NATIONAL BIOSOLIDS DATA PROJECT

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CALIFORNIA

BIOSOLIDS MANAGEMENT 2018 - STATE SUMMARY

This summary, a dashboard of state statistics, & further data are at www.biosolidsdata.org

In California...

- *With the largest state economy in the U.S., California generates more wastewater solids than any other state. What happens in California sets precedents, and resource recovery is a focus of many California water resource recovery facilities (WRRFs), encouraged by state agencies and wastewater organizations.*
- *Biosolids recycling to soil has been the dominant mode for biosolids management in the Golden State for decades, with many of the largest cities relying on land application and composting. Since the mid-2010s, including in 2018, state policy is driving even greater reliance on recycling biosolids.*
- *California leads the nation in climate change policy and regulation, and biosolids play a significant role. Recycling biosolids to soils provides the best net greenhouse gas (GHG) emissions reductions of any solids management option, and new policies are restricting landfilling and incineration of wastewater solids.*
- *Alternative daily cover (ADC) was historically considered a beneficial use and was a significant outlet for biosolids during winter months in the San Francisco Bay area and for several large municipalities in close proximity to landfills. However, under the new climate change laws, ADC is no longer considered beneficial, and landfilling in general is being phased out as legislation passed in 2016 requires a 75% diversion of organic waste, including biosolids, from landfills by 2025.*
- *California WRRFs have also been leaders in energy resource recovery. WRRF's have long utilized anaerobic digestion for sewage sludge treatment and the biogas produced to provide power and heat for their operations. As the organic waste diversion mandates are implemented, there will be an increase in WRRFs receiving that waste for co-digestion. This will result in significantly more renewable energy production as well as biosolids.*
- *State policies are intended to increase markets for biosolids and beneficial use of biogas as low-carbon transportation fuel or through pipeline injection, export of electricity, or on-site power and heat production.*
- *Biosolids fit nicely into California's new healthy soils initiative, providing organic matter and renewable nutrients.*

Biosolids Management in California

There are about 500 permitted water resource recovery facilities (WRRFs) in California (Seiple et al., 2020), 250 of which are majors (having daily average wastewater design flows of more than 1 million gallons (> 1mgd)). Of those majors, 237 prepare sewage sludge/biosolids (U.S. EPA Region 9). Data are compiled each year regarding the use and disposal of the wastewater solids created at those major facilities. Data on the use and disposal of the wastewater solids produced by smaller facilities are generally lacking; however, most of those facilities only manage solids every 5 – 25 years, storing

them for long periods in lagoons. When they are cleaned out and used or disposed, they are regulated and counted. So, in any given year, the amount of solids from smaller facilities is minimal, and the data presented here for 2018 likely represents about 97% of the total solids produced in California that year.

In 2018, 71% of the ~675,000 dry metric tons (dmt) of California wastewater solids were applied to land as Class A or Class B solids: the majority as Class A, mostly compost, and much of the rest as anaerobically-digested Class B cake. About 50% of the biosolids that were applied to land, not counting composted biosolids, were applied to farms in the Central Valley and 21% were land applied in Arizona. Driven by new climate change policies and regulations, decreasing amounts are landfilled or used as landfill alternative daily cover (ADC), which is being phased out as an option (see sidebar, below), impacting especially biosolids programs in the San Francisco Bay area and several large municipalities in close proximity to landfills that have long relied on ADC during wet winter months when agricultural sites are not available. Landfill disposal – including ADC – and surface disposal accounted for about 20% of the state's solids in 2018. That same year, several sewage sludge incinerators (SSIs) processed ~4% of the state's solids. Small percentages of solids were treated in other ways, such as the unique deep well injection process used by Los Angeles.

Composting biosolids is a significant practice in California. Some is done by WRRFs, but most is done by large composting facilities in the Central Valley. In total, those facilities produced more than 220,000 dry metric tons of biosolids compost (Table 1).

