FORECASTING FUTURE ISSUES FOR LAND APPLIED BIOSOLIDS

MABA Land Application of Biosolids: Theories, Practices and Insights
16July2013
Lancaster, PA

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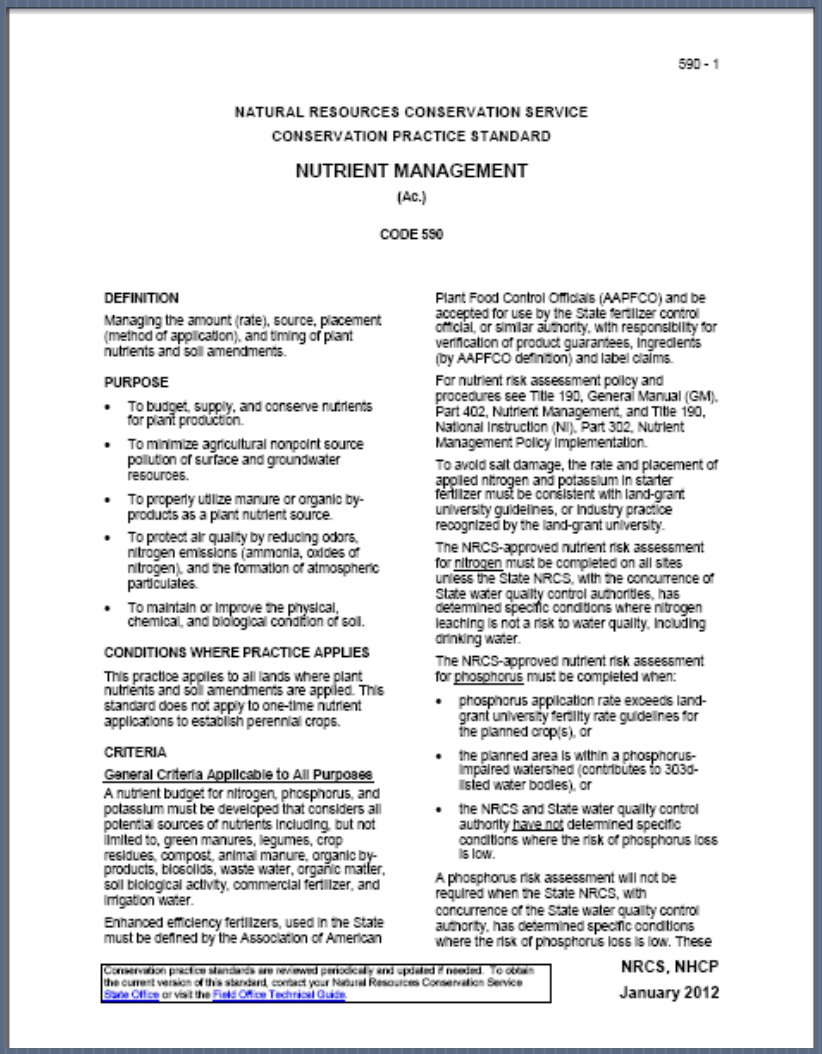
U.S. Environmental Protection Agency

Forecasting Future Issues for Land Applied Biosolids

- Conservation Practices — Agronomic Application Rates
- Food Crop Production/Marketing
- Prohibited Agricultural Practices
- Producing Biosolids Acceptable to the Public
- Managing Non-traditional Residuals Produced While Treating Wastewater
- Issues Associated with Deriving Products from Biosolids and/or Wastewater
- Opportunities for Deriving the Greatest Benefits from Land Applied Biosolids
- Regulations: Where are we 20 years later?

updated January 2012 NRCS CODE 590



590 - 1

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION

Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

PURPOSE

- To budget, supply, and conserve nutrients for plant production.
- To minimize agricultural nonpoint source pollution of surface and groundwater resources.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen), and the formation of atmospheric particulates.
- To maintain or improve the physical, chemical, and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied. This standard does not apply to one-time nutrient applications to establish perennial crops.

CRITERIA

General Criteria Applicable to All Purposes

A nutrient budget for nitrogen, phosphorus, and potassium must be developed that considers all potential sources of nutrients including, but not limited to, green manures, legumes, crop residues, compost, animal manure, organic by-products, biosolids, waste water, organic matter, soil biological activity, commercial fertilizer, and irrigation water.

Enhanced efficiency fertilizers, used in the State must be defined by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by the State fertilizer control official, or similar authority, with responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.

For nutrient risk assessment policy and procedures see Title 190, General Manual (GM), Part 402, Nutrient Management, and Title 190, National Instruction (NI), Part 302, Nutrient Management Policy Implementation.

To avoid salt damage, the rate and placement of applied nitrogen and potassium in starter fertilizer must be consistent with land-grant university guidelines, or industry practice recognized by the land-grant university.

The NRCS-approved nutrient risk assessment for nitrogen must be completed on all sites unless the State NRCS, with the concurrence of State water quality control authorities, has determined specific conditions where nitrogen leaching is not a risk to water quality, including drinking water.

The NRCS-approved nutrient risk assessment for phosphorus must be completed when:

- phosphorus application rate exceeds land-grant university fertility rate guidelines for the planned crop(s), or
- the planned area is within a phosphorus-impaired watershed (contributes to 303d-listed water bodies), or
- the NRCS and State water quality control authority have not determined specific conditions where the risk of phosphorus loss is low.

