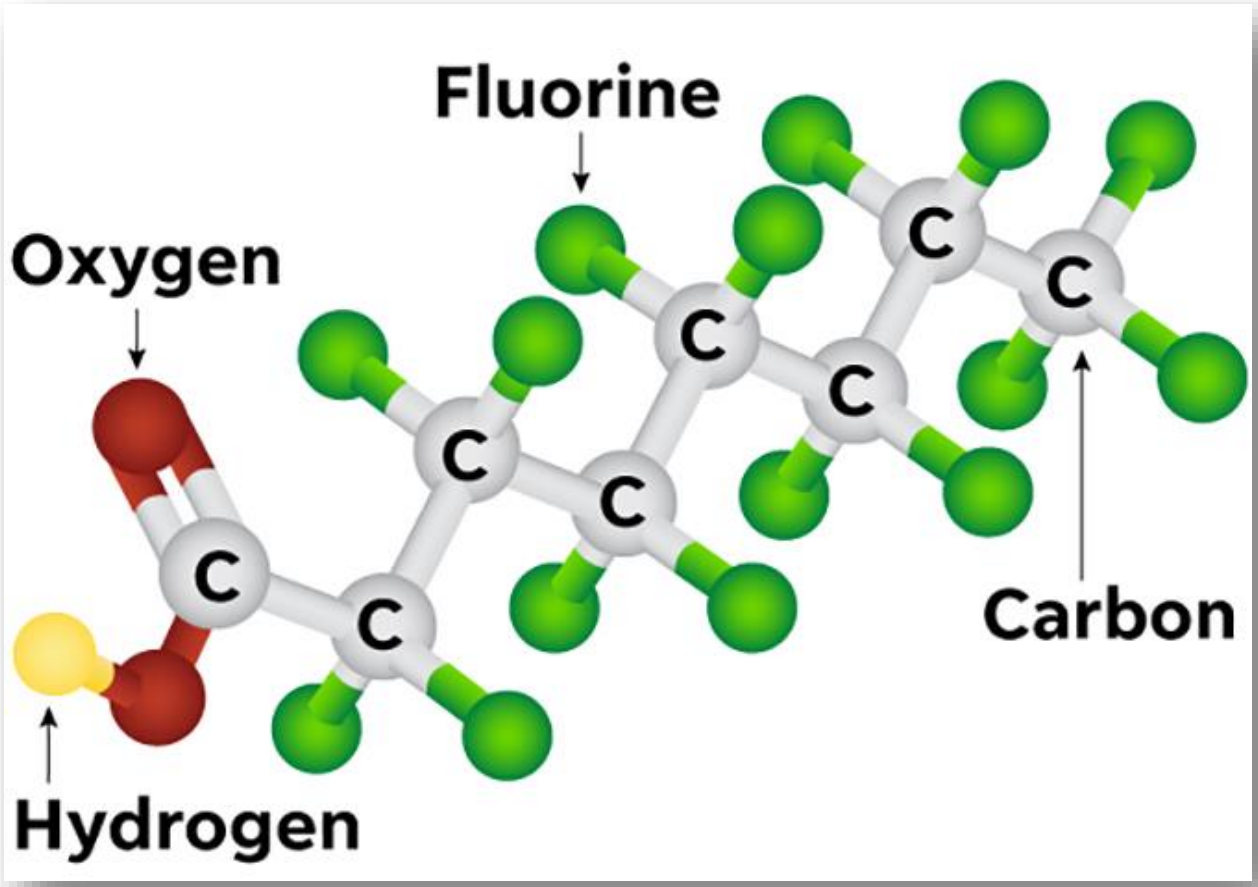

Depiction of PFOS (Perfluorooctanesulfonic acid) molecule.
Picture courtesy US EPA

SOLANO COUNTY

2025 ANNUAL BIOSOLIDS LAND APPLICATION REPORT

Reporting for the 2024 Biosolids Land application Season

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Presented to the Board of Supervisors: December 9, 2025

2025 Annual Biosolids Land Application Report

Reporting for the 2024 Biosolids Land application Season

Executive Summary

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Biosolids Registered fields owned by Flannery Associates, 2024

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A. Bay Area Clean Water Agencies Report
B. Final report: Trihydro Corporation "Study of the Fate of Per- And Polyfluoroalkyl Substances (PFAS) in Biosolids After Land Application"

2025 Annual Biosolids Land Application Report

Reporting for the 2024 Biosolids Land application Season

EXECUTIVE SUMMARY

Scope of Report

The Solano County Department of Resource Management provides this annual summary report for the 2024 biosolids land application season as required by Chapter 25 of the Solano County Code. Attachment A includes the 2024 Bay Area Clean Water Agency (BACWA) report summarizing trends in the biosolids industry.

