2002 report's recommendations by developing through notice and comment procedures an action plan to implement NRC's key suggestions to update some of the basic science underlying the Part 503 program. 68 Fed. Reg. 75,531 To comply with § 405 of the Clean Water Act, EPA simultaneously published the results of its biennial review to identify and regulate additional pollutants in biosolids. *Id.*; 33 U.S.C. § 1345(d)(2)(C).

In 2004, the State of California finalized a comprehensive Programmatic Environmental Impact Review (EIR) of biosolids land application practices. California State Water Resources Control Board, *Statewide Program EIR Covering General Waste Discharge Requirements for Biosolids Land Application* (2004) [hereinafter California EIR]. The California EIR thoroughly examined concerns regarding land application, including concentrations of trace metals and pathogens and potential groundwater impacts. It concluded that the protections of Part 503, coupled with the state-specific controls under the California Water Board's General Order for land application, provided a sufficient margin of safety for both

Class A and Class B biosolids.[3] In addition, as discussed in the balance of this brief, researchers outside EPA are pursuing a wide range of studies and data collection that are strengthening the scientific basis for land application.

III. The State of the Science on Land Application of Biosolids

A. Biosolids Benefit the Environment and the Land

Applying biosolids to land—whether in the form of agricultural or silviculture application, reclamation projects, or use of bagged products by home gardeners—continues to be an essential component of America's clean water program. In 2004, over 16,000 U.S. wastewater treatment facilities generated over 7,180,000 dry tons of sewage sludge (roughly 860,000 tractor trailer loads), of which approximately 55% was treated to yield biosolids and recycled onto land.[4] Much of this land application occurs in bulk on farmland. With farmers facing cost increases for nitrogen fertilizer, many land application programs, which usually provide biosolids at low to no cost, have long waiting lists for participation. For large-scale reclamation sites, where biosolids are approved for application at far higher rates than farm fields, formerly barren lands are dramatically transformed. *See* Figure 1.

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[3] *See, e.g.*, California EIR at ES-14-15, Table ES-1 (considering fifty potential impacts associated with land-application of biosolids and finding that all were "less than significant" when appropriate mitigation measures were employed).

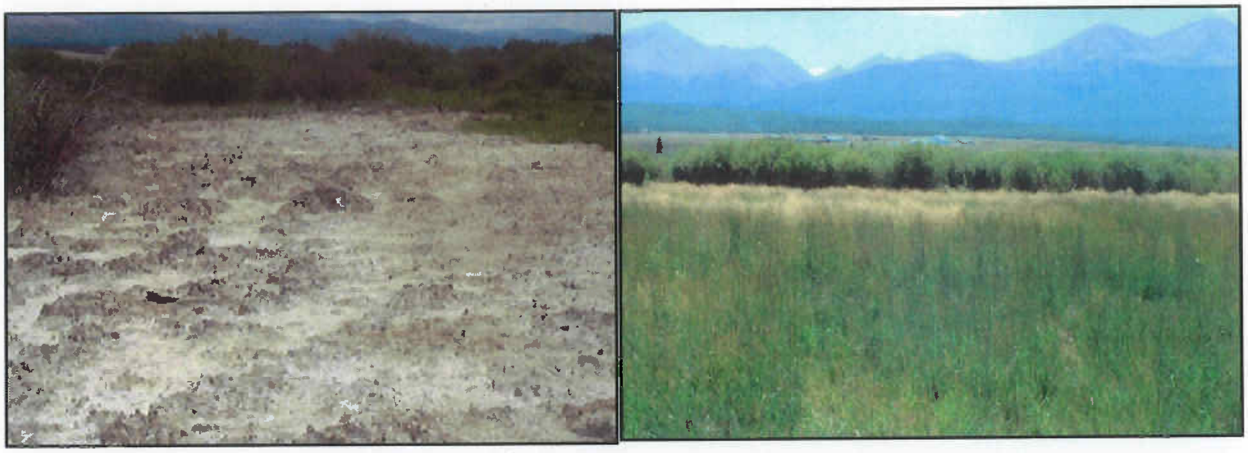

Fig. 1. Side-by-side comparison of a ranch site in Leadville Colorado contaminated with mining waste before (L, in 1997) and after (R, in 2005) reclamation using biosolids. Photos courtesy of Dr. Sally L. Brown, University of Washington.

