Biosolids Primer
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Agriculture is, by necessity, an aerobic process and environment. Land application of biosolids will **never** result in an anaerobic environment which could generate methane. An anaerobic environment could only be created if an application was so heavy that no oxygen transfer could occur. Given the application rate requirements mentioned below, this is impossible for a biosolids application. No crop, other than rice, can survive and thrive in an anaerobic environment.

In short, biosolids must meet stringent requirements in four areas in order to be land applied. This includes **pathogen destruction** for which there are multiple treatment options that can be employed. Examples are:

Class A = non-detection of fecal coliform or salmonella and process control requirements such as treatment at a certain temperature (thermophilic) for a prescribed amount of time.

Class B = greatly reduced but still detectable levels of fecal coliform through either measurement or process control such as treatment at a certain temperature (mesophilic) for a prescribed amount of time (minimum of 15 day mean cell residence time at prescribed temperatures) plus restrictions at the site related to time between application and harvest, public access, setbacks from waterways, etc. Class B treatment plus the site restrictions and management requirements equals the same level of protection as Class A.

Vector Attraction Reduction (VAR)

Requirements also includes **vector attraction reduction (VAR)**, which ensures the biosolids will not be an attractive source of food for any potential disease carrying organisms such as rodents, birds, etc.

There are a variety of options that can be used to demonstrate compliance with this requirement and they are largely dependent on the type of treatment used by the wastewater plant. For example, if anaerobic digestion is the means used for pathogen destruction, then the VAR is generally satisfied by reducing the volatile solids content by at least 38 percent. It should be noted that for Class A pathogen control, the VAR requirements which are based on process control, must be met at the same time or following the Class A process.

Pollutant Concentrations

Risk based requirements are also set for **pollutant concentrations**. EPA began with a list of 400 potential pollutants for regulation. They narrowed it to roughly 200 for further evaluation and finally 50 for which a health hazard index (HI) was calculated. If a HI was greater than one, a full risk assessment (RA) was conducted. A conservative RA was executed for 25 pollutants and nine of them were determined as necessary to regulate. The risk-based values were established as concentrations allowed in the biosolids below which no adverse lifetime impacts would result. These are termed the high quality (HQ) concentrations which virtually every wastewater plant in California meets. This high quality is largely due to the success of the pretreatment program which was developed in the 1980's and which limits the amount of pollutants which industry can discharge to the wastewater plants. There are also ceiling concentrations established above which land application is not allowed. For biosolids with any concentration between the HQ and ceiling limits, cumulative loading to each site must be calculated and

maintained and application cease when the cumulative loading rate is reached. This limit is never in practicality going to be reached because of the effectiveness of pretreatment and the management practices at POTWs. In addition, USEPA conducts a biennial review to determine if new constituents of concern need further evaluation or if new science would indicate if any previously dismissed pollutants warrant further review.

Site and Nutrient Management

The final area of regulation is on **site and nutrient management**. Application rates are limited to the nitrogen need of the crop to be grown and all sources of nitrogen must be considered. Thus if a crop needs 200 pounds of nitrogen per acre, the plant available nitrogen in the biosolids is calculated (NH4 + the mineralized portion of the organic nitrogen -- usually about 25% of organic N becomes available to the crop in the first year). Any nitrogen in commercial fertilizer or manure which may also be applied must also be calculated and accounted for in setting the application rate.

Decades of practice and research have demonstrated the multiple benefits of biosolids application. Biosolids increases soil organic matter (carbon sequestration), improves soil tilth, increases water holding capacity (and thus reduces the need to irrigate), and increases crop production. For further information, refer to this Statewide Programmatic Environmental Impact Report and General Order. The PEIR is a comprehensive evaluation and endorsement of regulations and the science on which they were based and the General Order implements them.

This paper describes a greenhouse gas emissions calculator that was adopted by the Canadian Government and illustrates the benefits of biosolids through carbon sequestration and the avoidance of fossil fuel based fertilizer. Note that almost a quarter gallon of fossil fuel is required to produce every pound of inorganic nitrogen. There were also two National Academies of Science reports which evaluated the use of biosolids and the regulations which govern them. Both concluded that biosolids are safe for use on food production and other agricultural products and that the regulations were developed comprehensively. There was acknowledgement that, like any environmental regulation, they must be dynamic and continually evaluate new science and findings and be revised accordingly. Such is the purpose of the biennial reviews. Read the 2002 National Academy of Science Biosolids and Use of Reclaimed Water Sludge in Food Production reports for more information.