A phosphorus risk assessment will not be required when the State NRCS, with concurrence of the State water quality control authority, has determined specific conditions where the risk of phosphorus loss is low. These

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

NRCS, NHCP
January 2012

U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

CONSERVATION PRACTICE STANDARD NUTRIENT MANAGEMENT

CODE 590

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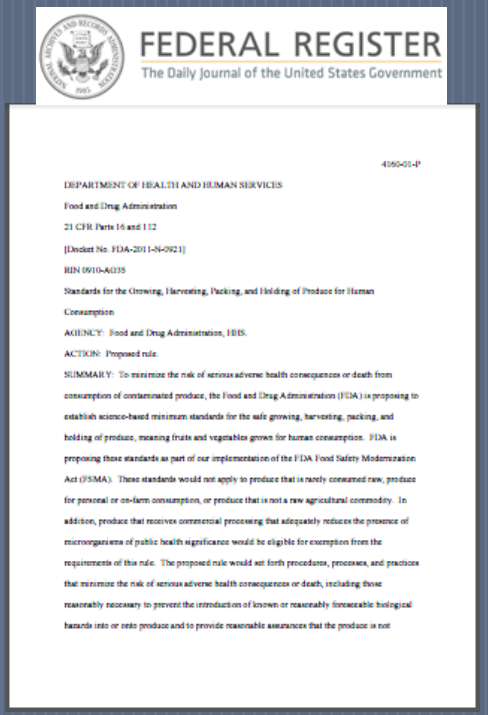
Resulting State P-Indexes vary in their approaches for handling Phosphorus bioavailability, runoff potential, etc.

Food Crop Production/Marketing

- FDA's Proposed (16Jan2013) ***Standards for the Growing, Harvesting, Packing and Holding of Produce for Human Consumption*** (21 CFR Parts 16 and 112) …

  FDA is proposing to establish science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption under the Food Safety Modernization Act (FSMA)


FEDERAL REGISTER
The Daily Journal of the United States Government

4160-01-P

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

21 CFR Parts 16 and 112

[Docket No. FDA-2011-N-0921]

RIN 0910-AG35

Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption

AGENCY: Food and Drug Administration, HHS.

ACTION: Proposed rule.

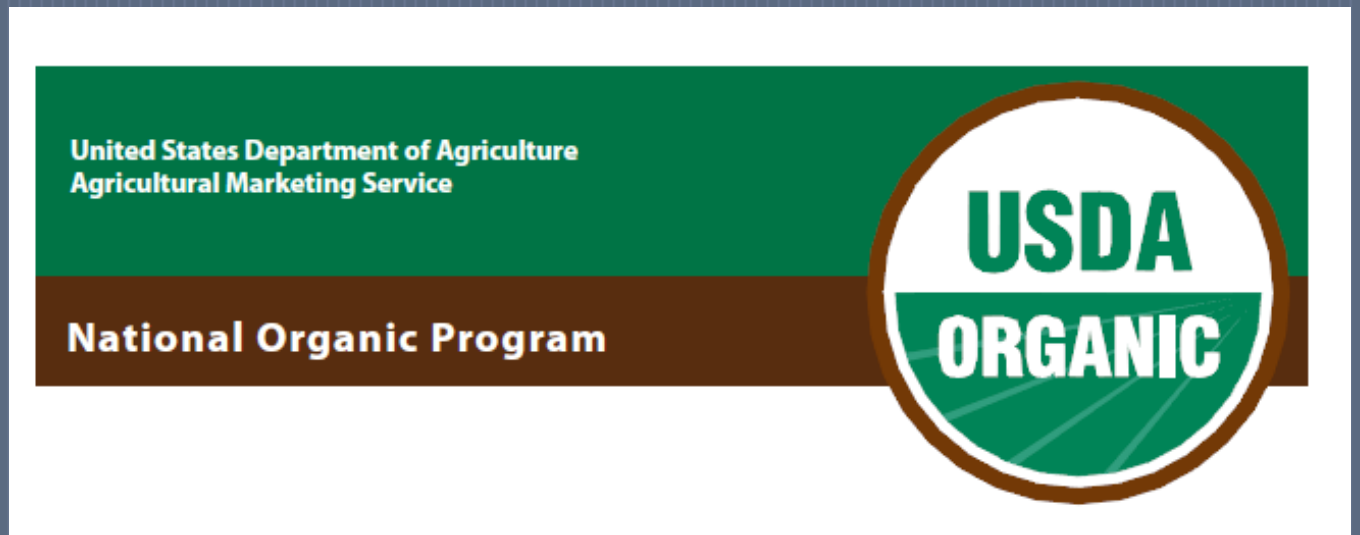
SUMMARY: To minimize the risk of serious adverse health consequences or death from consumption of contaminated produce, the Food and Drug Administration (FDA) is proposing to establish science-based minimum standards for the safe growing, harvesting, packing, and holding of produce, meaning fruits and vegetables grown for human consumption. FDA is proposing these standards as part of our implementation of the FDA Food Safety Modernization Act (FSMA). These standards would not apply to produce that is rarely consumed raw, produce for personal or on-farm consumption, or produce that is not a raw agricultural commodity. In addition, produce that receives commercial processing that adequately reduces the presence of microorganisms of public health significance would be eligible for exemption from the requirements of this rule. The proposed rule would set forth procedures, processes, and practices that minimize the risk of serious adverse health consequences or death, including those reasonably necessary to prevent the introduction of known or reasonably foreseeable biological hazards into or onto produce and to provide reasonable assurances that the produce is not

  - Includes coverage of water quality for all sources of water used
  - Refers to requirements for use of both manure and biosolids as "biological soil amendments" along with fertilizers, vegetative wastes, etc.
  - Prohibits use of human waste for growing covered produce, except sewage sludge biosolids used in accordance with the requirements of 40 CFR Part 503, Subpart D, or equivalent regulatory requirements.