Table 1. Class A Biosolids Compost Production in California, 2018, dry metric tons (dmt)

Facility Name	**County**	**Compost Produced (dry metric tons)**
Engel & Gray Composting	Santa Barbara	4,201
Inland Empire Regional Compost Facility	San Bernardino	33,314
Liberty Composting	Kern	29,961
Synagro Central Valley Compost	Merced	19,711
Synagro Nursery Products Hawes Compost	San Bernardino	87,078
Synagro South Kern Compost	Kern	38,099
Tulare Lake Compost Facility	Kings	7,320
TOTAL		219,684

***Note**: The number of tons of compost produced is different from the number of tons of wastewater solids that went into the compost. The latter – 226,772 dmt (U.S. EPA Region 9 data) – is what is counted in the biosolids use and disposal data in this report. This table shows the tons of finished compost produced.*

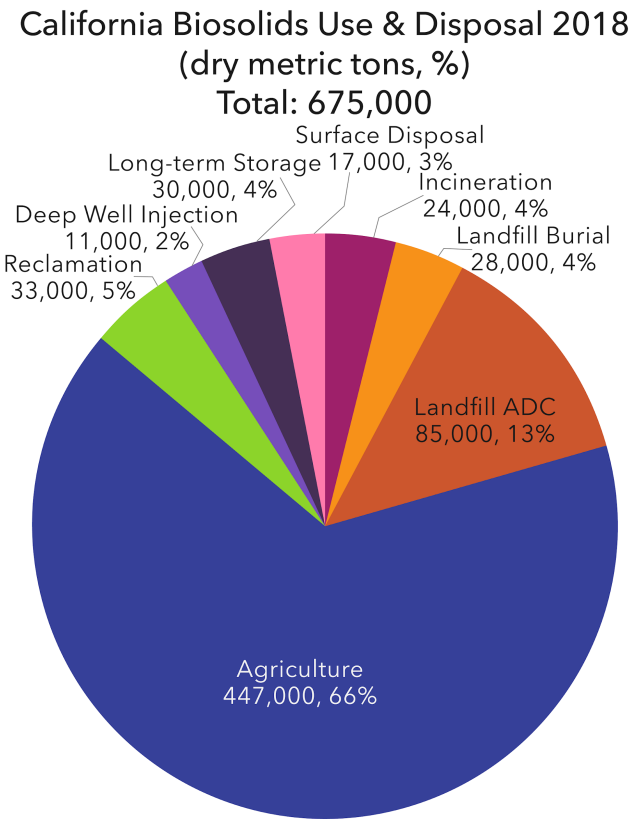
A newer Class A treatment option – Lystek thermal hydrolysis – opened in northern California in the mid-2010s. In 2018, that Lystek facility produced 4,237 dry metric tons of Class A liquid biosolids that was injected into farm land to support agricultural production.

In California, 96% of biosolids are managed by private contractors. This includes contractors hauling biosolids to land application sites or landfills, as well as land application companies and composters. The small number of WRRFs that land apply or surface dispose on their own property often also use contractors for hauling, spreading, and incorporation.

Several California WRRFs have been pioneers in biosolids management, advancing the profession in numerous ways, including quality practices, advanced anaerobic digestion and co-digestion, and renewable energy generation. See examples of exemplary local biosolids management programs, below.

Additional details on biosolids management in California are provided by several active organizations:

- *California Association of Sanitation Agencies (CASA) renewable resource program*: https://casaweb.org/renewable-resources/biosolids/. This statewide resource provides direction to regulations, research, and policy – including how biosolids are playing a significant role in meeting aggressive state goals for reducing net greenhouse gas emissions.
- *Bay Area Clean Water Agencies (BACWA):* https://bacwa.org/committees/biosolids/. This coalition of northern California public wastewater utilities has conducted biennial biosolids surveys of its members in even-numbered years, including 2018. These data are coordinated with similar survey data collected by the Southern California Alliance of Publicly-Owned Treatment Works (SCAP). BACWA's 2018 report, which includes comparisons with SCAP data, is available at the website above.
- *California Water Environment Association (CWEA):* this is the state member association of the Water Environment Federation and provides continuing education to the wastewater and biosolids sectors. https://www.cwea.org/news/tag/biosolids/.



Agency/Department Oversight

The CA Water Boards has a General Order that sets statewide requirements for biosolids management and also issues site specific waste discharge requirement (WDR) permits for land application. See https://www.waterboards.ca.gov/water_issues/programs/biosolids/.

Cal Recycle sets policies that affect wastewater solids management and compost facilities. See https://www.calrecycle.ca.gov/organics/biosolids.

