SOLANO COUNTY

2017 ANNUAL BIOSOLIDS LAND APPLICATION REPORT

Prepared by:

Jag Sahota, Environmental Health Manager
Matthew Geisert, Hazardous Materials Supervisor
Jeffrey Bell, Sr. Environmental Health Specialist, Acting Supervisor
Misty Kaltreider, Geologist
Anthony Endow, Environmental Health Specialist

Presented to the Board of Supervisors: March 13, 2018

2017 Annual Biosolids Land Application Report

Executive Summary

Exhibit I: 2017 Registered Biosolids Land Application Sites in Solano County

Exhibit II: Quantities and Acreages of Biosolids Land Applied 2002-2017

Exhibit III: Percentage Breakdown of Biosolids Land Applied by Generator

Exhibit IV: 2017 Biosolids Heavy Metal Analyses

Exhibit V: 2017 Protests, Complaints, and Comments Received

Exhibit VI: Stakeholders Group Meetings Summary

Exhibit VII: Biosolids Research Summary

Exhibit VIII: Biosolids Industry Update

Exhibit IX: Other Agency Report Summary

Attachments

A: Biosolids Research Report,

B: Bay Area Clean Water Agency Report

2017 Annual Biosolids Land Application Report

EXECUTIVE SUMMARY

Solano County Department of Resource Management provides this annual summary report documenting activity conducted during the 2017 biosolids land application season (April 16 through October 15, 2017) as required by Chapter 25 of the Solano County Code. Work performed by Solano County staff related to the land application of biosolids included: conducting stakeholder meetings, performing field inspections, responding to questions and complaints from the public and sampling of biosolids material for heavy metal analysis. Staff reviewed notifications and required reporting information prior to and during land application work. The Biosolids Research Report and the 2017 Bay Area Clean Water Agencies Report are attached.

Attachment A includes the Biosolids Research Report, *Assessment of the Agronomic Effects and Potential Carbon Sequestration Associated with Biosolid Applications on Rangelands in Solano County*, prepared by Blankenship and Associated, Inc. dated November 13, 2017. The Biosolids Research Report documents findings from the County funded 8-month field research project conducted in December 2015 through August 2016 to quantify agronomic effects, potential carbon sequestration, and determine the fate or movement of trace metals from land-applied biosolids in Solano County.

Attachment B includes the 2017 Bay Area Clean Water Agency Report summarizing the biosolids generator's progress toward evaluating alternative use technologies for biosolids.

Recommendations: The Department of Resource Management recommends no changes to the Solano County Code, Chapter 25 as the code is protective of public health and the environment.

Acres, Tonnages, and Sources: During the 2017 biosolids land application season, 1,080 acres of pasture and rangelands in Solano County received 6,239 calculated dry tons of class B biosolids as a soil amendment. Maps 1 and 2, presented in Exhibit I illustrates the location of fields registered for land application (Map 1), and the sties that were applied in 2017 (Map 2). A graph summarizing the historic and current tonnage quantities received and areas applied from 2002 through 2017 is presented in Exhibit II.

Biosolids were supplied by nine regional generators including: Calistoga, Central Marin Sanitation District, Delta Diablo, East Bay Municipal Utility District, Ironhouse, San Francisco (two sites – San Francisco Southeast and San Francisco Oceanside Treatment Works), Union Sanitary District, and the City of Windsor. Exhibit III illustrates the percentage of biosolids received from each generator in 2017.

Chapter 25 requires the applicators to notify the Environmental Health Division prior to bulk application of biosolids compost. During the 2017 season, no notices of bulk application of biosolid compost were received by the Environmental Health Division.

Staffing: During the 2017 biosolids land application season, staff conducted 15 field inspections at the land application sites. Staff spent 179 hours reviewing applications, performing inspections, reviewing reports, responding to public comments, requests for information and complaints, preparing and facilitating the biosolids stakeholder meetings, reviewing current industry trends, overseeing and evaluating research project work, and preparing this annual biosolids summary report.

Monitoring and Reporting: Prior to approving the receipt of biosolids from a generator source, biosolids samples must be analyzed for heavy metal concentrations and compared to the US EPA Part 503 acceptance criteria. Only biosolids that are within the Class B Part 503 heavy metal concentration criteria are accepted for land application in Solano County. In addition, Solano County staff collects field samples of the biosolids material received for heavy metal comparison analysis. The analyzed biosolids samples collected from each generator and collected by Solano County Staff were all below Class B threshold limits established by the Part 503 Federal regulations for heavy metals. Exhibit IV discusses and illustrates the biosolids heavy metal analyses performed.

During field application, a field weather station was used at each land application site to measure wind speed and duration. Precipitation was also monitored by visual inspection and through daily weather reports. Based on the data reviewed, wind speed did not exceed 25 mph for a period of 60 minutes during land spreading activity.

Protests and Complaint Investigations: Solano County Code Chapter 25 allows for the opportunity to submit a protest by an adjacent resident to a field proposed for biosolids land spreading. No protests were filed during the 2017 biosolids land application season for the applied fields.

In 2017, four complaints were received and investigated. All complaints were regarding odors, and were found to be attributed to the application of injectable fertilizer, produced by Lystek. No odor complaints were attributed to biosolids land spreading activities. Exhibit V provides additional details regarding complaint investigations.

Biosolids Stakeholder Group Meetings: The Biosolids Stakeholder Group met once in 2017, on December 13, 2017. The meeting summary is presented in Exhibit VI.

Solano County Research Study: Under contract awarded by the Solano County Board of Supervisors in 2015, Blankenship and Associates, Inc., an independent consulting firm, conducted an 8-month (December 2015 through August 2016) field research study project in Solano County. The research contract was paid through the Biosolids Education and Research Trust Fund fee of $15.00 for every acre land applied with biosolids in Solano County. The project goal was to identify general trends in soil and forage chemistry that may be attributed to the application of biosolids on non-irrigated rangelands in Solano County.

Findings from the study demonstrated short-term benefits through increased forage growth that allowed for higher density of animal grazing on lands that were applied with biosolids compared to non-biosolids applied rangeland soils. Long-term multi-year monitoring and research was recommended to further evaluate and quantify the cost effectiveness and benefits of land application of biosolids versus other soil augmentation processes such as blending and composting. Cost benefits of disposing biosolids into landfills versus land application of biosolids were also considered for comparison. A summary of the study findings is presented in Exhibit VII. The report, *Assessment of the Agronomic Effects and Potential Carbon Sequestration Associated with Biosolid Applications on Rangelands in Solano County*, prepared by Blankenship and Associates, Inc. dated November 13, 2017 is included as Attachment A.

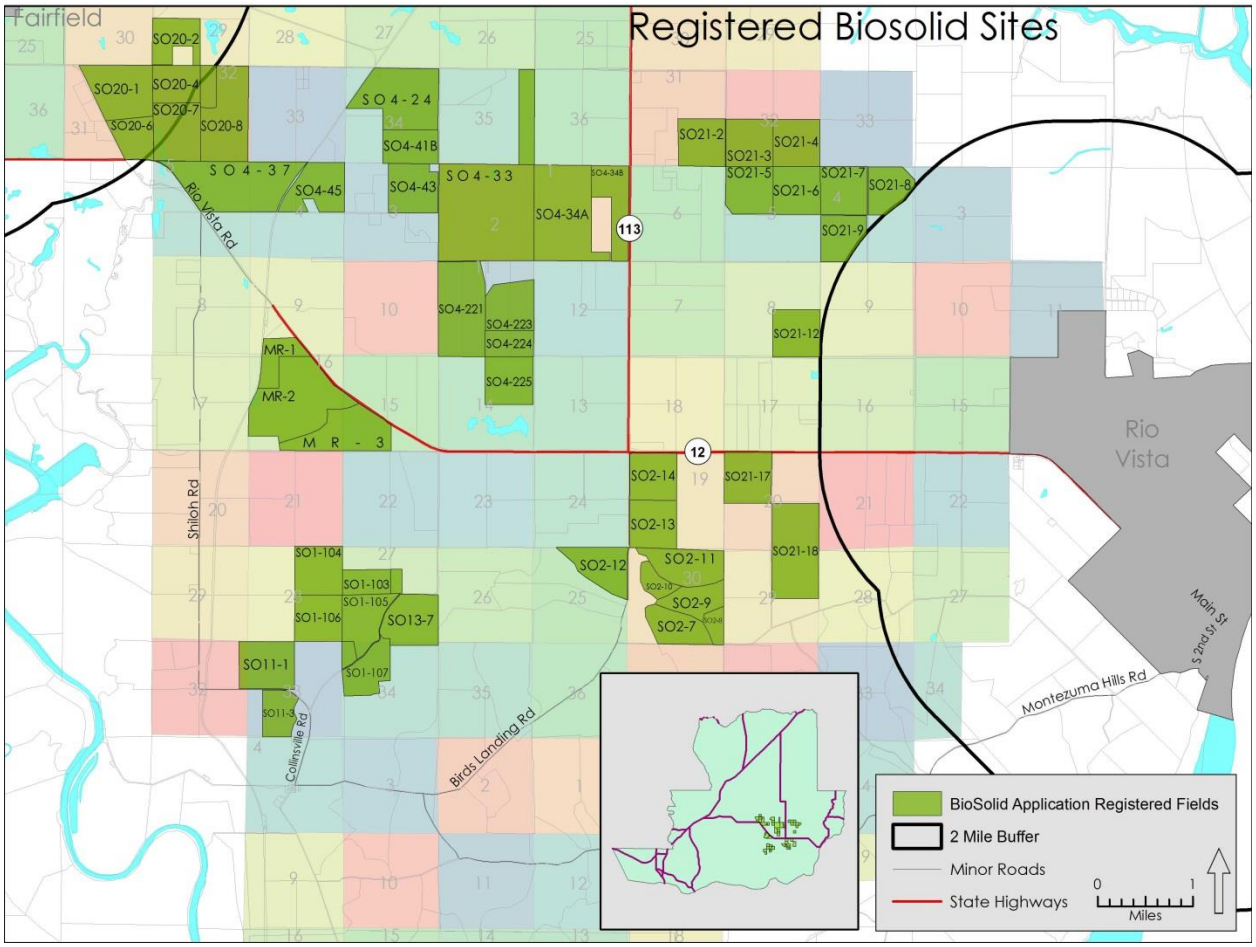
Biosolids to Fertilizer Industry Update: Canadian based Lystek Company continues operation of the Organic Materials Recovery Center at the Fairfield-Suisun Sewer District. Operational start-up occurred in August of 2016. The Public-Private Partnership utilized the