The benefits of biosolids for both soil and vegetation are numerous and well recognized. Eliot Epstein, *Land Application of Sewage Sludge and Biosolids* 143-158 (2003).[5] Biosolids provide primary nutrients (nitrogen and phosphorous) and secondary nutrients such as calcium, iron, magnesium and zinc. Use of biosolids increases crop yields and maintains nutrients in the root zone. Unlike chemical fertilizers, biosolids provide nitrogen that is released slowly over the growing season as the nutrient is mineralized and made available for plant uptake. *See generally* Gary Pierzynski, *Soils and*

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[4] National Biosolids Report, *supra*, 1.

Environmental Quality 174-80 (3d ed. 2005); Gary Pierzynski, *Plant Nutrient Aspects of Sewage Sludge*, in *Sewage Sludge: Land Utilization and the Environment* 21 (C.E. Clapp et al., eds. 1994). In addition, the organic matter in biosolids improves soil structure, thereby enhancing movement of air, and increasing water retention and timely release of nutrients. *See* Michael J. McFarland, *Biosolids Engineering* 7.16-17 (2001). Land application of biosolids can also offer net greenhouse gas benefits by recycling carbon to the soil and fertilizing vegetation for further carbon dioxide capture.[6]

Biosolids also offer a sound alternative to chemical and manure-based fertilizers. Because manure is often untreated or is minimally treated before field application, it may pose a greater risk of transmitting pathogens or trace

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[5] *See also* Thomas W. Speir et al., *Composted Biosolids Enhance Fertility of a Sandy Loam Soil Under Dairy Pasture*, 40 Biology & Fertility of Soils 349, 349 (2004) (finding that annual biosolids application over a four-year period "enhanced soil fertility, productivity and microbial biomass and activity with no apparent adverse effects from heavy metals"); Brian J. Chambers et al., *Benefits of Biosolids to Soil Quality and Fertility*, 17 Water & Env't Journal 162 (2003) (finding that biosolids positively influenced the physical characteristics of soil and increased plant nutrients at seven sites in the U.K.).

organic constituents such as antibiotics to soil or humans. Pathogen concentrations are magnitudes higher in untreated manures than in biosolids and, unlike biosolids, pathogen concentrations in manures are not strictly regulated. Lynne H. Moss et al., *Comparing the Characteristics, Risks and Benefits of Soil Amendments and Fertilizers Used in Agriculture, 16th Annual Water Environment Federation Residuals and Biosolids Management Conference* 14 (2002).

B. Trace Metals and Chemicals in Biosolids

The presence of trace amounts of anthropogenic (man-made) organic chemicals in sewage sludge and the transfer of these materials to the soil environment through biosolids has been, and continues to be, the focus of considerable research. Yet, studies indicate that low environmental risk is associated with properly treated and land-applied biosolids. While WEF supports continued investigation of these and other concerns, to date,

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[6] Sally Brown & Peggy Leonard, *Biosolids and Global Warming: Evaluating the Management Impacts*, BioCycle, Aug. 2004, at 54, 58 (conducting a carbon accounting of the King County, WA, biosolids program and finding that "using biosolids as a substitute for commercial fertilizers results in a net savings in CO_2 for both agricultural and forest application sites," even without including the potential for biosolids to increase carbon reserves in soil).

research findings do not suggest it is necessary to deviate from current biosolids management practices.

Current biosolids programs mitigate the risk of contamination by anthropogenic chemicals. First, the Part 503 program places limits on the amount of biosolids that may be applied to the land, ensuring metal concentrations in both the soil and in plants grown on biosolids-amended soils do not exceed safe levels. Second, the trace chemicals that on occasion have been identified in biosolids have not been found in environmentally or toxicologically significant amounts. In addition, the trace amounts of these substances that may be present typically bind to soil constituents, limiting human exposure.