State Regulations and Permitting

Land application sites are regulated either under Waste Discharge Requirements (WDRs) or the CA Regional Water Quality Boards' General Order. Most WDRs issued in CA require monitoring "CAM" pollutants on an annual basis – these are about 26 pollutants used in determining whether a material meets State of California hazardous waste limits. These include all the pollutants (except molybdenum) that are specified for monitoring in biosolids by the federal U.S. EPA 40 CFR Part 503 regulations, as well as a number of other mostly inorganic pollutants. Land application permits issued by CA Regional Water Quality Control Boards require groundwater, soil, and plant monitoring on a case-by-case basis.

In addition to the Water Quality Boards' oversight, many biosolids are also regulated by:

- the state solid waste regulations (if disposed of in landfills)
- the state's air quality requirements (applicable to biogas combustion, anaerobic digestion methane, and volatile organic compound (VO) emissions from composting)
- CalRecycle regulations and policies

Economics of Biosolids Management in California

The 2018 BACWA survey of the largest northern California WRRFs provides data on the costs of biosolids management that are a good representation for at least that part of the state. For 24 WRRFs that responded – including San Francisco, Oakland, and San Jose – the range of prices for hauling and tipping fee or end use – i.e. the WRRF's cost per wet ton leaving the facility gate – was $4 to $99. As BACWA noted: "unit costs for landfill ADC and land application showed a very large range, with landfill ADC (median cost: $48/ton) proving to be more expensive than land application (median cost: $33/ton)... The median unit cost for land application stayed about the same from 2015 to 2017, while the median unit cost for landfill ADC increased from $43/ton to $48/ton (12% increase over 2 years)."

The total annual cost for the use or disposal of those 24 communities' biosolids combined is close to $17 million – just in hauling and tipping fees – led by San Francisco at an estimated $4,169,200 and Oakland (East Bay MUD) at an estimated $3,280,400. Those agencies have a combined total of 40 full-time equivalent (FTE) jobs dedicated to just biosolids, plus considerable additional partial staff time for biosolids work.

Hauling distances were also included in the BACWA report and ranged from 0 – 370 miles round trip, with most programs having to haul more than 100 miles round trip at least some of the time. As CASA's renewable resources director notes: "Costs are dependent on the distance biosolids are hauled to and whether or not the contractor provides sampling, treatment, and/or a variety of use and disposal options at various times of the year."

SCAP has surveyed southern California agencies for more years than the BACWA survey. Many southern California agencies land apply their biosolids in Arizona due to restrictive southern California county ordinances. These agencies also send large amounts to compost facilities within California. Tipping fees reported in SCAP's 2016-2018 report are shown in Table 4 (SCAP, 2019).

Table 4 - Total Tipping Fees for the Management Types Utilized by All Agencies

	Tipping fee ($/ton) per contractor			Transportation cost ($/ton) per contractor		
	Min	Max	Average	Min	Max	Average
Composting	29.41	80.62	54.49	6.00	42.13	26.90
Deep well injection	76.00	76.00	76.00	7.53	7.74	7.64
Direct Burial	37.49	50.95	42.60			
Fertilizer	10.00	10.00	10.00	10.00	10.00	10.00
Land application	8.50	54.50	41.82	39.00	45.00	42.00
Landfill - Alt Daily Cover	37.90	61.00	46.01	13.75	13.75	13.75
Mine Reclamation	48.00	48.00	48.00			
Soil Blending Landfill	44.99	46.27	45.63	8.63	8.63	8.63

Pressures on Biosolids Management and Land Application

BACWA's 2018 survey identified the following pressures on biosolids management in northern California (BACWA, 2020):

"Agencies were asked to rank the challenges facing their biosolids program. The following challenges are ranked from the aggregate responses from most to least important:

1. Rising costs
2. Securing sustainable reuse options
3. Regulatory Restrictions on using Biosolids for Alternative Daily Cover
4. Hauling distance
5. Public perception/relations
6. Local restrictions on land application
7. Wet weather impeding drying operations
8. Space for drying operations
9. Other

"Reasons listed as "other" included:

- Uncertainty regarding the future viability of on-site disposal
- Loss of drying beds due to space constraints
- Sea level rise
- Restrictions on land application due to organic farming

"As in the 2016 survey, rising costs were the top concern overall. On an individual agency basis, rising costs were listed as the top concern for about half of the agencies that responded."