This report differs in scope from years past as no biosolids land application permits were applied for nor issued for the 2024 season. While this report to the Board of Supervisors is typically presented annually in March, due to the timing of the Biosolids Research Project this report for the 2024 season is being presented in December of 2025. No biosolids land application permits were applied for, nor issued, for the 2024 and 2025 season. This office will provide a separate report in early 2026 for the 2025 Biosolids Land Application Report.

California Forever, and their subsidiary company Flannery Associates, are seeking to create a new community within the vicinity of the CA State Highway 12 and the CA State Highway 113 intersection. To this end, California Forever has purchased over 55,000 acres of land within Solano County, including many of the Registered Fields that previously received biosolids land applications. While not all Registered Fields have been acquired by California Forever, the applicator, Synagro, has stated that the fields that remain within each ranch do not provide enough acreage to make mobilization and land application economically worthwhile.

Environmental Health does not anticipate receiving applications to land apply Class B biosolids until the potential new boundaries of the California Forever's proposed new community have been established.

This report will focus primarily on the status of the County biosolids research project and will provide industry and regulatory updates. The County also continues to study the best course of action for regulation of novel biosolids treatment processes and what oversight may be required for biosolids land application.

Recommendations:

The Department of Resource Management recommends the Board of Supervisors accept the 2024 Annual Biosolids Land Application Report.

Solano County Biosolids Research Project:

In 2023 the County identified a research topic through collaboration with the Biosolids Stakeholder Group. During Stakeholder Group meetings it was decided to move forward with a biosolids research project studying the fate of PFAS in biosolids applied fields. A Request for Proposal was put forth, a research team selected, and scoping meetings held with the selected research team, Trihydro Corporation, in 2023. The aim of the research project was to determine spatial relationships of residual PFAS compounds as to paths of migration, depth of soil and levels of accumulation at varied depths in the soil. Given that PFAS have been observed in various soil environments, including those with a history of biosolids application, the study examines whether, and to what extent, they may be present in local soils. The study will also differentiate if some PFAS compounds were observed in greater numbers than others, and to see if there were any identifiable trends in the PFAS species detected.

Five sampling events were conducted through 2024 and 2025, with a total of 73 soil and porewater samples taken for analysis.

The County biosolids research project, “Study of the Fate of Per- and Poly- fluoroalkyl substances (PFAS) in Biosolids After Land Application” concluded in October. A final report from the research partner, Trihydro Corporation, is anticipated in the early part of 2026.

Oversight of New Biosolids Treatment Technologies

County staff are exploring methods to apply or update Solano County Code Ch. 25 in an effort to bring new biosolids treatment and land application technologies under County oversight. More information on this is provided in Section IV.

Biosolids Stakeholder Group Meetings:

The Biosolids Stakeholder Group met on March 6th 2025. The meeting was held in a hybrid format and the in-person meeting was also broadcast virtually via the Microsoft Teams application. A summary of the meeting discussion is presented in Section V.

Bay Area Clean Water Agencies Report:

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 Report (BACWA) for 2024 is summarized in Section VI and included in Attachment B.

Section I:
A Brief Overview of Solano County's Biosolids Program and current status of the program

What are biosolids

Biosolids are the solid fraction of the sewage treatment process, extracted from the liquid portion of the sewage to reduce pathogens and reduce vector attraction factors. Various treatment methods are utilized by the Publicly Owned Treatment Works (POTW) to ensure the treated biosolids meet specifications for category and use. The pathogen reduction and vector attraction reduction methods must meet regulatory standards to beneficially reuse the biosolids as a soil amendment. Biosolids are regulated by federal, state, and county agencies, each providing requirements and oversight for the generation, sampling, management, and land application of biosolids.

Biosolids are typically between 15-25% solids by weight, with the remaining weight being comprised of water. The tracking and reporting of land applied biosolids, nitrogen content, and pollutants is performed on a "dry weight" basis with the water weight calculated out.