Further buttressing these safeguards are Clean Water Act provisions under which treatment facilities require pretreatment of industrial wastewater before it is discharged to sewers. Clean Water Act §§ 301(b)(2), 304(g) (33 U.S.C. §§ 1311(b)(2), 1314(g)). Pretreatment programs reduce or eliminate many hazardous chemicals entering the treatment facility, (influent) protecting biosolids quality. Pretreatment programs and a reduction in hazardous chemicals use in U.S. industry have resulted in a decline in metals concentrations in influent and biosolids. *See* National Ass'n of Clean Water Agencies (NACWA), *Biosolids Management:*

Options, Opportunities and Challenges 10-13 (2006) (case studies of reduction of metals in influent and biosolids in Los Angeles and greater Cleveland).

1. Trace Metals in Biosolids

An important focus of the Part 503 rule was to assess the constituents in biosolids that could pose a risk and whether the risk could be adequately controlled. After reviewing over 200 specific compounds and elements from an initial candidate list of thousands, EPA targeted at least 22 constituents for a formal risk assessment to examine the quantities of the chemicals in biosolids, their toxicity, routes of potential exposure to humans and the environment, and many other factors. The risk assessment ultimately determined that limits were advisable for nine trace elements (arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc), primarily to protect against toxic effects to plants and entry into the food chain. *See* EPA, A *Guide to the Biosolids Risk Assessments for the Part 503 Rule* (1995). As discussed, Part 503 places limits on the amount of these nine metals in biosolids and, for non-EQ quality biosolids, requires measurement of their cumulative loading in soils. 40 C.F.R. § 503.17 (2008). Finally, in developing the Part 503 regulations, EPA studied exposure pathways and placed additional conservative use and access

restrictions on land application sites to protect the public health.

Subsequent research has validated Part 503's conclusion that there is no appreciable risk from trace metals in biosolids that are properly managed through compliance with Part 503 and use of best practices. Metals become attached to soil colloids and in fact some researchers report metals become less bioavailable with time.[7] Ian Pepper et al., *Environmental and Pollution Science* 459 (2nd. ed. 2006) ("[C]oncern over the potential public health hazard with regard to metals has decreased . . . . An 'aging' effect has been observed for metals, in which bioavailability is observed to decrease with time.") The California EIR concluded in 2004 that "[a]s long as source control programs are effective at keeping metals levels in biosolids below the EPA Part 503 limitations and the provisions of the [General Order] regarding application rates (annual and cumulative or ceiling limits) are enforced, the risk of increased disease resulting from the presence of trace

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[7] *See also* R.Y. Surampalli et al., *Long-term Land Application of Biosolids—A Case Study*, 57 Water Sci. & Tech 345, 349 (2008) (finding "the cumulative metal loading rates after 10 years of biosolids application were far less than USEPA limits") Gregory Evanylo et al., *Bioavailability of Heavy Metals in Biosolids Amended Soil*, 37 Comm'n in Soil Sci. & Plant Analysis 2157, 2163 (2006) (finding that crops grown in biosolid-amended soils had higher metal concentrations than a control, but that metal concentrations in all plants were within the values observed for uncontaminated soils); Rufus Chaney, *Trace Metal Movement: Soil-Plant Systems and Bioavailability of Biosolids-Applied Metals* in *Sewage Sludge: Land Utilization and the Environment* (1994).

metals should be low and there will be no significant impact on public health." California EIR 2004 at 5-42

2. Trace Chemicals in Biosolids

As analytical techniques for measuring trace concentrations of organic chemicals becomes increasingly sensitive and widely used, biosolids will likely be found to contain low amounts of compounds that may give rise to scientific interest and public concern. *See generally* Water Environment Federation, *Microconstituents in Biosolids Technical Practice Update* (2007) (surveying literature identifying trace amounts of pharmaceuticals, flame retardants, plastics, fragrances, and other materials in biosolids). The ability to detect trace amounts of these chemicals, however, does not signify the existence of a risk that calls into doubt current biosolids management practices.