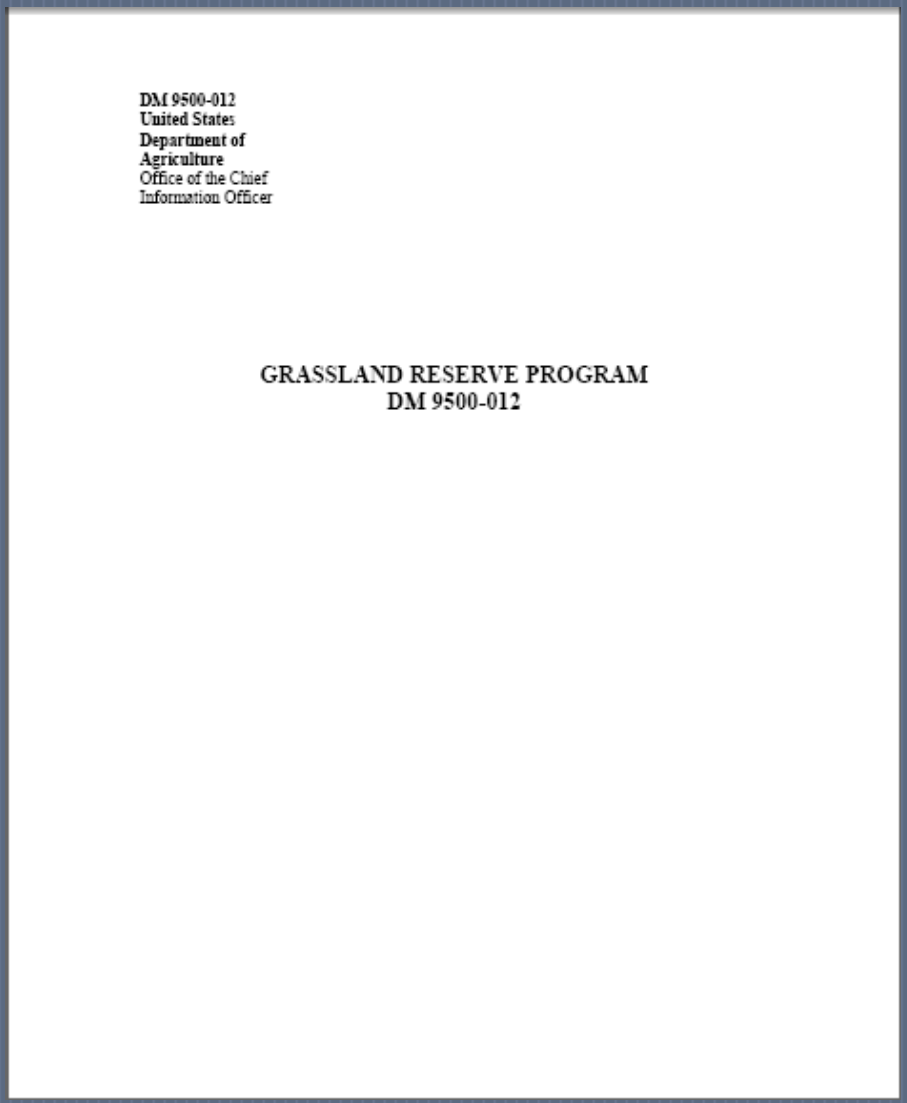
Prohibited Agricultural Practices

- USDA's "Organic" Food Crop Label
  - Share of foods labeled "organic" is increasing
  - No indication of USDA revisiting restrictions on GM, radiation of produce, or production on biosolids amended sites

Organic Labeling and Marketing



13Dec2010 NRCS DM 9500-012



DM 9500-012
United States
Department of
Agriculture
Office of the Chief
Information Officer

GRASSLAND RESERVE PROGRAM
DM 9500-012

U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

GRASSLAND RESERVE PROGRAM

PROGRAM PURPOSE

The purpose of the Grassland Reserve Program (GRP) is to provide assistance to landowners and operators to protect grazing uses and related conservation values on eligible private range and pasture lands.

16. PROHIBITED ACTIVITIES

Trash Dumping.

Dumping, collecting, recycling, or storing of trash, refuse or waste is prohibited, except that animal waste may be applied as fertilizer at rates recommended in the GRP Management plan. Sewage sludge is not allowed.

Producing Biosolids [more] Acceptable to the Public

- Need for optimal process controls ["industry based"?] to control potential odor production
- Need for establishing "Stability" measures ["industry based"?] for finished biosolids (incl. Class B as well as Class A/EQ products)
- Need to address [establish "industry based" limits for?] "CECs" in finished biosolids and biosolids products
- Need to address pathogen regrowth/reactivation and fate of antibiotic resistant pathogens in biosolids


THE
NATURAL ORGANIC
Milorganite®
FERTILIZER
6-2-0
ACTIVATED SEWAGE SLUDGE
Read directions and precautions on back panel carefully before using
For use on lawns, shrubs and ornamentals Not for vegetables
Long lasting
Will not burn
The golf course choice for fine turf
All organic, naturally
Processed Only By
Milwaukee Metropolitan Sewerage District
Milwaukee, Wisconsin


KNIGHT


TACTRO


Mulch

Residents complain of 'raw sewage' smell; City claims they have 'no control' … 03/24/2011

- Local area businesses and city of Wilmer residents were flooding The Ellis County Press office Monday, March 21 regarding smells of "raw sewage" and complaints of "human feces" being dumped on property within the city limits.
- … the city of Wilmer has no control over the type of commercial fertilizer the farmers are using … a material called "biosolids" … the organic residual of treated and processed wastewater and dredge from lakes, rivers and other bodies of water.
- Once the treatment process is complete, they load and transport the nutrient-rich organic material to farmers and ranchers for distribution as a fertilizer and soil conditioner.
- According to City Secretary Alice Holloway the commercial fertilizer is completely 100 percent safe.
- The farmers use the organic fertilizer in place of chemical fertilizer to help the environment.