What regulations govern the land application of biosolids in Solano County

In 1993, the US EPA promulgated "Standards for the Use or Disposal of Sewage Sludge" (Code of Federal Regulations Title 40, Part 503 – "Part 503") which regulates biosolids generation and establishes ceiling and lifetime pollutant accumulation concentrations in soils receiving biosolids, as well as pathogen and vector attraction reduction standards for the biosolids material. Part 503 also specifies the sampling frequency, methodology, and provides methods for calculating plant available nitrogen application (PAN), lifetime pollutant loading, and reporting requirements.

Solano County began overseeing the land application of biosolids in 1995 and currently regulates the land application of biosolids through Solano County Code Chapter 25.[1] Chapter 25 builds upon both federal and State requirements through a County-specific inspection and oversight program. The need to implement the program was established with concerns over application rates of the biosolids material in conjunction with rain events and the potential for stormwater runoff and potential for pollution to waters of the State. Chapter 25 restricts when and where biosolids may be applied to minimize offsite impacts by allowing applications only during the dry season (April 15th through October 15th) and prohibiting the land application of biosolids during wet weather and during high wind events. The County's program also encourages public participation through notifications and the holding of stakeholder meetings and establishes a funding mechanism to perform research on the composition and effects of land applied biosolids.

In July of 2004, the California State Water Resources Control Board (SWRCB) began to regulate the land application of biosolids under Water Quality General Order No. 2004-0012-DWQ[2]. The General Order places restrictions on land application in sensitive habitats, including the Suisun Marsh, specifies time restrictions between biosolids land application and various crop harvest or livestock grazing activities, minimum setback distances between staging and land application sites and sensitive receptors including water bodies, water wells, and public roads, and established a field registration process.

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[1] Solano County Code Chapter 25, Article IV: *Domestic Septage Land Application and Biosolids Land Application*.

[2] State Water Resources Control Board (SWRCB) Water Quality Order No. 2004–0012–DWQ: *General Waste Discharge Requirements For The Discharge Of Biosolids To Land For Use As A Soil Amendment In Agricultural, Silvicultural, Horticultural, And Land Reclamation Activities*

While oversight began in 1995, Solano County Code Ch. 25 has undergone numerous revisions and amendments in response to community and resident concerns, as well as evolving federal and State requirements. The ordinance was last amended in 2012 and currently incorporates the restrictions found in the State General Order.

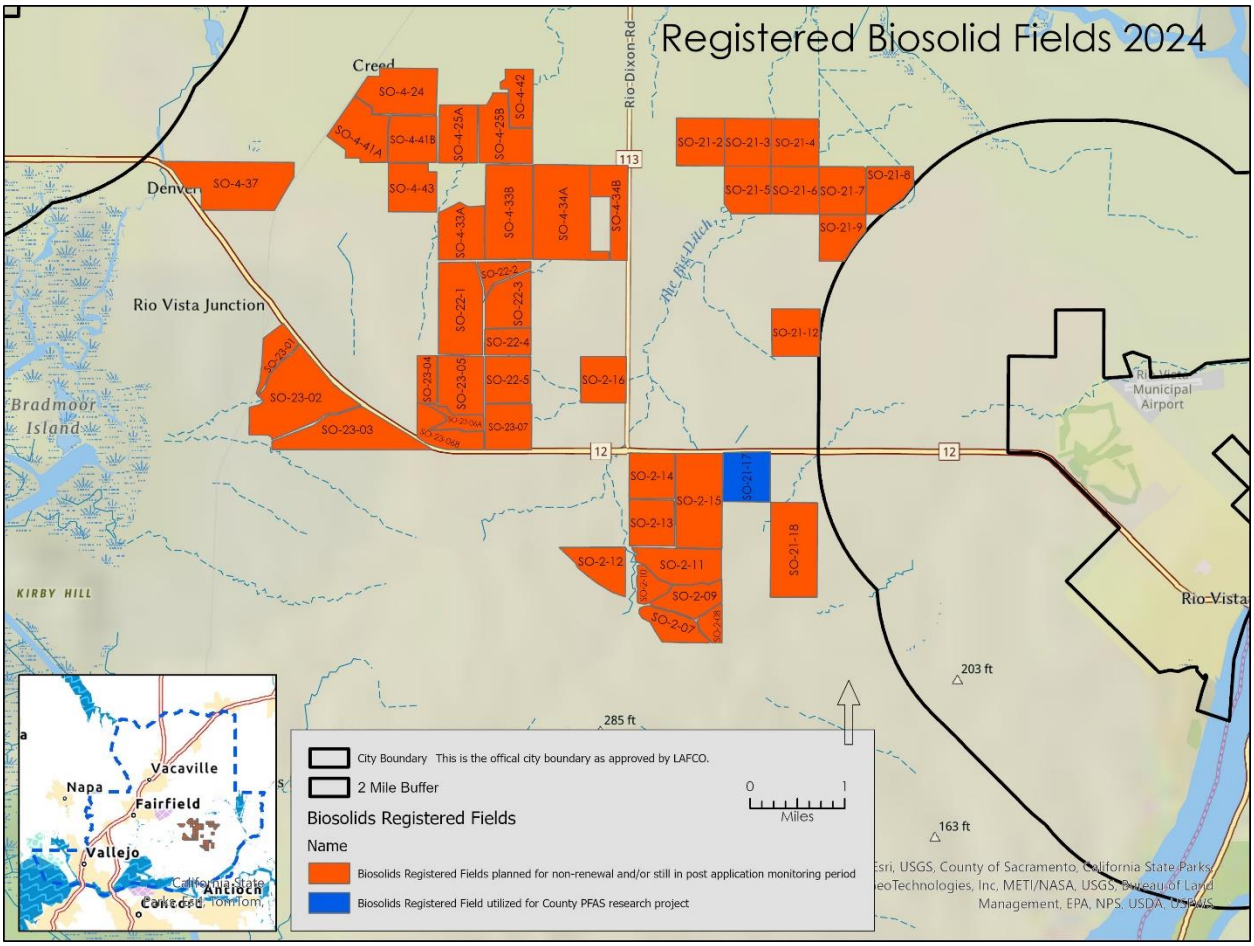
What is the current status of the County biosolids oversight program