Pressures on biosolids in CA as of 2018 include the following, which were selections from a preset list in the NBDP survey:

1. AGRICULTURAL ISSUES – declining farmland due to less agriculture or due to development, sprawl, seasonal restrictions, conversion to "organic" farming, or competition with manures, etc.
2. COST – disposal options are less expensive than recycling
3. MANAGEMENT ISSUES – hauling distances
4. REGULATIONS ON BENEFICIAL USE – restrictive local ordinances (disallowed in new regulations)
5. TRADITION

As of 2018, the beneficial use of biosolids was increasing in California, as use as alternative daily cover (ADC) diminishes and climate change policy drives increased recycling. In 2013, 56% of the state's wastewater solids were applied to soils as Class A or Class B products. In 2018, that had increased to 71%. This trend likely continues in 2021.

However, a countervailing pressure on biosolids management has been local regulation. For decades, several counties have restricted biosolids land application, some allowing only Class A biosolids and some making any land application impossible or impractical. State experts note that "a number of counties have not placed requirements in ordinances, but on a case-by-case basis for conditional use permits. County ordinances do not apply to city-owned lands, so several counties have restrictions on out-of-county biosolids applied on private lands which do not apply to cities applying biosolids on their own lands." A 10-year-long lawsuit against Kern County's restrictive ordinance, brought by southern California cities and utilities, resulted in an injunction against enforcement of the local ordinance, supporting ongoing land application. This court action will likely lead to similar lessening of restrictions in other counties over time. State regulations adopted in 2020 also disallow local ordinances which unreasonably restrict or prohibit land application.

Currently, the most significant pressures affecting biosolids management – and encouraging biosolids beneficial use in California – are the state's aggressive laws addressing climate change and greenhouse gas emissions. These are driving wastewater solids management toward more anaerobic digestion, co-digestion, and biosolids use on soils. Enforcement of many of the applicable regulations begins January 1, 2022, although there is little enforcement likely to affect most WRRFs. See sidebar.

The wastewater and biosolids management profession are taking advantage of the opportunity and assets they have. CASA explains that WRRFs can play a significant role in the state's GHG emissions goals:

- Use of existing infrastructure to accept at least 75% of food waste currently landfilled for anaerobic digestion
- Increase biogas production to generate renewable energy, low carbon transportation fuel, and pipeline grade RNG, in turn decreasing greenhouse gas emissions
- Build healthy soils, sequester carbon, and reduce fossil fuel based inorganic fertilizer use through land application of biosolids
- Develop collaborative partnerships with private sector

The Impacts of Climate Change Laws on California Biosolids Management

Greg Kester, CASA's resource recovery lead, describes the impacts on biosolids management of the state's monumental climate change legislation, SB 1383, and associated laws and regulations:

"SB 1383, signed into law in September 2016, requires a 40% reduction in methane emissions in California by 2030 below the levels emitted in 2013. In order to achieve the methane emission reductions, the legislation further requires a 75% diversion of organics (including biosolids) from landfills by 2025, using 2014 levels as the baseline.

"This means that in 2025 and beyond, a maximum of 5.7 million tons of organic waste will be allowed to be disposed of in landfills, regardless of increases in population or waste generation...

"Biosolids which are anaerobically digested and/or composted and land applied constitute a reduction in landfill disposal; 18983.1(b)(6)(B).

"All other biosolids treated or managed in alternative ways other than anaerobic digestion and/or composting, including aerobic digestion (unless subsequently composted and land applied), incineration, pyrolysis, surface disposal, etc., is considered landfill disposal; 18983.1(a)(3).

"Notwithstanding (2) above; biosolids managed through alternative means may be considered as a reduction in landfill disposal through an application process with CalRecycle, but the applicant must quantify reduced methane emissions. s. 18983.2

"The state recognizes the wastewater sector is critical to the achievement of the landfill reduction mandates. Existing infrastructure, with relatively minor upgrades in the form of anaerobic digestion, can accept diverted food waste for co-digestion, and diverted green waste can be added to biosolids composting facilities.