former lime stabilization building located within the Fairfield-Suisun Sewer Treatment Plant grounds as the Lystek Organic Material Recovery Center. A twenty year agreement is in place for this Public-Private partnership. Lystek is producing a biosolids-derived fertilizer product licensed by the California Department of Food and Agriculture. The fertilizer product is in liquid form and applied by shallow subsurface injection into the soil matrix. As a licensed fertilizer product subject to oversight by the Department of Food and Agriculture, it is by definition, not biosolids compost and not regulated under Chapter 25. Additional details are presented in Exhibit VIII.

Other Agency Reports – Bay Area Clean Water Agency Report: In accordance with Solano County Code, generators that provide biosolids for land application in Solano County are required to present a summary of material supplied and an update on each agency's efforts toward developing alternative energy sources and uses of biosolids. The Bay Area Clean Water Agency has completed the Land Application of Biosolids in Solano County Report (BACWA), which included information from The 2016 Biosolids Trends Survey Report (Trends Report). The Trends Report tracks and compares costs for specific data trends published for the participating supplier agencies. An electronic link to the Trends Report is provided in the text of the Land Application in Solano County Report. Based on the December 2017 annual BACWA report, all generators that provided biosolids to Solano County for land applications have either participated in biosolids-to-energy programs to develop alternative biosolids/energy options or are diverting a portion of their generated biosolids to Class A material. A summary of the report is provided in Exhibit IX. The complete BACWA report is provided in Attachment B.

EXHIBIT I –Registered Field Sites in Solano County - 2017

Map 1 – Registered Biosolid Land Application Fields



The above map illustrates the locations of all currently registered biosolids sites in Solano County. All registered sites are a minimum distance of two miles or more from City of Rio Vista city limit designation. There are a total of 7,742 acres registered by field, allowing this acreage for the land application of biosolids included in the following seven ranches:

Ranch Name and ID	Corresponding Fields	Total Acreage
Emigh Ltd Ranch (S0-4)	SO4-24,33,34,37,41,42,43,45,221,223,224,225	2605 acres
Anderson Ranch (S01)	SO1-101,102,103,104,105,106,107	1506 acres
Zadwick Ranch (S011)	SO11-1,3	212 acres
Peterson Ranch (S020)	SO20-1,2,3,4,5,6,7,8	1084 acres
Mayhood Ranch (MR)	MR-1,2,3	736 acres
Hamilton Ranch (S02)	SO2-7,8,9,10,11,12,13,14	910 acres
McCormack Ranch (S021)	SO21-7,8,9,12,17,18	689 acres
Total Acres Registered for Biosolids Applications		**7742**

Synagro is coordinating with this office and the Central Valley Regional Water Quality Control Board to modify the McCormack Farms registration to include five new fields for a total of 800 additional acres.

Map of All Active Biosolid Land Application Sites in Solano County – 2017

The below map (Map 2) illustrates the location of the fields utilized during the 2017 biosolids land application period (April 15 through October 15, 2017). These fields belong to sites registered by Emigh Limited Ranch (SO4) and McCormack Ranch. Site inspections were conducted before, during, and following biosolids land applications.

Map 2 – 2017 Active Biosolid Land Application Sites

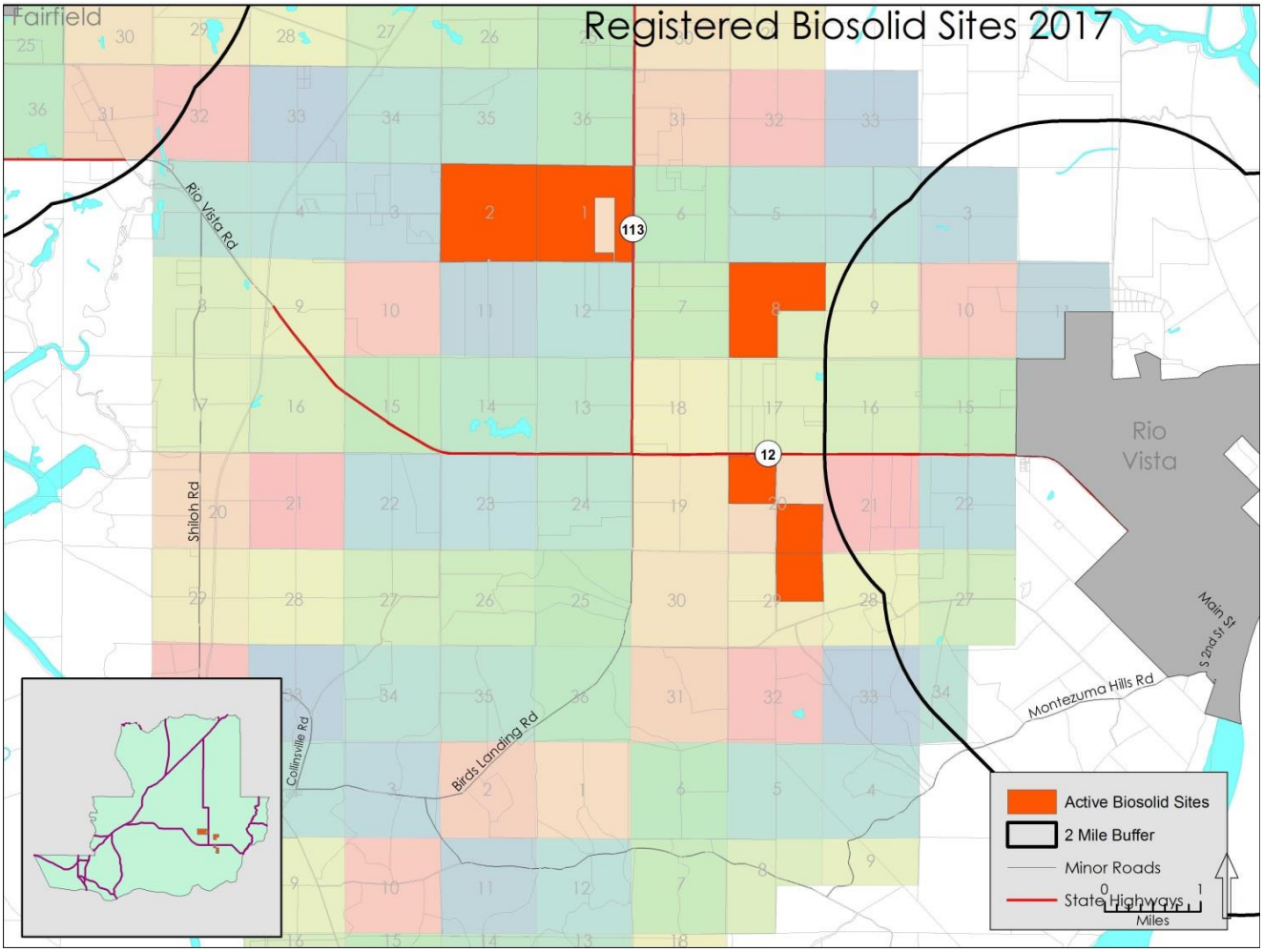


EXHIBIT II – Applied Quantities and Acreage of Land

A total of 1,080 acres of farmland received 6,239 calculated dry tons of Class B biosolids as soil amendments in 2017, which is a 14% decrease in tonnages when compared to 2016. The total acreage that biosolids were land applied decreased 27% compared to 2016. The previous five years of land application averaged 6,408 dry tons per year.