As reported in last year's annual Biosolids report to the Board of Supervisors, the acquisition of the majority of Registered Fields by California Forever through its subsidiary company Flannery Associates, and California Forever's subsequent decision to not allow permitted Class B biosolids land application on its properties, the permitted land application of Class B biosolids by Synagro is economically unfeasible as there is not enough available consolidated acreage to support their operations.

Solano County Environmental Health does not anticipate the land application of biosolids to resume within the County until the new borders of the potential new community envisioned by California Forever have been established.

Section II – Registered Biosolids Land Application Sites in Solano County

Map 1 – Registered Biosolid Land Application Fields, 2024



Ranch Name and ID	Corresponding Registered Fields	Total Net Acreage
Hamilton Farms (SO-2)	SO-2-7, -8, -9, -10, -11, -12, -13, -14, -15, -16	1,213
Emigh Ltd Ranch (SO-4)	SO-4-24, -25A+B, -33A+B, -34A+B, -37, -41A+B, -42, -43	1,951.19
McCormack Ranch (SO-21)	SO-21-2, -3, -4, -5, -6, -7, -8, -9, -12, -17, -18	1,439
Emigh Souza Ranch (SO-22)	SO-22-1, -2, -3, -4, -5	685
Mayhood Ranch (SO-23)	SO-23-1, -2, -3, -4, -5, -6A+B, -7	949.6
Total Net Acres Registered for Biosolids Applications		**6,237.79**

The above map illustrates the 6,237.79 net acres of biosolids registered fields in Solano County that were previously registered with the SWRCB. As depicted in the map, all of these fields, displayed in orange, are in the process of having their SWRCB registration terminated. The termination process can only be completed after 38 months of post application monitoring has concluded. Synagro has requested the State Water Board rescind the field registrations.

The registered field SO-21-17, depicted in blue, is the field utilized in the County Research and Education research project on the fate of PFAS compounds in biosolids after land application, which is described in more depth in Section III.

Section III – Summary of Biosolids Research Project:

Background on the Solano County Biosolids Education and Research Trust Fund

In 2004, the Board of Supervisors established a biosolids scientific research and education fee of $15 per applied acre, which is charged to all biosolids land application permit holders. This provides funding for the Biosolids Education and Research Trust Fund (Research Trust Fund). The Research Trust Fund allows Solano County to fund research studies on the potential effects of biosolids land application in Solano County.