"During the development of the regulatory framework, wastewater representatives stressed that in order for co-digestion and co-composting to be successful, municipal wastewater plants need assurance of markets for the products produced. This includes biogas, biomethane, biosolids, and compost. CalRecycle attempted to create the necessary markets by including two incentives in the regulation. First, the regulations require every jurisdiction (City or County) that must divert organic waste to also procure products of that diversion (s. 18993.1(a)).

"The regulations include language disallowing local ordinances which 'prohibit, or otherwise unreasonably restrict' the land application of biosolids (s. 18990.1(b)).

"There are no enforcement provisions which apply directly to POTWs or biosolids managers. No mandate absolutely requires the diversion of biosolids from landfills. However, given that biosolids are likely the cleanest organic waste which can be diverted, they will be among the easiest to divert and thus will be a likely first target."

Septage Management

An estimated 10% of California residents and small businesses rely on onsite wastewater systems (septic systems) for wastewater treatment. Septage can be land applied in California, and septage haulers treat septage by alkaline stabilization and land apply it directly, in accordance with federal requirements at 40 CFR Part 503. Septage not directly land applied is delivered to WRRFs.

Major WRRFs, Separate Preparers, and Notable Projects

Several California WRRFs have been pioneers in biosolids management, advancing the profession in numerous ways, including quality practices and renewable energy generation.

- ***The City of Los Angeles*** land applies about 70% of its biosolids to land as dewatered Class A cake, much of which is applied to the City-owned Green Acres farm in Kern County. Additional sites include other farmland and reclamation sites. About 10% of the City's wastewater solids are sent to composting operations, and the remaining 20% are injected into deep wells for disposal and biogas/methane production. More details are at https://www.lacitysan.org/san/faces/home/portal/s-lsh-wwd/s-lsh-wwd-cw/s-lsh-wwd-cw-b?_adf.ctrl-state=xsdyz58u7_5&_afrLoop=1496483119693815 5#. At the Hyperion WRRF there is an excellent museum about wastewater and biosolids management.

- ***Los Angeles County Sanitation Districts (LACSD)*** has 11 WRRFs, which manage most of the wastewater generated in the county outside of the City of Los Angeles. The greatest portion of wastewater solids are produced at the Joint Water Pollution Control Plant (JWPCP), which uses anaerobic digestion for stabilization and achieves energy self-sufficiency through its "Total Energy Facility." JWPCP can continue to operate even if grid power goes down. Over the past several years, the facility has been increasing its use of food waste to boost biogas production, which is being used for electricity production as well as innovative compressed natural gas vehicle fuel. The JWPCP has been an innovator in energy management dating back to the 1930s.

  Most of LACSD's wastewater solids are sent to composting operations, including the Inland Empire Regional Compost Authority. LACSD also owns and operates the $130 million Tulare Lake Compost Facility, which opened in ~2017 and composts a portion of LACSD wastewater solids. In 2018, 84% of LACSD composted and other biosolids were applied to agricultural soils, while 16% went to an old mine site landfilling operation.

- ***The San Francisco Public Utilities Commission (SFPUC)*** has long put biosolids to use as alternative daily cover (ADC) during the winter months due to ordinance limits on application during the "rainy" season. In the drier summer season, they send biosolids for direct land application in the Bay Area and Central Valley – and in increasing quantities as ADC becomes less available. SFPUC biosolids are anaerobically digested to Class B quality, and the biogas produced in the process is used for electricity and heat.

See more about SFPUC's program here: https://sfpuc.org/programs/biosolids.

In 2021, SFPUC is moving forward with a major upgrade, rebuilding its anaerobic digestion systems for a future of 100% beneficial use of biosolids and biogas. See details here: https://www.sfwater.org/index.aspx?page=796

- ***Orange County Sanitation District (OCSD)*** has been a leader in advanced biosolids recycling for decades. Because of a long commitment to quality, in 2003 they were the first biosolids program in the U.S. to become certified under the National Biosolids Partnership's Environmental Management System (EMS), which focuses on best management practices and quality outcomes. OCSD has also been recognized several years by the Water Environment Federation (WEF) as a "Utility of the Future Today."

  Learn all about the OCSD program here: https://www.tpomag.com/online_exclusives/2020/10/california-district-embarks-on-next-generation-class-a-wastewater-digester-facility.