The below graph illustrates the historical and current annual amounts applied compared to the applied acreage since 2002. The most biosolids applied in a single year was in 2002 (18,697 dry tons) compared to 4,965 dry tons received in 2013 when the least amount of material was land spread. In general, the trend of biosolids land spread in Solano County have decreased over time, with the annual amount of land applied material averaging 6,408 dry tons over the last five years.

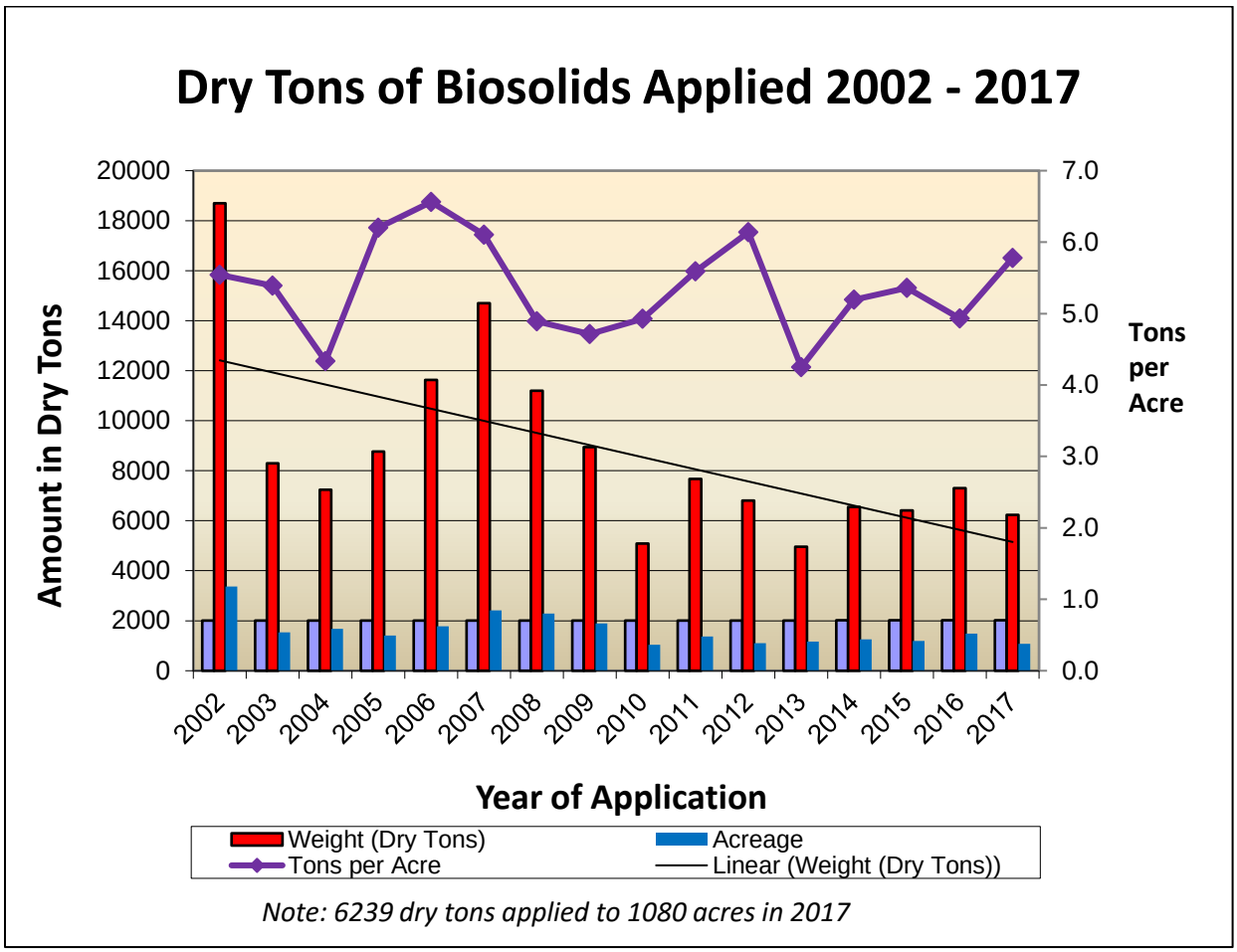
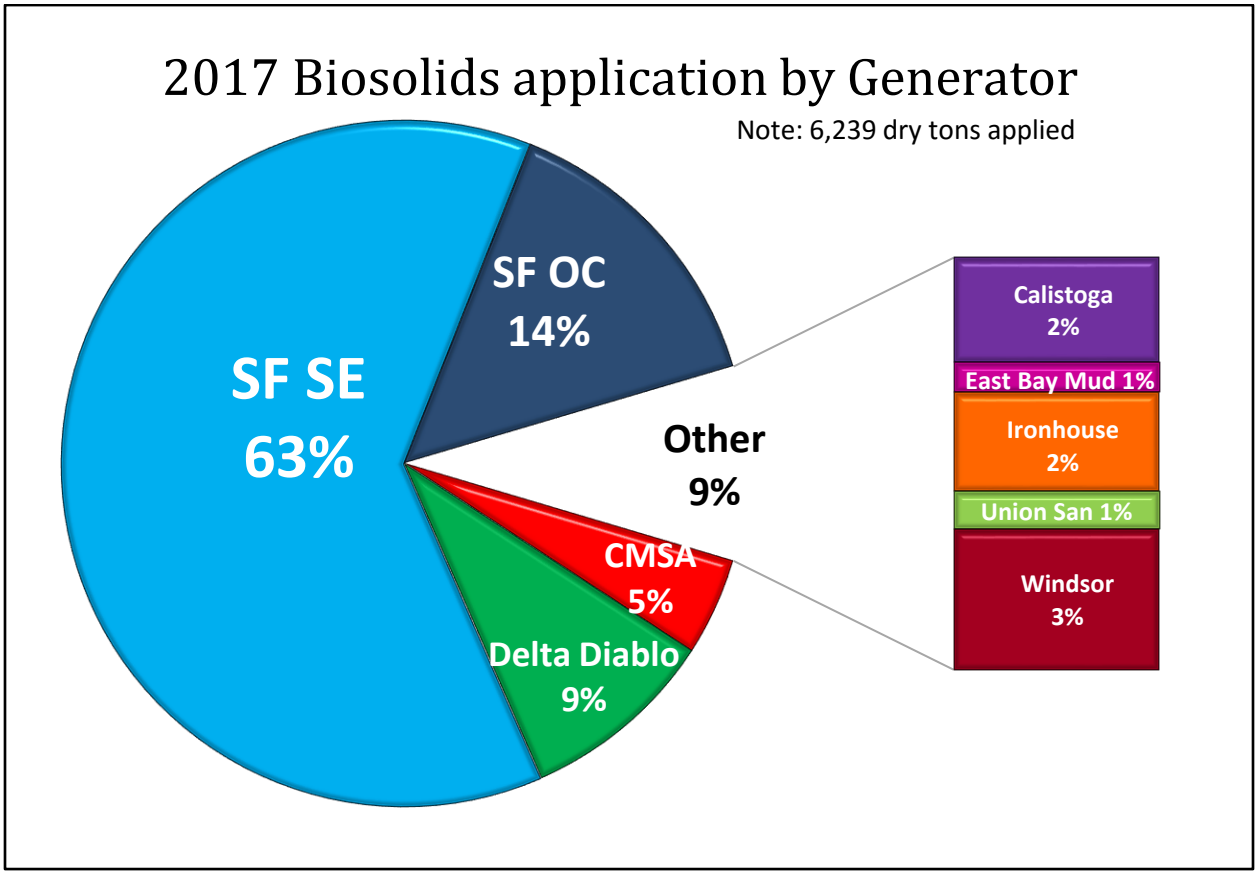


EXHIBIT III – Generators and Percent of Biosolids Land Applied in Solano County in 2017

In 2017, nine generators provided biosolids for land application in Solano County. The below graph illustrates the percentage of biosolids provided by each of these generators.