The process … Biosolids are derived from a wastewater treatment process that separates water from solids, with the solids going through anaerobic digestion – a process in which microorganisms break down the material in the absence of oxygen – for about 28 days. The solids then go through a belt press for additional dewatering until they resemble potting soil. Lime is incorporated to raise the pH level, abate the odor and kill off any remaining pathogens such as e. coli and salmonella. The biosolids are then stored on-site at the treatment facility for about 24 hours before being applied to agricultural land.

Human waste is raising a stink in Ellis County … 03/11/2013

- "You know, there is no other smell like this. I put it just short of a dead person," … "I'm serious."
- "It's horrible," … "It's gotten in our cars so when someone gets in your car to ride with you they say, 'Man, what's that smell?'"
- … dozens of residents who say they love where they live except for this: Truckload, after truckload, after truckload of treated human waste, or "biosolids," dumped and spread across hundreds of acres on three area farms.
- Farmers pay $20 a load to use the waste as fertilizer. The company that applies the biosolids contracts with sewage treatment plants to dispose of their solid wastes after the pathogens and metals have been eliminated. The main thing they can't eliminate is the smell; the smell is not good. It's a combination of organic materials as well as chemicals giving off an ammonia-type aroma.
- So bad is the smell that in the past five years, neighbors have lodged 110 complaints with the Texas Commission on Environmental Quality. Fourteen of those complaints have been filed since January. Despite odor nuisance laws on the books, in those five years the TCEQ has never issued any citations.
- "You call the TCEQ; the TCEQ says, 'OK, we will send somebody out there.' Three or four days later they'll show up, stick their nose in the air. 'Well, we don't smell nothing.' Nothing founded and they disappear and leave." "Just over the tree line… that's where hundreds and hundreds of trucks are dumping."
- State officials said their investigation continues. … Meanwhile, neighbors keep holding their breath, hoping for winds of change.

State to look at biosolids rules after odor complaints

Trinity River Authority opposes sludge rule changes ... 06/20/2013

- Local officials have been bombarded with complaints over the past three weeks after a company contracting with the City of Fort Worth for the removal of wastewater product began applying treated sewage sludge to pastureland southwest of Springtown.
- Residents say their quality of life has been affected by a foul stench, many saying the odor has kept them from going outdoors or made them feel sick. Many are also concerned about possible health and environmental effects, as well.
- No permit is required to use Class A biosolids as fertilizer, though the sludge must be treated to reduce flies and other vector attractions and tested to ensure it's non-hazardous, according to the state.
- TCEQ responded to the complaints and has an open investigation but took no action to stop the application of the biosolids in the neighborhood. However, the City of Fort Worth has halted the application of biosolids by their contractor in Parker County after officials in that county were contacted.
- TCEQ has opened enforcement action against the company involved in relation to similar complaints in Wise County last month. Complainants in that case documented the affects of the odor issue, according to a TCEQ representative.

Special Report: Biosolids in Ellis County … 06/20/2013

- The Texas Commission on Environmental Quality will soon consider a rule petition that would restrict the land application of biosolids, also known as sewer sludge, in Ellis County. The petition is among agenda items at the agency's June 18 meeting in Austin.
- In draft form, the petition requests that the use of sewer sludge be prohibited within a three-mile radius of any city limit in a county with more than 140,000 in population.
- Residents in several areas of Ellis County have complained about the practice, voicing anger over the odor along with their health and environmental concerns.
- Their complaints aren't going unnoticed by public officials … "Earlier this spring, I collected a dried, weeks-old sample that had been left on a county road." … "After keeping it in a jar for several days, I rehydrated it, and the smell nearly knocked my head off. What is being spread has too much odor to be used near homes." … he's been told if sufficient heat is used in the processing of the biosolids, there shouldn't be a noticeable odor. … "This is noticeable." … "I guess there could be a quality control issue in regard to the heating of the biosolids. A true neutral should be doing frequent testing and there needs to be a compliance mechanism."
- The Fort Worth-based company has a contract with the Trinity River Authority, which handles wastewater treatment for the Metroplex's mid-cities. They annually will spread the material on from 3,600 to 4,200 acres in Ellis County, according to the company's figures. … Ellis County has 47,000 acres comprising 69 sites and 34 landowners that have submitted a letter of notice to the TCEQ that they want biosolids applications. The demand greatly exceeds the supply and there is a waiting list.