For example, recent attention has focused on compounds that may affect the endocrine system. These compounds may be present in pharmaceuticals, personal care, and other consumer products. If present in wastewater, these compounds may be removed or degraded during wastewater treatment.[8] Some of these may also partition to the solids and be

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[8] *See* Epstein, *supra*, at 89 (2003) ("[T]ransformation to biosolids can significantly reduce the level of organics.").

present in biosolids, but studies have concluded that this occurrence is not indicative of an appreciable risk to humans. Epstein, *supra*, at 97 ("The relative risk from organic chemicals in biosolids has been shown to be minimal . . . ."); *see also* NRC, *Biosolids Applied to Land* (2002), *supra*, 172 ("Despite the evidence of the toxic potential of BDEs [brominated diphenyl ethers] . . . current human dietary intakes of BDEs [from biosolids in food chain] were a million times lower than the lowest-observed-adverse-effect levels in animal studies.") and at 174-76 (observing that "there have been increasingly frequent reports of pharmaceuticals detected in wastewater treatment effluent or surface water in trace concentrations," but concluding that "there is not adequate evidence that pharmaceuticals are likely to occur in biosolids at concentrations sufficient to warrant their inclusion in a biosolids risk assessment").

Similarly, the 2004 California EIR noted that without a credible exposure route from biosolids to human populations, risk can not be established: "No data are available that can be used to relate any type of biosolids-related exposure to any occupational or consumer-related exposure to chemicals that could be meaningfully interpreted. Further investigation would require an expenditure and work effort that are not warranted by the

low risk . . . ." California EIR, *supra*, at 5-18. A 2005 literature review on the issue of trace contaminants concluded that "[b]ecause of the capacity of land-based systems to buffer the potential toxic effects of waste-associated organic contaminants and to contribute to their assimilation into the soil, the majority of studies conclude that they pose little or no risk to the environment when applied appropriately." Michael Overcash et al., *Beneficial Reuse and Sustainability: The Fate of Organic Compounds in Land-Applied Waste*, 34 J. Envtl. Quality 29, 30 (2005).

C. Pathogens in Biosolids

The possibility that pathogens can survive in biosolids and infect individuals living near land application sites has been a source of scientific inquiry for many years, and it remains an important area of research.[9] In the Part 503 rulemaking, EPA studied and approved specific sewage sludge treatment technologies to produce biosolids with quantifiable reductions in pathogen loads. Research has continued to validate this technology-driven approach and shows low risk for the transmission of pathogens from land application sites to surrounding residents. To link living near a biosolids

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[9] For example, Water Environment Research Federation (WERF) is working on risk assessment methodologies for biosolids pathogens. *See also* Suresh D. Pillai, *Bioaerosols from Land-Applied Biosolids: Issues and Needs*, 79 Water Env't Research 270 (2007) (calling for additional research on the

application site to human illness, one must demonstrate both the existence of human pathogens in biosolids and exposure to those pathogens. Studies on the relationship between land application of biosolids and illness have not found such a link.

The conclusion that application of biosolids utilizing best management practices poses negligible health risks from pathogens is based on scientific understanding about pathogen survivability in the environment. Pathogens are enteric organisms that prefer and need the conditions inside the human body to thrive. Many pathogens do not survive passage through the collection and treatment system and through the additional treatment processes that further disinfect solids and effluent. Raina M. Maier et al., *Environmental Microbiology* 512-13 (2000). As established by Part 503, treatment of biosolids to Class B or Class A (and particularly Class A) standards eliminates 99% or more of the pathogens that may exist in biosolids. EPA, *Control of Pathogens and Vector Attraction in Sewage Sludge* 43-50 (1999; rev. 2003) (discussing two-log (over 99%) reductions in organisms in Class B biosolids).