The generators that provided biosolids for land application in 2017 included: Calistoga, Central Marin Sanitation District, Delta Diablo, East Bay Municipal Utility District, Ironhouse, San Francisco (two sites – San Francisco Southeast and San Francisco Oceanside Treatment Works), Union Sanitary District, and the City of Windsor.

The two San Francisco Public Utilities Districts (San Francisco Oceanside and San Francisco Southeast) together accounted for approximately 77% (4,803 calculated dry tons) of the total biosolids received during the 2017 season.



Notes:
SF SE = San Francisco Southside
SF OC = San Francisco Oceanside Treatment Works
CMCA = Central Marin Sanitation District

EXHIBIT IV – Heavy Metals in Biosolids

The United States Environmental Protection Agency (US EPA) published Title 40 of the Code of Federal Regulations (CFR) Part 503 in 1993, commonly referred to as Part 503. Part 503 provides a regulatory framework for the land application of biosolids, including heavy metal concentration limits. Part 503 refers to heavy metals as pollutants. Solano County Code Chapter 25 adopted by reference Title 40 CFR, Part 503 as part of its biosolids regulations.

As specified under Part 503, prior to biosolids land application, the biosolids generator must provide documentation of Notice and Necessary Information (NANI) that demonstrates the Class B biosolid materials proposed for land application meet standards for heavy metal concentrations, class and method of pathogen reduction, and method of vector attraction reduction.

Heavy metal concentration limits are specified under Part 503 for Arsenic, Cadmium, Copper, Lead, Mercury, Nickel, Selenium, and Zinc. US EPA eliminated Chromium concentration limits for biosolids in 1995 as the risk of concentrated hexavalent chromium in biosolids (12,000 mg/kg) was found to be negligible.

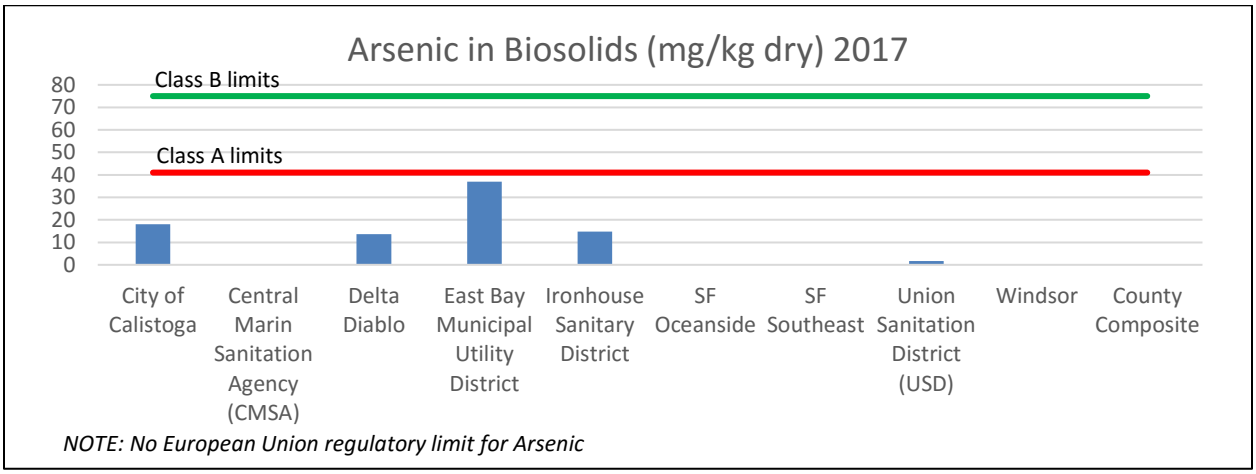
Solano County only permits the application of biosolids from generators that provide the NANI reports. In addition, biosolids material that exceed Part 503 Class B heavy metal concentrations are not accepted for land application in Solano County. As part of the application review process, prior to land application, all generators for the 2017 biosolids season submitted documentation of the NANI reports.

2017 metal concentrations, with the exception of copper levels from the City of Windsor, all metal concentrations were found to meet the Part 503 Class A, Class B and European Union (EU) standard limits. The City of Windsor biosolids material met the copper threshold for Class B material, but exceeded the European Union standard for copper. Windsor metal concentrations as tested in 2016 were similar, with copper exceeding European Union standard limits, and meeting Class A Part 503 standards for copper in 2016 and 2017.

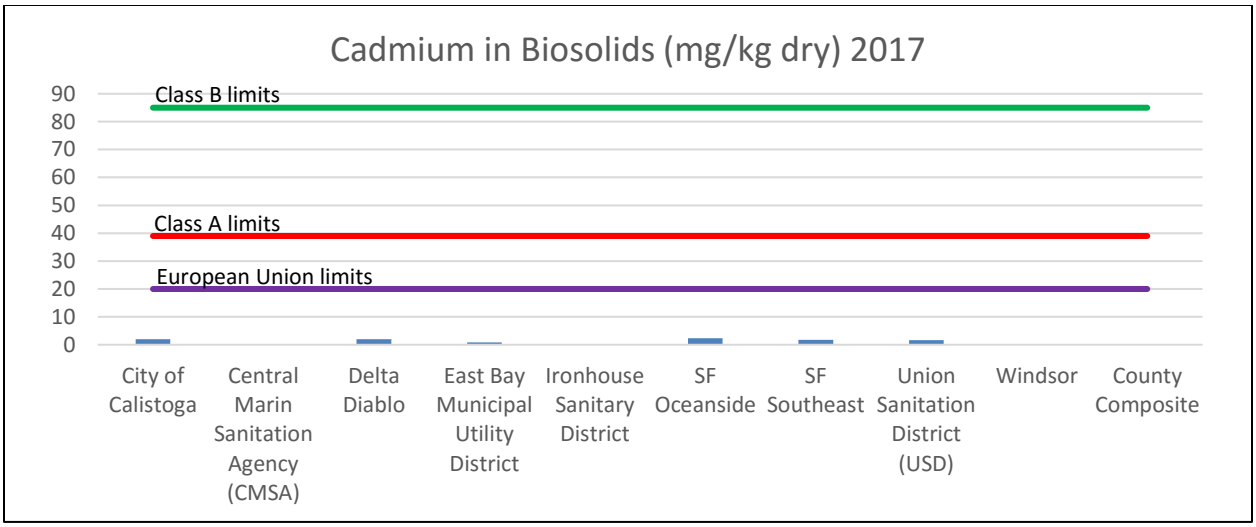
The EU limits for biosolids are taken from the European Council Directive 86/278/EEC of 12 June 1986, Annex 1B. EU limits are not required for land application of biosolids in Solano County but are presented herein as a reference. There are no EU limits for Arsenic, Chromium, or Selenium.

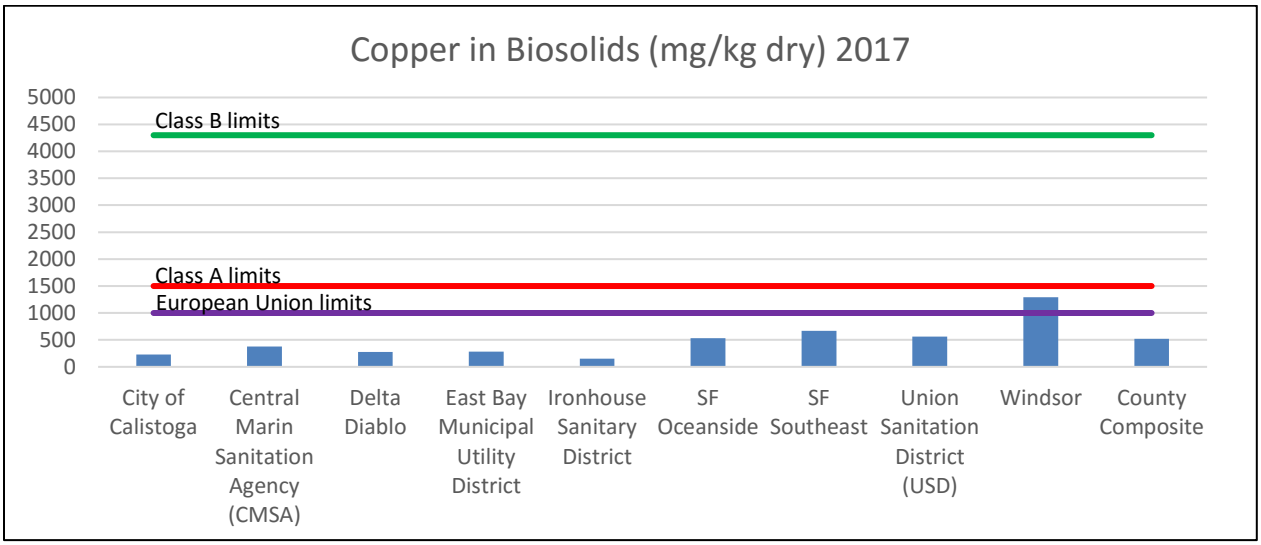
In addition to the sampling performed by the generators as part of the application process, Solano County staff collected nine samples of the Class B biosolids during the 2017 land application season. All samples were within the acceptable criteria for heavy metals established by the Part 503 Federal regulations for Class A and Class B biosolids, and are represented on the following graphs as the County Composite. As demonstrated in analytical results from prior years, heavy metals in the biosolids material received are within acceptable heavy metal limits and do not pose a significant concern over the short term.