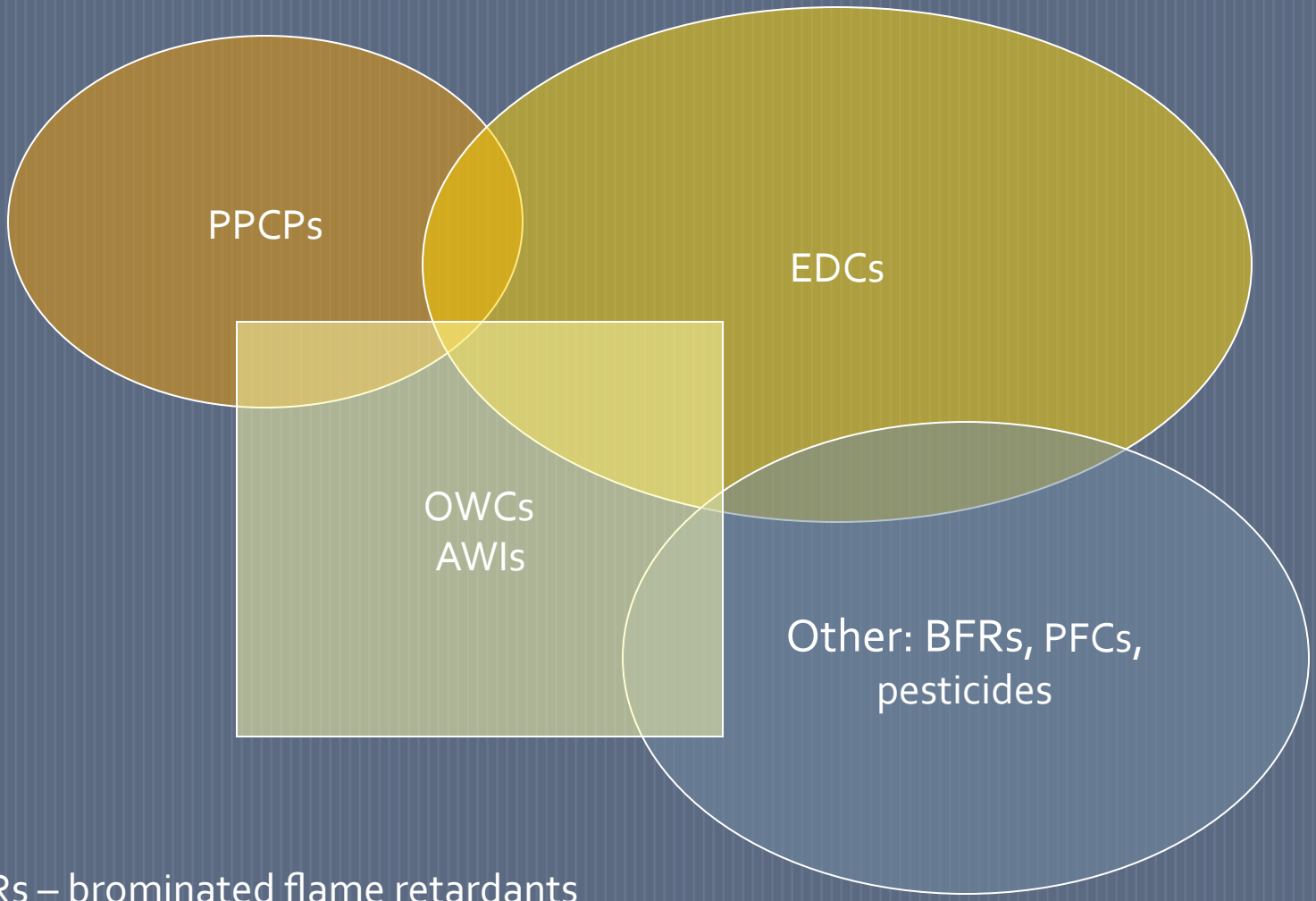
Special Report: Biosolids in Ellis County … 06/20/2013 … cont'd.

- … less than 8-percent of Ellis County's 47,000 acres that wants biosolids receives it annually. About two-thirds of TRA's biosolids – from 28,800 to 33,600 dry tons a year – are applied in Ellis County with the remainder trucked to farmers elsewhere. … The wait can be lengthy for people wanting to become part of the acreage total as those already receiving the product stick with it. … "It usually takes urban encroachment or someone selling their land to have that land exit the program."
- A biosolids contract with the city of Fort Worth involves land application in other counties where the demand exceeds the supply. Of the noticed acreage in Johnson County, about 27-percent receive biosolids applications annually, with Wise County at 20-percent, Hill County at 12-percent and Palo Pinto at 10-percent, according to 2012 figures from the city of Fort Worth.
- If that petition's proposed rule changes were accepted, it's unlikely that the application of biosolids in any of these other counties would be affected based on the draft wording.
- Not all sites have drawn the volume of complaints as the ones in the rural Midlothian area. At an 800-acre site off of Slate Rock Road in Bristol, is in its second year of having biosolids applied to hay fields and pastureland. There's about a half-mile between his site and neighbors, along with several tree lines in between. "Last year (the first year of biosolids applications), I produced 738 round bales on 125 acres. A friend of mine, two miles down the road, didn't use the biosolids and produced 160 bales on a hundred acres." … "I'm told that it's the second year you really notice the benefits and my worry is where am I going to store all of the hay I'm going to produce?" The farmer, who waited four years to get his first application after signing up for the program, acknowledges there's a smell to the material but wants people to realize the benefit to the farmers.

Special Report: Biosolids in Ellis County … 06/20/2013 … cont'd.

- "This isn't doing anything but helping the farmers." … "Biosolids is the greatest thing going right now."
- A neighboring resident said the smell can be "pretty strong" at times but "it's not totally unbearable." She's willing to put up with it when the biosolids are being applied because of the benefit to the farmer. "It's very good for their crops. The hay comes back twice as good." she says. "It's natural. It's fertilizer."
- An Ellis County Commissioner … there has to be common sense involved with the application of biosolids. … "The problem you get is common sense and people wanting to use it next to their neighbors. If you have good neighbors that put it on locations away from everybody, it's a good product. If you have a location in an area that's more urbanized, it leads to a lot of problems."
- **Benefits for farmers …** Ellis County agriculture extension agent says biosolids have been used on "most all crops grown in the area," including corn, milo, soybeans, sunflowers, cotton, wheat, oats and hay, both permanent pasture and annual hay crops. With a cost of $20 per acre for biosolids application as opposed to $50-$70 per acre for commercial fertilizer, it's a less expensive option for farmers. "It's an excellent source of organic matter for crop and pasture. There are no negatives as long as proper or required testing is done and applied as needed or recommended per soil test." … an increase in phosphorous levels in the soil is possible with repeated use, hence the need for testing. … There are social concerns when people live close by or are downwind. He would personally use the product on his 80 acres but doesn't because of the number of residences that have moved in around him. … "It's a good product/tool if used properly and where needed." … "It provides a cheap source of nutrients and organic material to producers and keeps it out of municipal landfills." … "Land application is a way to help the farmer."