  Don't miss this excellent two-part video: https://www.ocsan.gov/Home/Components/News/News/1939/.

- ***East Bay Municipal Utility District (EBMUD)*** treats the wastewater in Oakland, CA. Like other facilities in the state, they have been industry leaders, including becoming the first WRRF in the U.S. to be energy neutral – creating as much or more electricity as is needed to power the energy-intensive operations of the WRRF. EBMUD pioneered co-digestion of food waste and utilized combined heat and power (CHP) driven by anaerobic digestion biogas.

  Learn more about EBMUD resource recovery and biosolids here: https://www.ebmud.com/wastewater/recycling-water-and-energy/food-scraps-recycling/ and here: https://www.ebmud.com/wastewater/collection-treatment/wastewater-treatment/biosolids/.

- ***San Diego*** wastewater solids are sent to the Metropolitan Biosolids Center (MBC), which "is the City's regional biosolids facility that receives and processes solids from both the North City Water Reclamation Plant (NCWRP) and the Point Loma Wastewater Treatment Plant" (https://www.bidnet.com/closed-government-contracts/pure-water-program--metro-biosolids-center-improvements?itemId=675131651). The MBC treats the solids with anaerobic digestion and dewatering, producing electricity and heat from the biogas created in the process.

  In 2018, the facilities produced 35,666 dry U.S. tons of biosolids, 54% of which was sent to agricultural uses (typically in Arizona), where it helped grow mostly hay for animal feed. The remaining 46% was mostly used at area landfills for alternative daily cover. In 2021, improvements to the MBC commence and are anticipated to be completed in 2025: https://www.sandiego.gov/public-utilities/sustainability/pure-water-sd/phase-1-

projects/university-city-eastgate-mall/metropolitan-biosolids-center-improvements.

- ***Sacramento*** produced about 29,000 dry U.S. tons of biosolids from its Elk Grove WRRF in 2018. Regional San owns and operates the facilities, serving a population of about 1.6 million (https://www.regionalsan.com/about-us). Biosolids treatment includes anaerobic digestion followed by storage in lagoons for 3 - 5 years. In 2018, 75% of the biosolids were sent to lagoon storage from which some solids are disposed of by being injected into lined land disposal units on nearby facility-owned land. The remaining 25% went to the Synagro heat-drying facility, where they were treated to Class A standards and used as fertilizer, mostly to grow hay for animal feed.

  In addition to recycling some of its biosolids, Regional San provides biogas to a Sacramento Municipal Utility District electrical plant, which uses biogas and natural gas to produce up to 100 megawatts of power for local residential and industrial use. Some of the steam from the power plant is returned to the wastewater facility to heat the anaerobic digesters. Regional San also recycles wastewater effluent for irrigation and other non-potable uses.

- ***The City of Modesto,*** in Stanislaus County, owns and operates two WRRFs and has a notable liquid biosolids land application program. The Sutter facility provides primary treatment in clarifiers, and the primary solids are sent to landfill while organic solids are treated for beneficial use as biosolids. The further treatment of effluent is achieved at the Jennings facility, which is the largest wastewater pond treatment facility in the country. The wastewater is treated in these facultative ponds "and stored for irrigation. It is then blended with seasonal cannery waste and applied with biosolids from Sutter to the ranch at Jennings," which is 2,450 acres growing animal fodder neighboring the Jennings treatment ponds (https://www.modestogov.com/1921/Jennings-Secondary-Tertiary-Treatment-Fa).

- ***Palo Alto and Contra Costa*** were the two California WRRFs that incinerated wastewater solids in 2018. But Palo Alto, which treats 18 million gallons of wastewater daily, was in the process of building a $30 million dewatering and trucking facility that, beginning in 2019, produces 30% solids dewatered cake using belt filter presses. Palo Alto solids had been incinerated since 1972. The change was driven by several factors, including the incinerator's age and its high greenhouse gas (GHG) emissions. The new system reduces GHG emissions by an estimated 50%, some 15,000 metric tons of carbon dioxide equivalent annually.

  The new dewatering facility hauls dewatered solids 82 miles to the Lystek thermal hydrolysis treatment facility in Fairfield or to the Synagro composting facility in Merced County (114 miles one way). Those facilities blend Palo Alto solids with others and create Class A products used in agriculture.