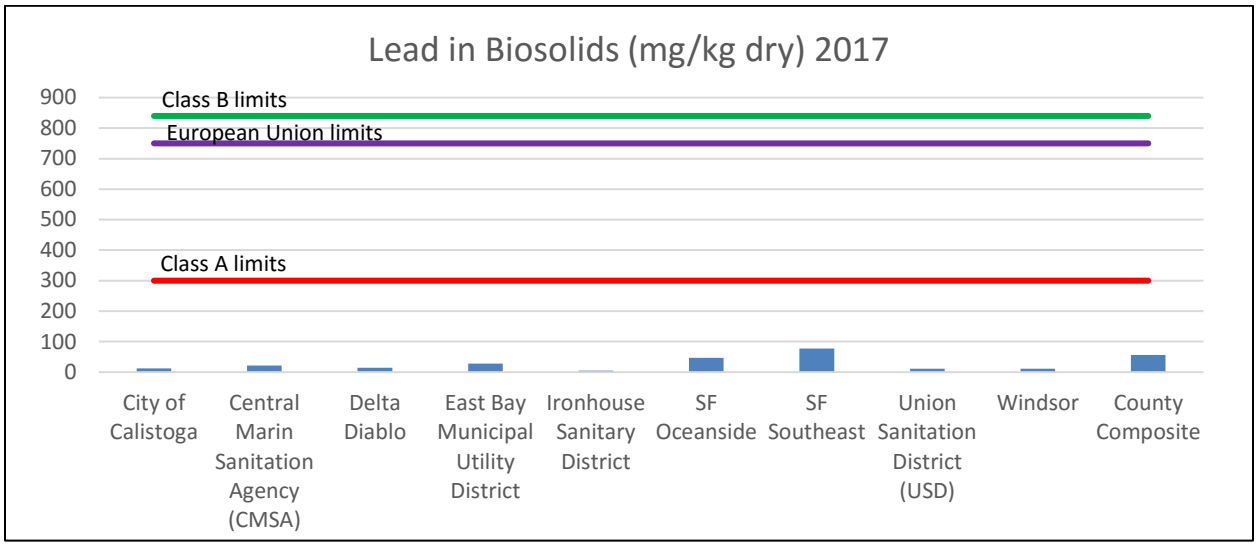
Highest Detectable Heavy Metal Concentration by Generator 2017

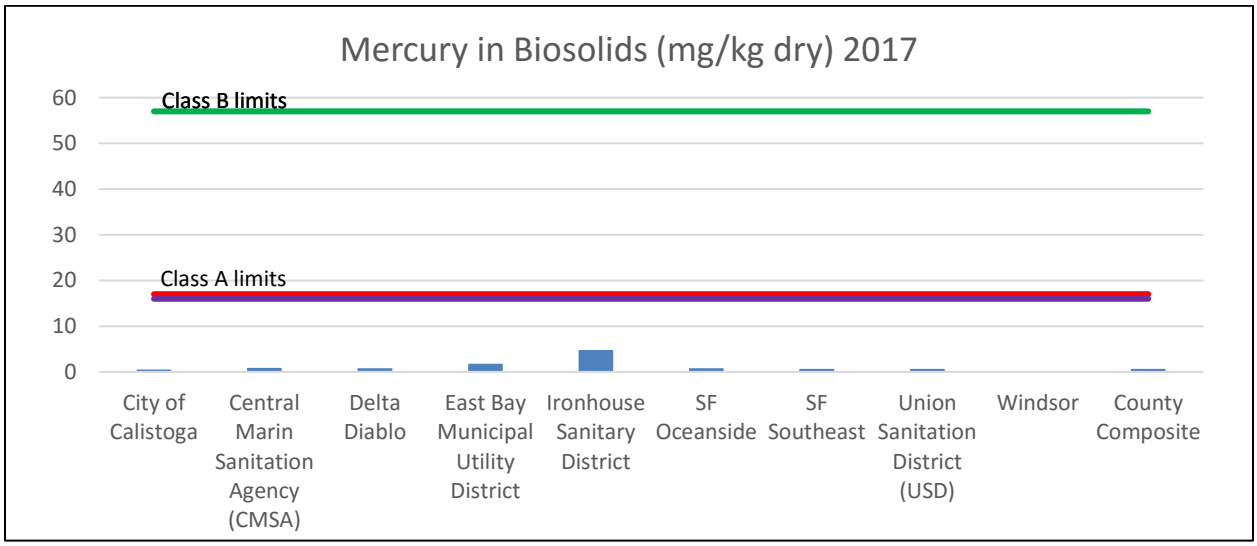


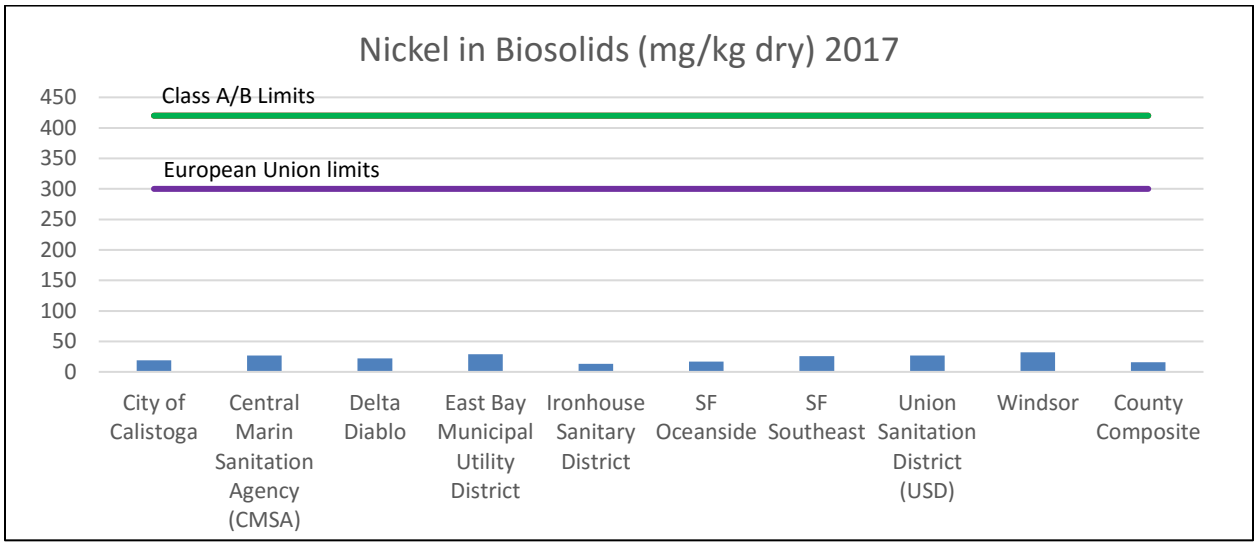
NOTE: No European Union regulatory limit for Arsenic