The County released a Request for Proposals (RFP) on the OpenGov Procurement website on July 13, 2023, soliciting bids and proposals to study the fate and transport of per- and poly-fluoroalkyl ("PFAS") chemicals potentially present in biosolids.

Four proposals from qualified research teams were evaluated during July and August of 2023, and the winning research team was selected in October of 2023. A contract with the Trihydro Corporation was approved by the Board of Supervisors on October 24, 2023.

What are Per- And Polyfluoroalkyl Substances (PFAS)

First synthesized in the late 1930s and 1940s, per- and poly- fluoroalkyl (PFAS) compounds are a class of manmade compounds that all contain the unusually strong carbon to fluorine chemical bond. Due to the nature of the carbon-fluorine bond, these compounds exhibit resistance to heat, oil, and water. One of the earliest discoveries in the PFAS class include polytetrafluoroethylene (PTFE) – commonly known as Teflon, which has been widely used as a coating for cooking and food preparation equipment. Depending on how "PFAS" is defined, there are between 15,000 to seven million PFAS compounds, with only several dozen routinely monitored or studied.

PFAS compounds have been used in a wide range of industrial and commercial applications including canned foods, non-stick cookware, paints, varnishes and sealants, firefighting foams, electronics manufacturing, textile waterproofing coatings, cosmetic and personal hygiene items, and medical equipment. The same strong carbon-fluorine chemical bond that grants PFAS compounds their heat, oil, and water resistant characteristics also make the compounds very persistent and resistant to degradation. PFAS compounds are considered ubiquitous and are found globally within the tissues of every organism that has so far been tested – PFAS compounds have been identified in blue whale and polar bear tissues to name a few. The persistent nature of PFAS compounds have led to these being labeled "forever chemicals." US EPA currently supports PFAS research and development efforts through several programs, including research grants, Small Business Innovation Research program and challenges such as innovative ways to destroy PFAS compounds.

While concern regarding PFAS compounds began to accumulate during the 1980's and 1990's, increased scrutiny over the widespread persistence and ecological impact of the compounds began to accelerate during the early 2000's and has become a major focus of testing and remediation efforts today. In part, this can be attributed to increased sensitivity in sampling methods – there is wide consensus that PFAS compounds can impact human health at the parts per trillion (ppt) levels, but it was only recently that equipment and laboratory methods were developed that can detect PFAS compounds at this level. Of note is the finalization of US EPA Method 1633, which is a critical analytical method that was developed to test for 40 PFAS compounds in water, soil, biosolids, and tissue samples. The previous EPA methods for testing for PFAS compounds were developed to test water samples – Method 1633 is the first approved method for testing for PFAS compounds in media other than water.

Initial federal efforts to address PFAS contamination include the US EPA's 2016 establishment of a Health Advisory (HA) threshold for two PFAS compounds in drinking water. Health Advisories

are not legally enforceable, but provide guidance for when additional screening, risk assessment, and/or investigation should be performed.

Subsequently in 2024, the US EPA issued the PFAS National Primary Drinking Water Regulation (NPDWR), which established legally enforceable national maximum contaminant levels (MCLs), for six of the most widely studied PFAS compounds. Under the final rule, monitoring for PFAS compounds within all public water systems will take place between now and 2027, with implementation of treatment and remediation strategies expected to be in place by 2029. It should be noted that legal actions taken in September of 2025 by the federal government indicate that portions of this final rule may be relaxed, revised, or pushed back prior to currently set implementation dates.

At the state level, California has acted through the SWRCB to establish Notification and Response Levels (NL and RLs) for PFAS compounds in drinking water in 2018 and 2020, as well as Environmental Screening Levels (ESLs) for site cleanup in 2020. In 2024, the Office of Environmental Health Hazard Assessment (OEHHA) adopted a Public Health Goal (PHG) for PFAS compounds, and while the PHG by itself is not legally enforceable, it is the first step toward California establishing legally enforceable Maximum Contaminant Levels (MCLs) for PFAS compounds.

California is also pursuing the strategy of PFAS source reduction, restricting or banning the use of "intentionally added" PFAS compounds, as well as increased monitoring and scoping to determine the potential extent of PFAS impacts.

In the 2019-2020 legislative session SB 1044 was passed which prohibited the use of fire-fighting foams that had intentionally added PFAS compounds. During this time period, the SWRCB issued Order WQ 2020-0015-DWQ which required a one-time testing for PFAS compounds at many publicly owned treatment works (POTW) facilities.