Emerging Contaminants



BFRs – brominated flame retardants
PFCs – perfluorinated compounds

*Contaminants of Emerging Concern in Water**

PFOA

Pharmaceuticals and Personal Care Products (PPCPs)

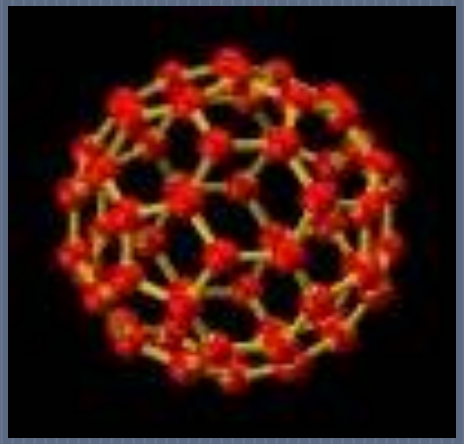
Prions

Nanomaterials

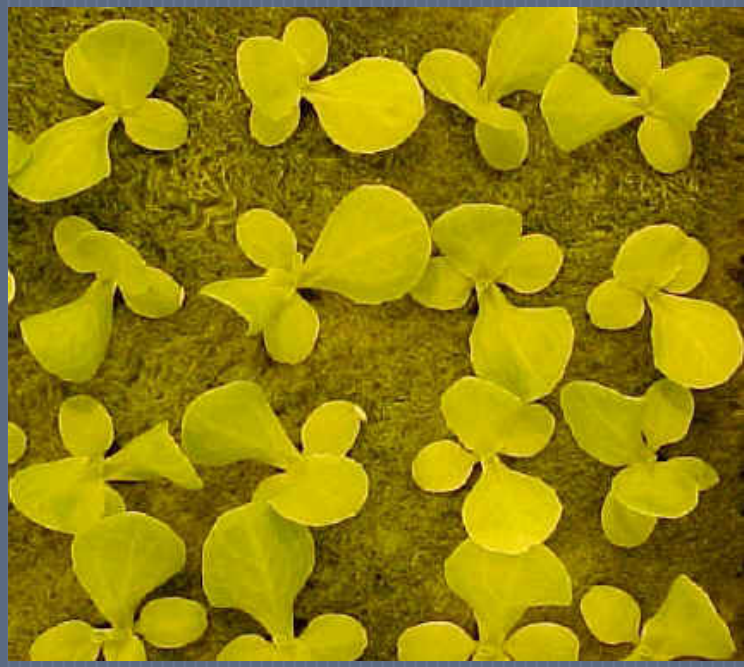
Pesticides

Endocrine Disrupting Compounds

PBDEs

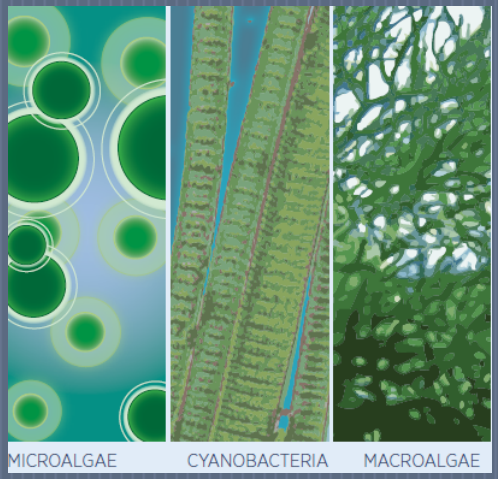


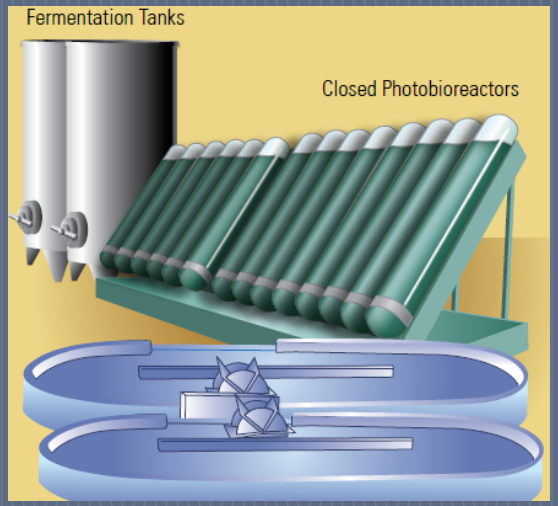
*Not an exhaustive list.