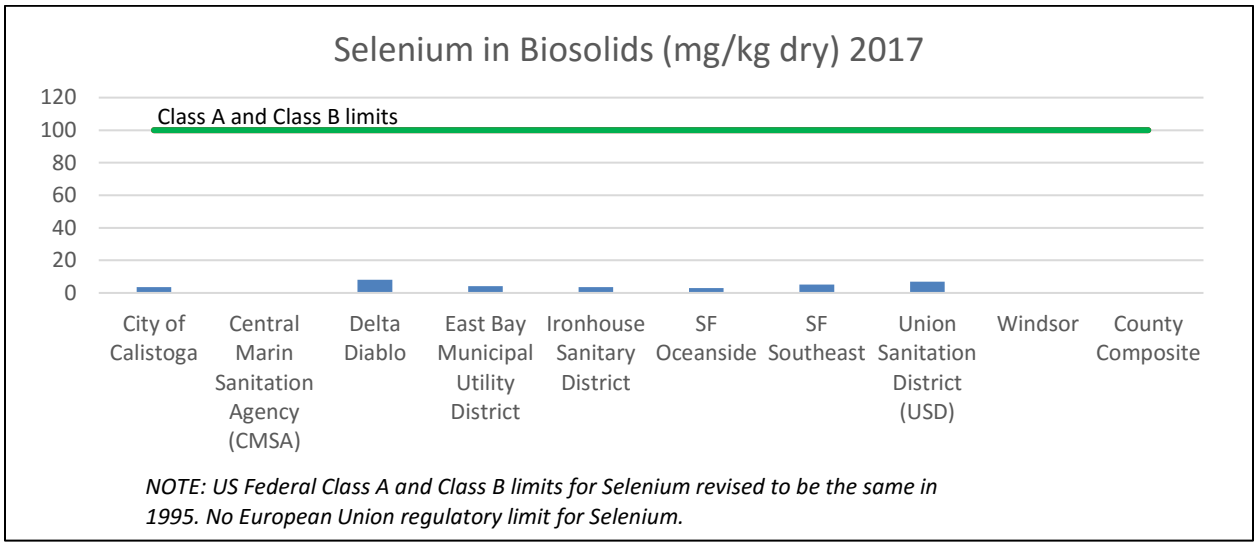





Lead in Biosolids (mg/kg dry) 2017
900
800
700
600
500
400
300
200
100
0
Class B limits
European Union limits
Class A limits
City of Calistoga
Central Marin Sanitation Agency (CMSA)
Delta Diablo
East Bay Municipal Utility District
Ironhouse Sanitary District
SF Oceanside
SF Southeast
Union Sanitation District (USD)
Windsor
County Composite


Mercury in Biosolids (mg/kg dry) 2017
60
50
40
30
20
10
0
Class B limits
Class A limits
City of Calistoga
Central Marin Sanitation Agency (CMSA)
Delta Diablo
East Bay Municipal Utility District
Ironhouse Sanitary District
SF Oceanside
SF Southeast
Union Sanitation District (USD)
Windsor
County Composite


Nickel in Biosolids (mg/kg dry) 2017
450
400
350
300
250
200
150
100
50
0
Class A/B Limits
European Union limits
City of Calistoga
Central Marin Sanitation Agency (CMSA)
Delta Diablo
East Bay Municipal Utility District
Ironhouse Sanitary District
SF Oceanside
SF Southeast
Union Sanitation District (USD)
Windsor
County Composite



NOTE: US Federal Class A and Class B limits for Selenium revised to be the same in 1995. No European Union regulatory limit for Selenium.

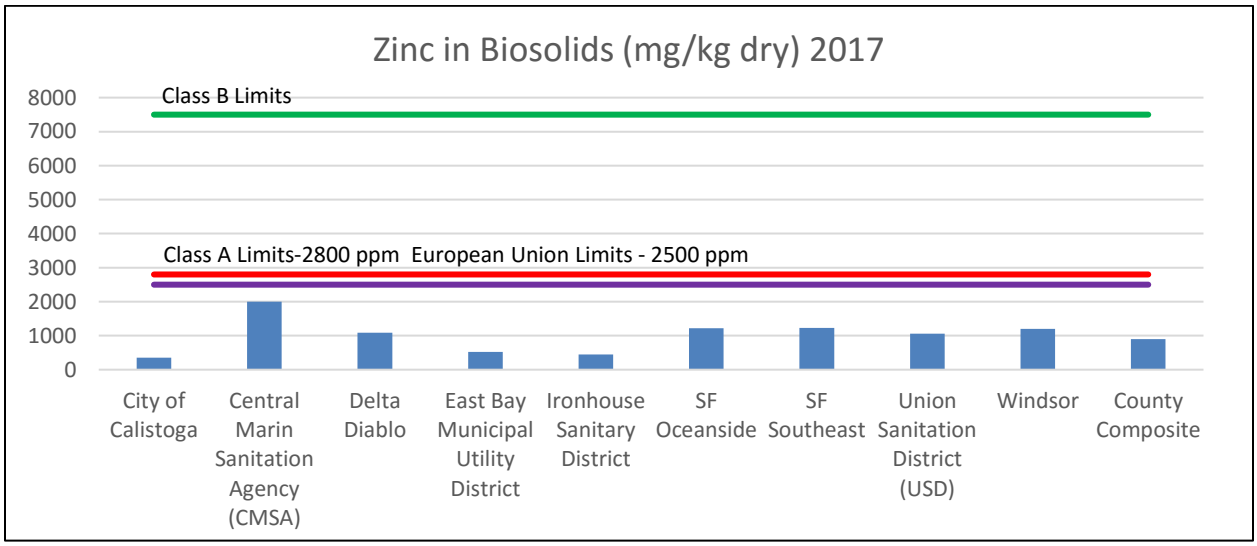


EXHIBIT V – Protests Received and Complaint Investigations

Protests Received:

Solano County Code Chapter 25 allows residents residing adjacent to a field proposed for biosolids land spreading the opportunity to protest the land application of biosolids. As required by Chapter 25 the biosolids applicator, Synagro, provided notices of biosolids land application to residents adjacent to proposed land application sites at least 14, to a maximum of 45, days prior to commencement of land spreading operations. Due to a delay in noticing residents, biosolids land application began on May 4, 2017, fourteen working days after the official start of the land application season on April 15.

Public notices stating the intent to land apply biosolids were published on March 31, 2017 in the Fairfield Daily Republic and in the Vacaville Reporter. No protests were received for the 2017 land spreading season.

Complaint Investigations:

The Department received four odor complaints in 2017. One complaint was received 10 days prior to the commencement of the 2017 biosolids land application season. Two odor complaints were received during the land spreading season, including one complaint from the Yolo-Solano Air Quality Management District (YS-AQMD), and one complaint was received five days after the conclusion of the 2017 biosolids land spreading season.

All four of the complaints alleged that the land application of biosolids contributed to some combination of: sewage smell, bad odor, and illegal land application of biosolids. All of the complaints were investigated by staff.

The four received complaints were attributed to the land application of a biosolids-derived certified injectable fertilizer product, LystGro®[1], being applied by Lystek International. Although the presence of sewage odors was confirmed, the source of the odors was determined to not be attributed by the land application of biosolids under the Solano County program. The confirmed complaints and presence of odors were referred to the Solano County Agriculture Department, which has jurisdiction over the use of fertilizer products within the County pursuant to Chapter 2.2 of Solano County Code.

The complaint investigation included general program discussion and update of the biosolids land application process with YS-AQMD and the complainant. During the Investigation of this complaint, it was determined that a Synagro biosolids land application site, and a Lystek injectable fertilizer site were less than two miles apart, however wind direction at the time of inspection and the complainant's description of the area where the odors were present led Environmental Health to conclude that the confirmed odors were attributable to the Lystek operation.

At the stakeholders meeting held on December 13, 2017, the Solano County Department of Agriculture informed the group that follow up for these complaints was coordinated with Lystek who stated that they were developing a set of best management practices to prevent odors from traveling off application sites. One of the management practices mentioned involved beginning fertilizer application from the middle, rather than the edge, of a field to minimize odor migration.

---

[1] California Department of Food and Agriculture, Fertilizer Materials Inspection Program (CDFA-FMIP) lists Lystek International LTD under license #447783. Lystek's registered fertilizer product is LysteGro®, which has the CDFA-FMIP approved registration ID# 486200. Further information can be found at the CDFA website: https://www.cdfa.ca.gov/is/ffldrs/fertilizer.html

For comparison, the number of complaints received in previous years is summarized by graph.