- ***The Central Contra Costa Sanitary District*** owns one secondary WRRF that treats ~53.8 million gallons per day (MGD). It continues to operate its multiple hearth sewage sludge incinerator (SSI) in the most environmentally sound way possible. The SSI is fueled with

biogas from a nearby landfill gas recovery system. Heat is recovered and used to drive turbines for aeration in the wastewater treatment process. And the incinerator ash is blended into soil amendments applied in agriculture.

- ***Santa Rosa's Laguna Subregional Water Reclamation Facility (WRF)*** treats about 18 MGD and generated 4,610 dry metric tons of biosolids in 2018, 44% of which was treated to Class B standards and went to agricultural uses. The rest went to Class A EQ production at the Lystek thermal hydrolysis facility in Fairfield (24%), long-term storage at a barn with concrete bays where up to 7000 wet tons can be kept (23%), and landfill (9%). At the WRF, anaerobic digestion is used to treat the solids, and electricity is generated in a combined heat and power internal combustion engine system, meeting about 30% of the WRF's electrical demand. See more about Santa Rosa's biosolids recycling program here: https://srcity.org/1093/Biosolids.

- ***Regional biosolids separate preparers:*** California has many of the largest private biosolids preparation facilities in the country – mostly huge composting facilities. Each of these are well described at their online websites:
    - Inland Empire Regional Composting Authority : https://www.ierca.org/
    - Synagro South Kern Compost Manufacturing Facility: https://www.synagro.com/locations/south-kern-compost-manufacturing-facility-2/
    - Synagro Central Valley Composting Facility: https://www.synagro.com/locations/central-valley-2/
    - Synagro Nursery Products : https://www.synagro.com/locations/nursery-products/
    - Engel & Gray Composting, Santa Barbara County: http://www.engelandgray.com/
    - Liberty Composting, Lost Hills, Kern County: http://libertyrecyc.com/
    - Lystek: https://lystek.com/projects/fairfield-omrc/

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Lauren Fondahl, the U.S. EPA Region 9 biosolids coordinator, and Greg Kester of CASA, provided most of the California biosolids data reported here. Additional information was provided by BACWA, SCAP, and other sources, including:

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SCAP (Southern California Alliance of Publicly Owned Treatment Works), 2019. Biosolids Biennial Trend Survey, 2016 - 2018. https://bacwa.org/wp-content/uploads/2020/11/2018_SCAP_BIOSOLIDS_BIENNIAL-2020_01_14-FINALv3.pdf

CA biosolids brochures & introductions:
CASA:
https://casaweb.org/wp-content/uploads/2021/06/6-3-21-Biosolids-A-Natural-Resource-2-sided-flier-060321.pdf
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BACWA: https://bacwa.org/wp-content/uploads/2012/10/BACWA_biosolids_082312.pdf
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Biosolids regulations: https://www.waterboards.ca.gov/water_issues/programs/biosolids/
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Climate change policy & regulation:
https://www.calrecycle.ca.gov/organics/slcp
https://www.cwea.org/news/sb-1383-and-its-implementation/

Biosolids and food waste co-digestion in CA:
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California Water Boards & Carollo, 2019. Co-Digestion Capacity in California.
https://www.waterboards.ca.gov/water_issues/programs/climate/docs/co_digestion/final_co_digestion_capacity_in_california_report_only.pdf

Central Contra Costa: https://www.centralsan.org/sites/main/files/file-attachments/cwmp_technical_executive_summary.pdf

LACSD:
https://dpw.lacounty.gov/epd/SoCalConversion/PDFS/LosAngelesMassiveEnergyProject.pdf
https://www.biocycle.net/sanitation-districts-gear-food-waste-codigestion/
https://www.latimes.com/local/lanow/la-me-human-waste-composting-lawsuit-20160816-snap-story.html

Orange County SD:
https://www.tpomag.com/online_exclusives/2020/10/california-district-embarks-on-next-generation-class-a-wastewater-digester-facility
https://www.ocsan.gov/education/biosolids-program

Palo Alto: https://www.paloaltoonline.com/news/2019/06/05/environmentalists-cheer-as-palo-alto-retires-incinerators

Sacramento: https://www.regionalsan.com/sustainability-innovation

Santa Rosa: https://srcity.org/1093/Biosolids