

# Tools for Biosolids Education

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**The Biosolids Lifecycle**

<http://www.biosolids.state.va.us/>

# Topics

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1. What are biosolids?
  2. How are biosolids generated and processed?
  3. How, where, and why are biosolids used?
  4. How are biosolids classified?
  5. How are biosolids regulated?
  6. Current land application issues.
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# 1. What are biosolids?

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Gerald Kidder, Univ. of Florida

# Definitions

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- ❑ “Domestic wastewater residuals.”
  - ❑ The solid, cake, or liquid material generated during domestic wastewater treatment.
  - ❑ Wastewater treatment produces effluent and residuals (a.k.a. sewage sludge, biosolids).
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# Sewage sludge is to biosolids as:

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- A. Sea water is to Salt.
  - B. Paint is to Pigment.
  - C. Cow is to Milk.
  - D. Crude oil is to Gasoline.
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# Biosolids characteristics

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- Nutrient-rich, mostly organic material.
  - Recyclable as fertilizers or soil amendments:
    - Improve and maintain productive soils.
      - Increased biological activity.
      - Slow-release nutrients.
    - No harm to human health or the environment.
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# How do we know that biosolids are safe to use?

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- Decades of worldwide research have demonstrated that biosolids can be safely used on food crops if application guidelines are followed.
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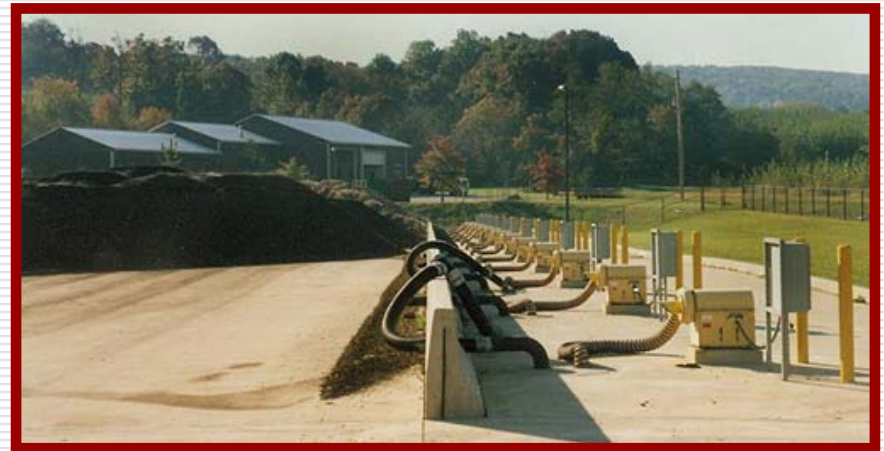
## 2. How are biosolids generated and processed?

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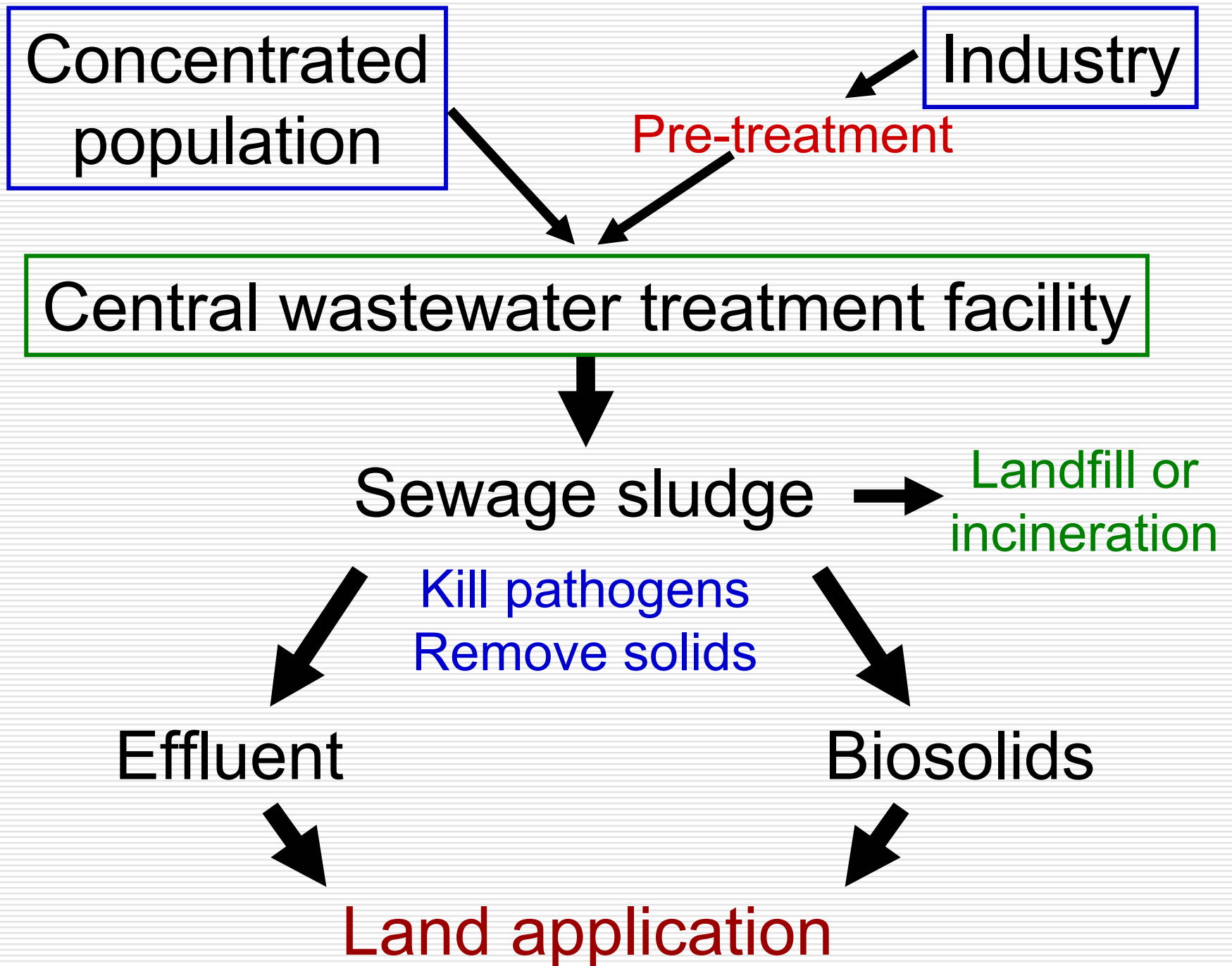
### **Biosolids Land Application Program**