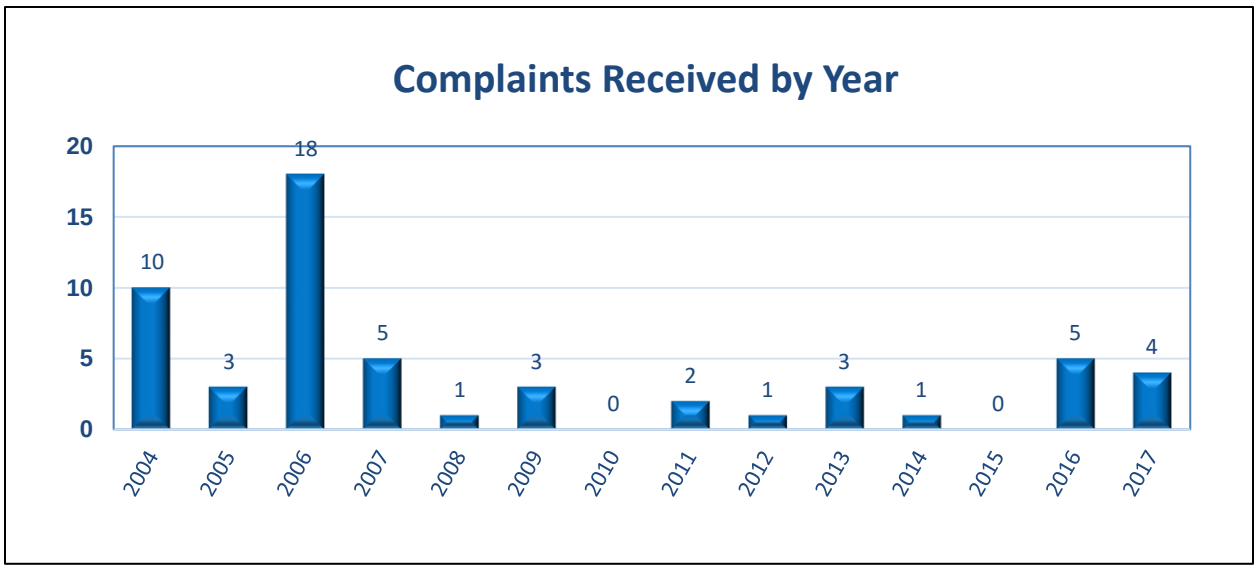


EXHIBIT VI – Biosolids Stakeholder Group Meetings Summary

A Stakeholder Group meeting was held on December 13, 2017. A summary of this meeting is presented below.

Participants in the Stakeholder Group Meeting included: Solano County Environmental Health staff, EPA, Synagro, San Francisco PUC, Fairfield-Suisun Sewer District, East Bay Municipal Utilities District, Lystek, and the Blankenship research team.

Staff provided a summary of the 2017 application season including the total acres and total tons of biosolids land applied during the season.

Dry tonnage calculations were provided for all generators – dry tonnage calculation methodology was briefly discussed. Staff noted all biosolids were applied to the fields at the approved agronomic rates as required in the permit conditions.

San Francisco Public Utilities and East Bay Municipal Sanitation District each presented a summary of the upgrade work at the Oceanside plant which will be producing approximately 4000 tons per year of Class A biosolids product and the research conducted with UC Riverside. The research includes in-field evaluations of biosolids to identify various micro communities for field crops, based on various soil types and uses.

The EPA indicated that they are in the second year of electronic reporting.

Lystek representatives indicated they are working with UC Davis on a research project comparing the application of Lystek product on irrigated versus dry land fields planted with wheat and safflower. Fairfield Suisun Sewer District representatives reported that since August 2016, 100% of their sewage sludge is supplied to Lystek. Lystek produced 40,000 tons of fertilizer product in 2017 and can increase to 150,000 tons per year at complete buildout of the Fairfield plant.

Biosolids representatives asked the County to consider changes to current County Code to allow for applications of biosolids to land from October 15 to April 15 when wet weather is not occurring.

The research team, Blankinship and Associates Inc., presented the draft finding from the 20-month research project. The report of findings is attached as Appendix A.

EXHIBIT VII – Research Study Summary

In 2004, the Board of Supervisors established a biosolids scientific research and education fee as a per-acre surcharge, charged to the applicator of land applied biosolids, to provide funding for the Biosolids Education and Research Trust Fund (Research Trust Fund). Revenue generated through the fees allowed Solano County to fund research studies on the potential effects of biosolids land application in Solano County. Previous County-funded biosolids research projects include:

- *Evaluation of the Potential Regrowth of Fecal Coliform Bacteria in biosolids between Sewage Treatment Plants and Land Application sites in Solano County* (Department of Resource Management, 2005),

- *Occurrence and Fate of Selected Pharmaceutical and Personal Care Products in Biosolids-Applied Soils in Solano County, California,* (Mississippi State University, 2006),

- *Assessment of the Impacts of Biosolid Application on Water and Soil Quality and Bioavailability of Constituents of Concern*, (University of California, Davis, 2012).

Discussions with stakeholders who have used biosolids applications on rangelands in Solano County describe a substantial increase in forage growth and quality. Understanding and quantifying the beneficial effects of biosolids applications on rangeland forage production was recommended in order to help evaluate plant productivity and forage quality.

In 2013, through a stakeholder input process, the Department identified projects for future research consideration, including;

- Assess the agronomic effects of biosolids applications on Solano County rangeland;
- Quantity the nutritional value of vegetation on biosolids vs non-biosolids applied fields for grazing animal stock (sheep and cattle);
- Evaluate the potential carbon sequestration enhancement in biosolids-applied soil; and
- Quantify the accumulation rates of metals associated with biosolids land applications on Solano County rangeland soil to develop site-specific application rates.

On June 23, 2015, the Solano County Board of Supervisors awarded a contract to Blankinship & Associates, Inc. The contract was funded through the Research Trust Fund, to identify the general trends in soil and forage chemistry that may be attributed to the application of biosolids in Solano County.

The Blankinship team consisted of Agronomists, Certified Crop Advisers, Engineers, Certified Professional Soil Scientists, University of California Cooperative Extension experts in grazing and forage crops, and Veterinarians. The research, “Assessing Agronomic Effects and Potential Carbon Sequestration Associated with Biosolids Applications on Rangelands in Solano County” was conducted over an 8-month period, between December 2015 through August 2016 on two (S04-221 and S04-223) adjacent non-irrigated rangeland fields. The fields selected for the study were not planted nor mechanically harvested. Forage crops grew from an established seedbank and had on-going sheep and cattle grazing. Fields chosen for the study were based on accessibility, similarity of soil type and topography, historic biosolids applications including applications in 2015 with no other soil amendments, landowner cooperativeness, and the presence of buffer zones where no biosolids were applied.

Four sampling sites in each of the two fields were chosen for soil and forage sampling. Two sampling sites were located in biosolids-applied areas and two sites located within nearby buffer zones that had no biosolids applications. Various soil and forage samples were collected

between December 2015 through August 2016 to assess pre- and post-growing season for rangeland forage.

Site segregated fenced enclosure for study of forage growth rates

Over 30 constituents were measured for soil at each sample site and depth interval, including nutrients, metals, texture, and moisture retention. Over 16 constituents were measured for forage at each sample site, including biomass, nutrients, and digestibility. Over 1,000 data points were generated through the analytical process and used to generate forage and grazing animal growth models. The data and model results concluded that biosolids-applied fields showed an approximate 43% increase in plant production. Plants on biosolids-applied fields grew approximately 50% taller compared to non-biosolids applied fields. There was no significant difference in the forage nutrient values between biosolids to non-biosolids applied field samples. However, the increased forage growth in the biosolids-applied fields may allow for a higher density of animals to graze on the biosolids applied fields versus non-biosolids applied fields.

The additional forage growth in biosolids applied fields also increased the short-term carbon sequestration capacity of the rangeland fields by approximately 55% compared to non-biosolids applied fields. This additional carbon sequestration value equates to approximately 0.656 tons of carbon stored per acre.

The below graph illustrates the average dry mass forage yield that compared biosolids applied fields (BAS) to non biosolids applied fields. The overall forage growth yield was observed following biosolids applications over multiple cuttings.