In the 2021-2022 legislative session several bills were passed into law aimed at restricting the intentional addition of PFAS compounds into food packaging and cookware (AB 1200), juvenile products like booster seats, changing pads, and cribs (AB 652), cosmetic items (AB 2771), and clothing and textiles (AB 1817).

In the 2023-2024 legislative session AB 347 was passed into law and unlike the other California bills mentioned, this law established the legal mechanism and enforcement authority for the PFAS compound restrictions and bans referenced in other bills. AB 347 designated the Department of Toxic Substances Control (DTSC) as the lead agency for oversight and enforcement.

Most recently, in July of 2025 the San Francisco Bay Regional Water Quality Control Board (SF-RWQCB) updated the Environmental Screening Levels (ESLs) for site cleanup from two to now include 16 PFAS compounds, while also lowering ESL threshold values. Again, while ESLs are not legally enforceable, like MCLs, they provide a tool for determining when additional screening, risk assessment, and/or investigations are needed.

Solano County Research Project:

"Study of the Fate of Per- And Polyfluoroalkyl Substances (PFAS) in Biosolids After Land Application"

As a topic of emerging concern, the County biosolids research project – "Study of the Fate of Per- and Poly- fluoroalkyl substances (PFAS) in Biosolids After Land Application" was designed to better understand the potential presence and behavior of PFAS compounds in soils on fields with a history of biosolids application, how the materials accumulate in the soil, how the chemicals migrate in the soil and determining the speciation of the different PFAS compounds encountered.

While relatively modest in comparison to other state and federally funded research projects, it is hoped that the project will be able to assist in future decision making on matters of biosolids within the County and add to the body of work currently ongoing that seeks to better understand these unique compounds.

One previously Registered Field, for which records indicated biosolids land application had been initiated in 2005 and had occurred periodically until 2023, was selected as the sampling location. Solano County Code requires a water well setback distance for biosolids land application of 500 ft. and an area within this 500 ft. setback distance to the existing onsite water well was identified as a control sampling area. As Class B biosolids are not allowed within 500 feet of the water well, this area close to the water well serves as a control area where biosolids land application is not occurring.

Five sampling events were conducted through 2024 and 2025, with a total of 73 soil and porewater samples taken for analysis. The samples were analyzed using a laboratory specific 537-M method, which modified the EPA Method 537 to allow for analysis of PFAS compounds in a soil sample, as well as EPA Method 1633, which is currently considered the standard for PFAS testing. The fact that EPA Method 1633 was not yet finalized at the initiation of the research project, as well as budgetary constraints, dictated the use of the Method 537-M in analyzing some of the samples. Not all PFAS compounds are readily detected by either analytical method – it is widely acknowledged that precursor PFAS compounds exist which take months or years to breakdown into PFAS compounds that are detected by current analytical methods. To attempt to address this, six Total Oxidizable Precursor (TOP) Assay samples were also analyzed using the 537-M method. The TOP samples were subjected to an oxidation step to breakdown the samples into final, potentially more detectable, PFAS compounds. The oxidation step is said to simulate decades or centuries of weathering, allowing the precursor compounds to breakdown into more readily detected PFAS compounds.

As a part of the report, PFAS sampling data previously collected by the San Francisco Public Utilities Commission (SF-PUC) was incorporated into the data analysis – this sampling data was considered the best representation of the potential initial PFAS concentrations and speciation.

As previously mentioned, the final report is anticipated in the first half of 2026.

US EPA continues to encourage PFAS research and has an extensive library of PFAS related research papers available for this emerging topic.

Section IV – Oversight of New Biosolids Treatment Technologies

New Biosolids Treatment Technologies

The potential and degree of oversight for land application of a liquid injectable Class A biosolids fertilizer product by Lystek International continues to be studied by County staff.

Lystek first opened its Organic Material Recovery Center at the Fairfield Suisun Sewer District facility on Chadbourne road in 2016. Lystek has a patented process to convert biosolids feedstock into a Class A biosolids derived injectable fertilizer product – marketed under the name LysteGro.

While initially deemed a fertilizer product and not subject to County oversight, complaints from the community, discussions with area residents, and a more informed understanding of the dearth of fertilizer regulation has prompted the County to begin seeking oversight over the application of this product. Several meetings have been held between Lystek and County staff to formulate a path forward for County oversight of LysteGro applications.