In addition to treatment, and perhaps most importantly, conditions existing in farm fields and outdoor environments generally lead to rapid die-

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potential dispersal and health risks of pathogens from biosolids).

off of surviving pathogens. This is particularly true in hostile climates such as those found in the arid southwest, including Kern County. Pathogens perish rapidly because they cannot compete with native soil microorganisms for food.[10] In addition, pathogens are inactivated or made non-infectious by desiccation, ultraviolet light, and heating of the soil.[11]

Finally, before there can be a disease risk, the pathogens must reach a human receptor in an amount sufficient to trigger infection. Recent studies have examined the potential for off-site transportation of biological agents at a number of land application sites. A 2005 U.S. study surveyed bioaerosol emissions at 10 different land application sites with a variety of biosolids application methods and environmental conditions. Applying quantitative

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[10] *See, e.g.*, Kathleen J. Zaleski et al., *Potential Regrowth and Recolonization of Salmonella and Indicators in Biosolids and Biosolid Amended Soil*, 71 Applied and Envtl. Microbiology 3701 (2005) (pathogens such as *Salmonella* did not regrow in biosolids amended soil); John P. Brooks et al., *Occurrence of Antibiotic-Resistant Bacteria and Endotoxin Associated with the Land Application of Biosolids*, 53 Can. J. Microbiology 616, 619-621 (2007) (finding "biosolids did little to alter the overall concentrations of antibiotic resistant bacteria" or endotoxic concentrations in a biosolids land-applied field).

[11] *See* N.L. Lang et al., *Field Investigations on the Survival of Escherichia coli and Presence of Other Enteric Micro-organisms in Biosolids-amended Agricultural Soil*, 103 J. of Applied Microbiology 1868, 1878 (2007) (finding "agricultural utilization of sewage sludge is very unlikely to pose a microbiological risk to health from disseminating Salmonella in the environment and the risks to health from enteroviruses in sludge are also very small . . . .").

microbial risk assessment techniques to the sampling results, researchers found minimal risk to downwind residents (*e.g.*, the risk of infection from aerosolized *Salmonella* to a person living 30.5 meters from the site was 3.6×10^{-7}).[12] John P. Brooks et al., *A National Study on the Residential Impact of Biological Aerosols from the Land Application of Biosolids*, 99 J. of Applied Microbiology 310, 318 (2005); *see also* John P. Brooks et al. *Estimation of Bioaerosol Risk of Infection to Residents Adjacent to a Land Applied Biosolids Site Using an Empirically Derived Transport Model*, 98 J. Appl. Microbiology 397 (2005). Other studies examining bioaerosols and risk have similarly concluded that nearby residents are unlikely to be exposed to infectious agents in any significant quantities where land application is conducted in compliance with regulations and accepted best management practices.[13] Although bacterial aerosols may exist in the

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[12] This translates to an infection risk of 3.7 in ten million; most environmental regulations guard against risk to the level of one in 100,000 or less.

[13] Patricia A. Rusin et al., *Evidence for the Absence of* Staphylococcus aureus *in Land Applied Biosolids*, 37 Envtl. Sci. Tech. 4027, 4029 (2003) (detecting no *Staphlyococcus aureus* in Class A biosolids, Class B biosolids, or aerosols obtained during biosolid application, but finding it did exist in untreated sewage samples and undigested primary sewage sludge); John P. Brooks et al., *The Measurement of Aerosolized Endotoxin from Land-Application of Class B Biosolids in Southeast Arizona*, 52 Can. J. Microbiology 52:150–156 (2006); John P. Brooks et al., *Bioaerosol Emission, Fate and Transport From Municipal and Animal Waste*, 1 J. Residuals Sci. & Tech. 15 (2004).