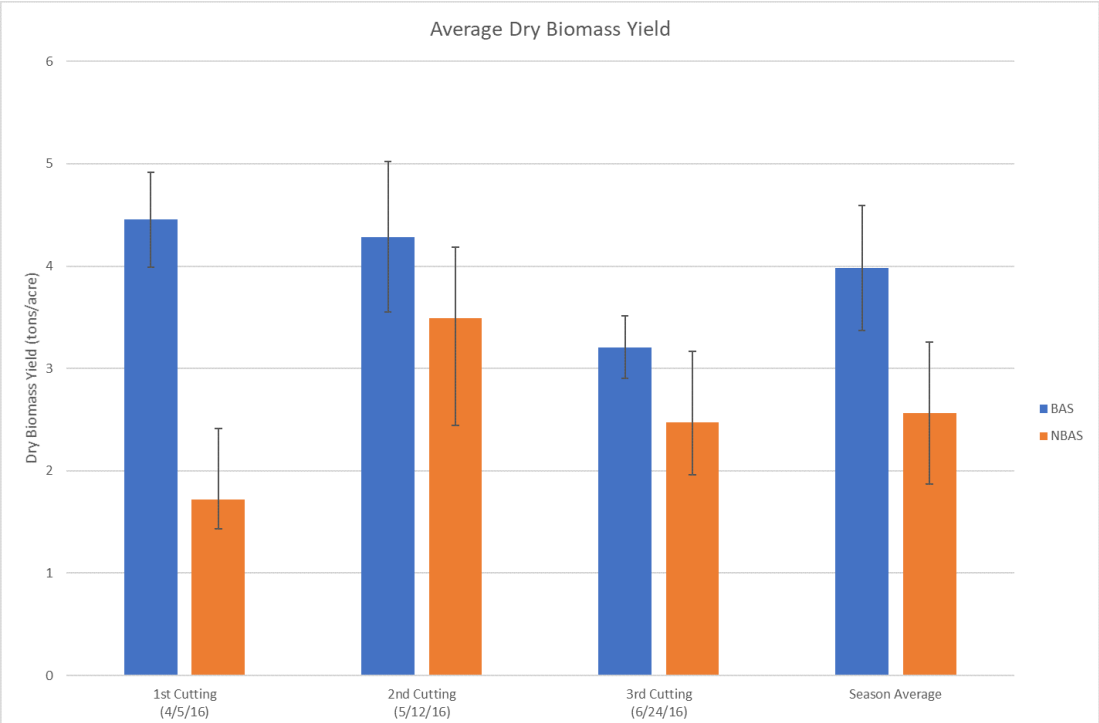


Figure 13 Notes:
Error bar is equivalent to 1 standard deviation

The data also indicated that select trace metals including nitrogen, phosphorus, copper, and zinc were higher in soil on biosolids-applied fields (BAS) when compared to non-biosolids applied soil (NBAS). All trace metals in the soil were below regulatory screening levels or regional background concentrations. The forage cuttings showed no evidence that the concentrations of trace metals exceeded values that would be injurious to grazing animals.

Findings from the study demonstrate short-term benefits for land applications of biosolids to range-lands soils. Long-term multi-year monitoring and research was recommended to further evaluate and quantify the cost effectiveness and benefits of land application of biosolids versus other soil augmentation processes versus disposing of biosolids into landfills.

The report, *Assessment of the Agronomic Effects and Potential Carbon Sequestration Associated with Biosolid Applications on Rangelands in Solano County*, prepared by Blankenship and Associates, Inc. is included as Attachment A.

Exhibit VIII: Biosolids Industry Update

On October 21, 2016 Lystek International Inc. ("Lystek") opened the Organic Material Recovery Center at the Fairfield Suisun Sewer District (OMRC-FSSD) location on Chadbourne Road. Founded in 2000 and based out of the City of Cambridge, in Ontario Canada, Lystek uses a patented[1] thermal hydrolysis process to provide biosolids solutions to municipalities and wastewater treatment plants in North America.

Although not yet at full capacity, the Lystek OMRF-FSSD facility may eventually process up to 150,000 tons of waste per year, including the 14,000 tons produced annually at the co-located Fairfield-Suisun Sewer District facility. Lystek continues to secure additional product sources, including the City of Santa Rosa and the San Francisco Public Utilities Commission. As biosolids are diverted to the Lystek process over time, the amount of material going toward biosolids land application or landfill as waste material may decrease.

According to the company website, the proprietary "LystMize" process uses a combination of heat, alkali, and high shearing to effectively breakdown the biological material in biosolids. The company states that the LystMize process increases biogas production, which is typically reclaimed for energy, reduces biosolids output volumes, and reduces offensive odors.

The processed product is termed "LystGro" and is a slurry (consisting of 14-17% suspended solids) that is applied via subsurface injection into fields. The product has been classified by the US EPA as Class A EQ material[2] – approved for use without restriction. Lystek received a license[3] by the California Department of Food and Agriculture Fertilizer Materials Inspection Program (CDFA-FMIP) and is currently marketing the material as a fertilizer product.

The processed material is considered fertilizer products; therefore this material does not meet the definition of biosolids. There are no current plans to regulate this material under Solano County Code Chapter 25 – the Biosolids Land Application regulations.

Further information on Lystek can be found at: www.lystek.com

Footnote 1: US Patent 6,808,636 B2 www.uspto.gov - "Treatment of Sewage Sludge". Patent issued October 26, 2004, to Lystek International Inc. Abstract of the patent reads:

> *"A method for reducing sludge viscosity of a sewage sludge having a solids concentration of at least 10% (w/w). The method comprises the steps of increasing the pH of the sludge to 9.5-12.5%, at least one step selected from subjecting the sludge to a holding step of at least one day and adding inorganic or organic chemicals to facilitate viscosity reduction, followed by incubating the sludge at temperature up to 100° C., and subjecting the sludge to a shearing or disintegration step. The method provides sludge, especially concentrated sludge, that is more readily pumped or transported."*

Footnote 2: EQ – "Exceptional Quality" biosolids material have demonstrated to the US EPA that they meet the following three criteria:

1. **Pollutant Level Limits** – Both ceiling concentration limits (Table 1 of 40 CFR 503.13) and monthly average pollutant concentration limits (Table 3 of 40 CFR 503.13) for arsenic, cadmium, copper, lead, molybdenum, mercury, nickel, selenium, and zinc have been met. Note: There is only a ceiling concentration limit (Table 1) for molybdenum in Table 1 of 40 CFR 503.13.
2. **Pathogen Reduction** – The treatment process used has demonstrated that it meets one of the six Class A Pathogen Reduction Alternatives set of criteria, as specified under 40 CFR 503.32.
3. **Vector Attraction Reduction** – The treatment process used has demonstrated that it meets one of the eight Options for Vector Attraction Reduction set of criteria, as specified under 40 CFR 503.33.

Note: Pollutant Levels, Pathogen Reduction, and Vector Attraction Reduction criteria must be monitored and continually re-verified at frequencies ranging from once per year to once per month depending on the amount of biosolid material processed, as specified by 40 CFR 503.16. More information on the Code of Federal Regulations, Title 40, Chapter 1, Subchapter O, Part 503 can be found at: http://www.ecfr.gov/

Footnote 3: California Department of Food and Agriculture, Fertilizer Materials Inspection Program (CDFA-FMIP) lists Lystek International LTD under license #447783. CDFA website: https://www.cdfa.ca.gov/is/ffldrs/fertilizer.html

EXHIBIT IX - Report to Board of Supervisors by Bay Area Clean Water Agencies (BACWA) Regarding Alternatives to Class B Biosolids Land Spreading

BACWA is a joint powers agency providing technical expertise and financial support from a Public Utilities perspective. The BACWA Principals are East Bay Municipal Utilities District, East Bay Dischargers Association, San Francisco Public Utilities Commission, Central Contra Costa Sanitary District and the City of San Jose. BACWA's charter members are the five largest wastewater treatment agencies in the San Francisco Bay Area. The BACWA Executive Board is comprised of one member from each of the five founding Public Utilities.

The BACWA Annual Report to the Solano County Board of Supervisors Land Application of Biosolids in Solano County report, dated December 2017 summarizes the land application of biosolids conducted in 2017. The Report also provided an update on agency efforts toward other options for beneficial reuse of biosolids. Options for reuse, recycling and disposal of biosolids are evaluated, including exploring technologies for extracting energy and nutrients from the biosolids material. BACWA has prepared a separate report, 2016 Biosolids Trends Survey that includes detailed cost analysis comparing landfill disposal, landfill alternative daily cover and land application. Land application and the beneficial use as alternative daily cover are predominant in California. BACWA indicates that in the Bay Area Region biosolids primary uses include; landfill, beneficial use, land application, and incineration.

BACWA continues to explore emerging issues including climate change mitigation. For example, Senate Bill 1383, adopted September 2016 reduces the amount of organics going to landfill. Production of Class A biosolids and the use of energy driven technologies such as biogas production are continually being explored. Alternatives for the use of biosolids are becoming more critical as the ability to dispose of the product as a waste in landfills is deemed a long-term environmentally effective solution due to air emission standards and residual organics. Air emission standards are also challenging while considering development of energy capture and conversion technologies using biosolid residuals.

San Francisco Public Utilities Commission provided more than 76% of all biosolids material land spread in Solano County in 2017. San Francisco Public Utilities Commission continues to provide the majority of biosolids material land spread in Solano County.

The Bay Area Biosolids Coalition, formerly known as The Bay Area Biosolids to Energy Coalition is now focusing on Green House Gas Reductions and the impact for biosolids disposal at Sanitary Landfills in California. The Bay Area Biosolids Coalition consists of fifteen member agencies: City of Millbrae, City of Palo Alto, City of Santa Rosa, Central Marin Sanitation Agency, Delta Diablo, Dublin San Ramon Services District, East Bay Municipal Utility District, Fairfield-Suisun Sewer District, Ironhouse Sanitary District, North San Mateo County Sanitation District, San Francisco Public Utilities Commission, Sausalito-Marin City Sanitary District, Union Sanitary District, Vallejo Food and Wastewater District, and West County Wastewater District. Individual agency reporting is included as part of the 2017 BACWA report. Additional information is available at www.bayareabiosolids.com; www.bacwa.org