Managing Non-Traditional Residuals/ Sludges Produced while Treating Wastewater

- Algae from algae produced in wastewater treatment systems or algae biomass production systems using wastewater
- Energy crops or crops grown to remove nutrients from wastewater effluents for advanced treatment for nutrient removal


MICROALGAE
CYANOBACTERIA
MACROALGAE


Fermentation Tanks
Closed Photobioreactors

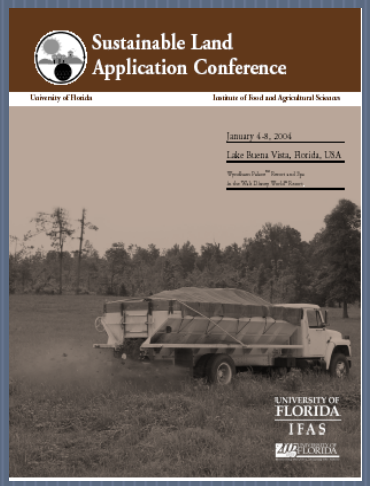

Grown
for
Biofuel

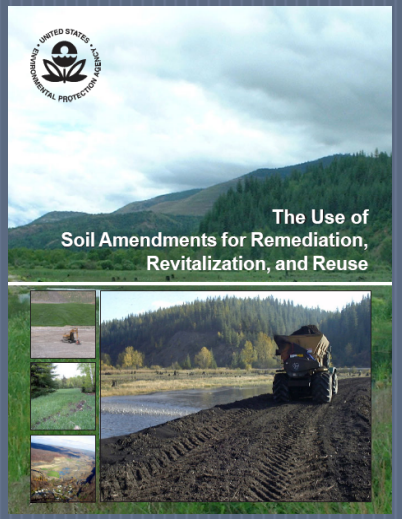
Issues Associated with Deriving Products from Biosolids

- Potential impact of maximizing energy recovery from biosolids on the resulting residuals for land application
- Potential impact of recovering nutrients from wastewater, sidestreams &/or biosolids on the resulting residuals for land application
- Potential impact of producing biopolymers, etc. from biosolids on the resulting residuals for land application

Opportunities for Deriving the Greatest Benefits from Land Applied Biosolids

- Agricultural use vs. reclamation/restoration uses
- Carbon sequestration/GHG offsets





Stafford Airport Reclamation

The Airport Authority faced importing topsoil at cost of several million dollars for the 300+ acres of acidic (pH ~2) soil at the new Stafford County Airport in 2001. In the first season after biosolids application, grass began to grow, then became so long, the Airport Authority now has to worry about wildlife and mowing.