ambient air, researchers have further concluded that in arid climates (like Kern County) most bacterial aerosols that come from fields may not be from biosolids sources. Rather, they found that naturally occurring, on-site soil microbes contributed most of the bacteria that were measured in their study. John P. Brooks et al, *Diversity of Aerosolized Bacteria During Land Application of Biosolids* 103 J. Applied Microbiology 1779 (2007); *see also* Tania Paez-Rubio et al., *Particulate Matter Composition and Emission Rates From the Disk Incorporation of Class B Biosolids into Soil,* 40 Atmospheric Env't 7034, 7039 (2006) (finding that endotoxin counts downwind from disking operations at a biosolids-amended field and a control field disked without biosolids were largely the same). Microbial risk assessment and control remains a priority for the scientific community, however, and pathogen-related issues continue to be closely monitored.[14]

An important 2008 literature survey of pathogen research concluded:

> The overall conclusion we have reached based on all of our land-application studies over the past two decades and an in depth review of other relevant land application studies is that land-application of Class B biosolids is sustainable. Specifically, the risks to human health posed by many microbiological entities within biosolids have been shown to be low if current EPA regulatory guidelines are followed. In addition, risks from indirect exposures such as aerosolized

[14] For example, WERF is studying pathogen reactivation and regrowth.

pathogens or contaminated groundwaters appear to be particularly low.

Ian Pepper, Huruy Zerzghi, John P. Brooks, and Charles P. Gerba, *Sustainability of Land Application of Class B Biosolids*, J. of Envtl. Quality (*In Press*). This conclusion is consistent with the practical experience in the wastewater treatment sector where exposure to biosolids has not been associated with illness.[15]

D. Groundwater, Runoff and Biosolids

Like any nutrient-rich fertilizer, biosolids should only be applied in ways that minimize risk of leaching of nutrients or other constituents to groundwater or runoff to nearby surface waters. Current land application programs have been successful in minimizing these risks through regulation and best management practices.

The Part 503 rule limits the amount of biosolids that can be applied to a field to the amount needed to meet the nitrogen requirement of the crop grown (commonly referred to as the agronomic rate). 40 C.F.R.

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[15] Studies demonstrate that workers at wastewater treatment facilities, highly exposed to untreated sewage and biosolids, do not have significantly higher rates of illness than similar unexposed workers. California EIR (2004), *supra*, at 5-19 ("Studies of the incidence of disease among wastewater personnel have indicated that they have no greater incidence of disease than the population in general."). Similarly, no differences have been found in the health of farm families from farms using biosolids compared to the health of families on farms not using biosolids. *Id.*

§§ 503.11(b), 503.14(d) (2008). Part 503 also mandates a 10 meter setback from waterbodies; biosolids may not be applied in this area. 40 C.F.R. § 503.14(c) (2008). More importantly, states typically require site-specific data on proposed land application sites so that sites with shallow water tables or inappropriate soils will be precluded.[16] Other state requirements such as maximum slopes, prohibition on application during significant precipitation, and bans on biosolids application on standing water or wetlands strengthen these protections. Also, biosolids may be incorporated into the soil as part of the land application process, further reducing the potential for runoff from fields. Federal and state requirements for biosolids are significantly more stringent than the controls over the use of chemical fertilizers and manures. In many cases, untreated manure and chemical fertilizers may legally be applied in the setback areas where biosolids land application is prohibited.

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[16] The extent to which biosolids affect groundwater or surface water quality depends upon "a wide range of factors, including climate, topography, land use, soil characteristics, and the chemical composition and application rate of the biosolids" and therefore requires case-by-case analysis. Kathryn J. Draeger et al., Water Env't Research Found., *Watershed Effects of Biosolids Land Application: Literature Review* 2-8 (1999). This is true of any fertilizer. *Id.*