When first written, neither State nor County regulations envisioned this type of biosolids injectable fertilizer. Fitting the land application of LysteGro into the current County regulations has proven to be difficult as the County strives to protect the quality of life for its area residents while recognizing the need for this alternative, lower cost, biosolids derived fertilizer product for its many area farmers.

The process of determining how to best regulate this novel product and protect the community, while recognizing the operational needs of Lystek, is still ongoing. County staff hope to have a compliance agreement, or some other framework for oversight, completed within 2026.

Section V – Biosolids Stakeholder Group Meetings Summary

The Biosolids Stakeholder's Group meeting was held in a hybrid format – in person and virtually – on March 6, 2025. Participants in the Stakeholder Group Meeting included representatives from:

- Central Valley Regional Water Quality Control Board
- San Francisco Public Utilities Commission
- Synagro West
- Lystek International
- California Forever
- Trihydro Corporation
- Solano County Environmental Health division
- Area residents (2)

Environmental Health presented an overview of the 2024 land application season – leading off with the fact that no biosolids land application permits were applied for nor issued for the 2024 season. It was reiterated that with California Forever's acquisition of many of the Registered Fields, and their reluctance to allow biosolids land application to proceed on those properties, there was not a financially feasible path forward for Synagro to perform biosolids land application within Solano County.

A brief overview of the research project sampling dates and contract end date was shared with the group. Some discussion was held about the sampling techniques that was to be used in the project.

Prior to the Stakeholder's meeting, Synagro provided information verifying that they had submitted Notices of Termination (NOT) for several of the Registered Fields and that they anticipated submitting NOTs for the remaining Registered Fields once the required 38-month post application monitoring period had concluded. Per the SWRCB General Order Water Quality Order NO. 2004-0012-DWQ, monitoring and reporting of biosolid applied fields for 38 months post application is required prior to terminating the field registration. Synagro also mentioned that the material which was previously being land applied in Solano County had been shifted to land application in Sacramento, Merced, and San Benito Counties.

Lystek representatives relayed that their operations were expanding, and they looked forward to working with the County in finding the correct balance for oversight of their biosolids derived fertilizer application operations.

Section VI: Summary of the 2024 Annual Bay Area Clean Water Agencies (BACWA) Report to the Solano County Board of Supervisors

The Bay Area Clean Water Agencies, BACWA, is a joint powers agency providing technical expertise and financial support from a Public Utilities perspective. Collectively, the member agencies operate throughout nine Bay Area Counties and provide sanitary services to over 7.1 million people.

The BACWA principal agencies are the five largest wastewater treatment agencies in the San Francisco Bay Area: East Bay Municipal Utilities District, East Bay Dischargers Authority, San Francisco Public Utilities Commission, Central Contra Costa Sanitary District, and the City of San Jose. The BACWA Executive Board is comprised of one member from each of the five founding Public Utilities.

The BACWA report mentions that ongoing coordination and work is continuing through the Bay Area Biosolids Coalition. The Bay Area Biosolids Coalition's (BABC) website states that in 2025 the BABC transitioned to become a committee of BACWA.

BACWA 2024 Annual Report to the Solano County Board of Supervisors

The BACWA Annual Report to the Solano County Board of Supervisors Land Application of Biosolids in Solano County report, dated December 2024, summarizes the land application of biosolids conducted in Solano County in 2023 and larger industry trends in the management of biosolids.

Note: The BACWA report summarizes data from the previous year, so the 2024 report provides information from 2023 data.

The 2024 report highlights two trends in biosolids management within the Bay area:

- The 2023 data indicates a significant increase (from 24% to 30% of all biosolids end uses) in the volume of biosolids processed as compost. The report further specifies that many facilities are upgrading treatment facilities to produce Class A biosolids product in a move away from landfill disposal and use of biosolids as landfill alternative daily cover. This appears to be in response to SB 1383 which re-classified the use of biosolids as alternative daily cover from "beneficial reuse" to "disposal".
- From 2020 to 2023, biosolids reuse and disposal costs have increased by more than 50% - the report attributes changes in disposal practices, like sending biosolids to compost instead of use as landfill alternative daily cover, as well as increased travel distances for the cost increases.

A copy of the BACWA report is included as Attachment A of this report.