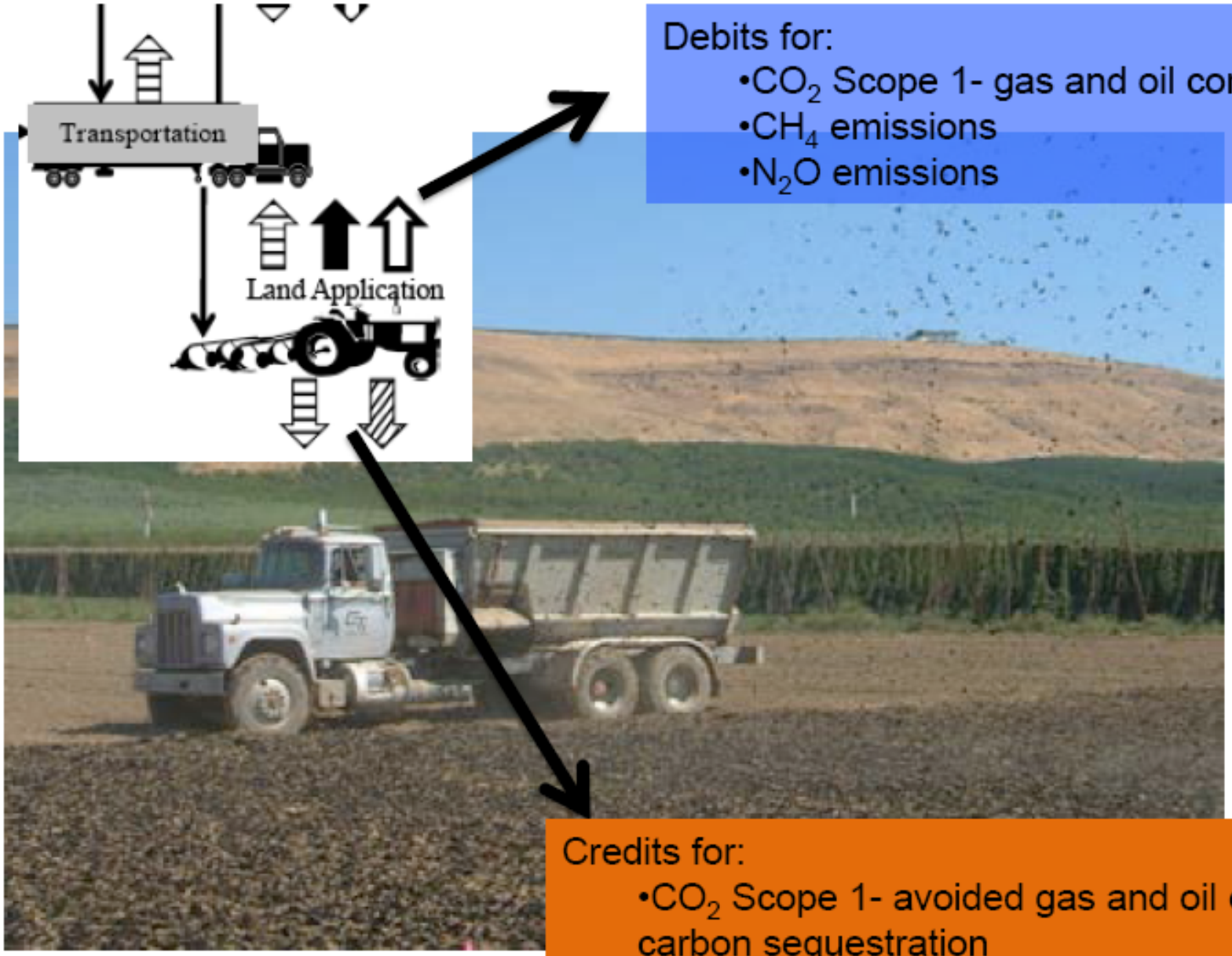












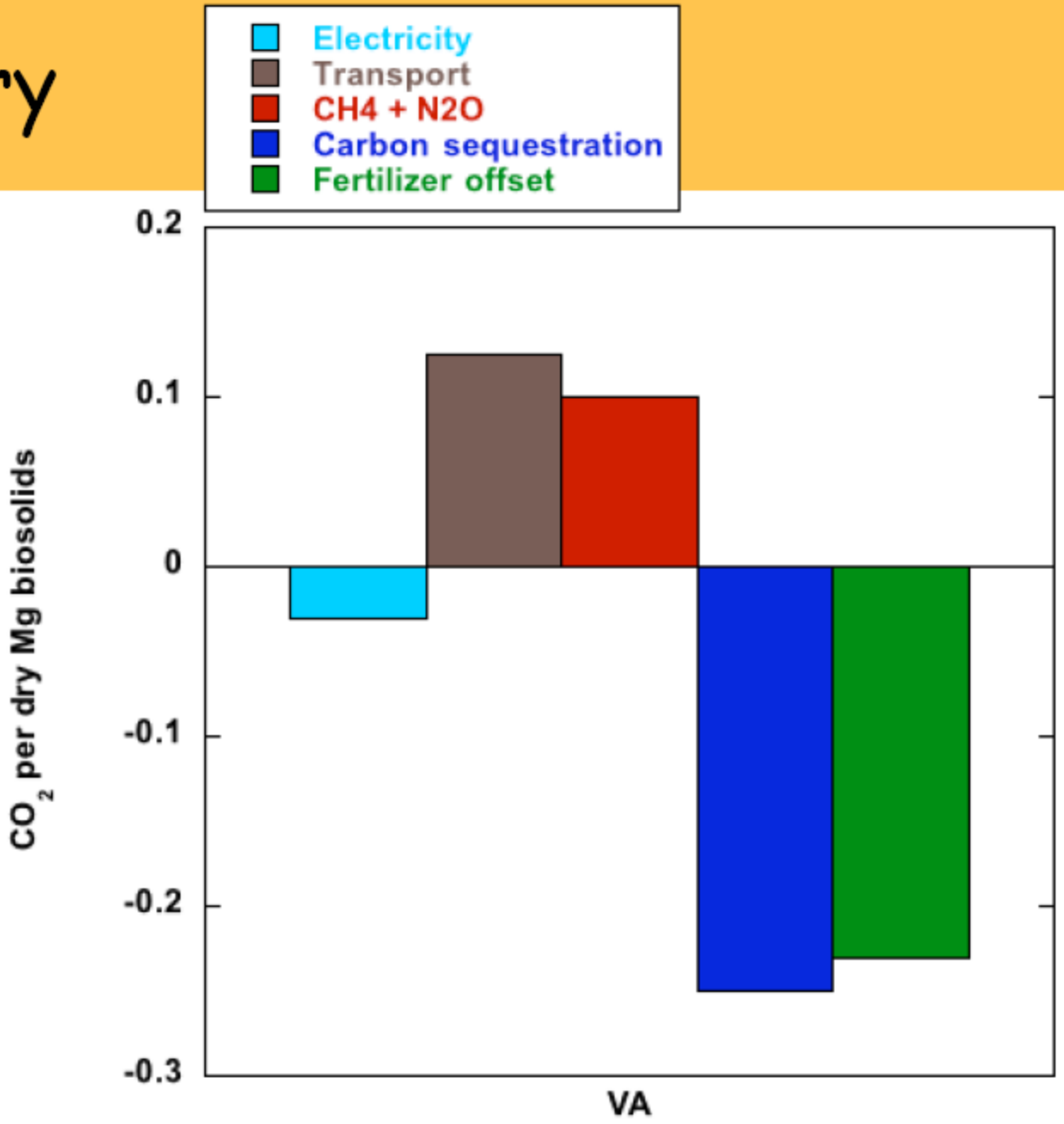
Debits for:

- CO_2 Scope 1- gas and oil combustion
- CH_4 emissions
- N_2O emissions

Credits for:

- CO_2 Scope 1- avoided gas and oil combustion, carbon sequestration
- CO_2 Scope 3 – avoided fertilizer use, avoided cement manufacture

VA summary


Electricity
Transport
CH4 + N2O
Carbon sequestration
Fertilizer offset
0.2
0.1
0
-0.1
-0.2
-0.3
CO2 per dry Mg biosolids
VA

Regulations: Where are we 20 years later?

- What EPA has been doing with limited budget and resources …
  - Finalize a subset of refined risk assessments on pollutants of concern found in the Targeted National Sewage Sludge Survey (TNSSS)
  - Ten pollutants (i.e., Barium, Beryllium, Manganese, Molybdenum, Silver, 4-Chloroaniline, Fluoranthene, Pyrene, Nitrate, Nitrite) are undergoing management review, to be followed by peer review

Regulations: Where are we 20 years later?

- Develop/refine scientific tools available for screening risks for pollutants found in biosolids
- Reevaluate dioxins utilizing a new IRIS human health benchmark (RfD) and arsenic using a new cancer slope (when finalized)
- Comply with statutory requirements of CWA via biennial reviews

Revising Biosolids Action Plan and Research Strategy

- Focus on recognizing that biosolids are a renewable resources that is valuable in context of growing need for renewable energy and sustainability.
  - Establish regulations, technology, research, and outreach activities that maximize safety, recovery and use of the resources in biosolids
  - Recognize the core business of wastewater treatment plants has moved toward resource recovery and sustainability
  - Promote public awareness and acceptance of biosolids as a renewable resource by supporting the NBP's Biosolids Management Program
  - Partner with regulatory agencies, municipal agencies, and professional organizations as needed to promote needed research and development