Research on the leaching potential of biosolids has validated the success of the regulatory and management practices described above. The Part 503 risk assessment considered potential contamination of shallow groundwater as an exposure pathway for at least 22 chemicals and metals that underwent a risk assessment. Generally, metals in the biosolids bind and are immobilized in the crop's root zone, decreasing the likelihood of leaching. Long-term studies have confirmed the lack of impacts on safety of groundwater at properly managed sites. *See, e.g*. Draeger et al., *supra*, at 3-13 (1999,) (reporting that, after 20 years of land application, tests of deep wells at an agricultural research site demonstrated no evidence of nitrate leaching and negligible fecal coliform concentrations). A 4-year study by the U.S. Geological Survey (USGS) of Denver Metro Wastewater Reclamation District land application sites measured the effects of the application of Class B biosolids on the nutrient and metal content of soils, groundwater, and surface waters. USGS found that "soil data indicated that biosolids have no measurable effect on the concentrations of constituents monitored." Tracy J.B. Yager, et al., USGS Scientific Investigations Report 2004-5289, *Effects of Surface Applications of Biosolids on Soil, Crops, Groundwater, and Streambed Sediment Near Deer Trail, Colorado, 1999-2003* 1 (2004). Further, the study did not establish any adverse biosolids-

related effects on soils, crops, or groundwater on or near the biosolids application site. *Id.* at 59-61.

Further, leaching to groundwater and off site transport of pathogens from properly managed land application sites is not a significant risk according to a recent survey of the literature. Ian Pepper et al., *Sustainability of Land Application of Class B Biosolids,* J. Envtl. Quality (*In Press*) ("[G]roundwater contamination from land-application of biosolids does not appear to be likely other than in areas where karst soils predominate with the potential for preferential flow.").

E. Odors

No data have shown that odors from biosolids can cause toxicological effects on individuals.[17] The human sense of smell detects and registers

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[17] *See* Paul Chrostowki & Sarah Foster, *Odor Perception and Health Effects*, 76th Annual Water Environment Federation Technical Exhibition and Conference Workshop (2003). A 2004 literature review of the health effects of odors from municipal wastewater operations presented five reasons to conclude that odors do not cause illness: (1) odors do not cause signs of illness in healthy individuals; (2) odor acceptability varies with circumstances of exposure and the meaning people associate with the exposure (3) below toxic levels of exposure, symptoms associated with odors involve no pathology; (4) symptoms are reduced almost immediately when the source of an odor is removed; and (5) nonphysical variables, such as anxiety and stress, seem to mediate symptoms from odors. William S. Cain and J. Enrique Cometto-Muñiz, Water Env't Research Found., *Identifying and Controlling Odor in the Municipal Wastewater Environment* 6-1 (2004).

odor based on a compound's concentration that is far below the amount needed to trigger a health impact on an individual.[18] Most odors in biosolids are caused by sulfur compounds that only cause toxic effects in concentrations vastly greater than that which triggers a smell. Any gases with a possible toxic effect simply are not present in biosolids in concentrations that anyone living near a land application site would be exposed to them in dangerous amounts. Though there have not been observed health risks, good BMPs and site and process-specific stabilization or vector attraction reduction criteria are essential. Accordingly, local agencies invest significant resources for odor control.

IV. CONCLUSION

Decades of successful land application experience and numerous studies demonstrate that biosolids recycling is a sound practice. There is no evidence in properly conducted scientific studies that land application performed pursuant to Part 503, state requirements, and in accordance with accepted best management practices poses any danger to public health or the environment. Kern County's Measure E banning land application was not

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[18] *See* Pamela Dalton, *Odor, Irritation and Perception of Health Risk* 75 Int. Arch. Occup. Envtl. Health 283, 285 (2002) (observing that "for a number of chemicals for which odor and irritancy thresholds have been established, the distance between these two thresholds appears to be fairly large").

science-based and, if allowed to stand, could encourage similar unfounded efforts and inhibit an environmentally beneficial practice.

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Certificate of Compliance Pursuant to Fed. R. App. P. 29(d), 32(a)(7)(C) and Circuit Rule 32-1 for CA Case No. 07-56564 (DC No. 06-5094).

I certify that:

Pursuant to Fed. R. App. P. 29(d), 32(a)(7)(C) and Ninth Circuit Rule 32-1, the attached brief is proportionately spaced, has a typeface of 14 points or more and contains 6951 words, according to the word-processing system used to prepare it.

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