Univ of Nebraska Extension in Lancaster County  
<http://lancaster.unl.edu/enviro/biosolids/sl05.jpg>



### **R. Alexander Associates**

[http://www.alexassoc.net/organic\\_recycled\\_products\\_services.htm](http://www.alexassoc.net/organic_recycled_products_services.htm)



*Sewage sludge that is disposed of by landfilling or incineration is not biosolids.*

# 3. How, where, and why are biosolids used?

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## **Biosolids Land Application Program**

Univ of Nebraska Extension in Lancaster County

<http://lancaster.unl.edu/enviro/biosolids/sl04.jpg>



## **City of Clinton, NC, Public Works**

<http://www.cityofclintonnc.com/departments/pubworks/wastewater/biosolids.asp>

# Biosolids use/Disposal methods

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- Landfill.
  - Incinerate.
  - Transfer.
  - Land apply (Class A or B).
  - Distribute and market (Class AA).
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# Cost to dispose of biosolids

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<b>Method</b>	<b>\$ per dry ton</b>
Land application	50 – 200
Composting	150 – 500
Heat drying	225 – 600
Landfilling	175 – 650

# Biosolids use

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- Land application takes place in all 50 states:
    - Farms and ranches.
    - Forests.
    - Gardens and parks.
    - Reclaimed mining sites.
  - Fertilizer value of biosolids: \$60 to \$160 per acre.
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# Biosolids use

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- 8 million dry tons produced nationally each year:
    - In 1988, 35% land-applied.
    - In 2003, 65% land-applied.
  
  - In Florida:
    - 270,000 dry tons produced each year.
    - 83% used beneficially.
    - Additional 90,000 – 100,000 dry tons of Class AA pellets imported annually.
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# Biosolids use

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- Agricultural uses of biosolids have improved crop growth and yield.
- Nutrients in biosolids:
  - N, P, S, Ca, Mg, micronutrients.



**King Co., WA Biosolids Research and Demonstration**  
<http://splash.metrokc.gov/WTD/biosolids/ResDem.htm>

## 4. How are biosolids classified?

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**"AA"**

**"A"**

**"B"**

**"EQ"**

# Classification

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- Biosolids are classified based on:
    - Degree of pathogen reduction.
    - Concentration of metals (pollutants).
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# Biosolids classes

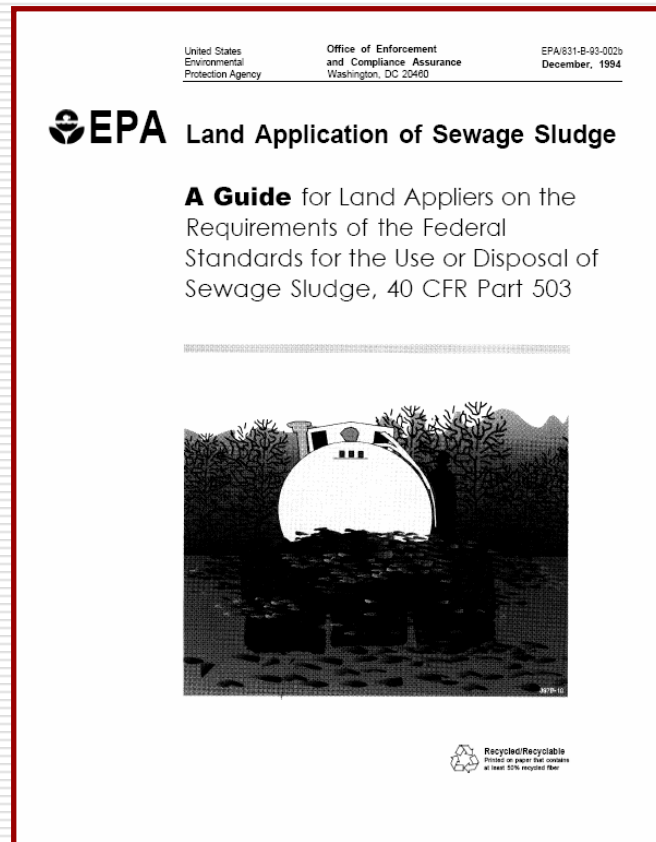
<b>Class</b>	<b>Pathogen reduction</b>	<b>Pollutant limits</b>	<b>Ag use plan required?</b>	<b>Public access OK?</b>
AA	Highest degree. (PFRP)	Highest standard. (EPA EQ)	No. (Non-restricted use)	Yes.
A	Highest degree. (PFRP)	Secondary standard.	Yes.	Yes.
B	Secondary standard. (PSRP)	Secondary standard.	Yes	After 1 year.

PSRP = Process to significantly reduce pathogens.

PFRP = Process to further reduce pathogens.

*Pre-treatment has resulted in dramatic decreases in metals concentrations of biosolids nationwide, so the biosolids of today are substantially different from the metal-laden sewage sludges that were produced before 1980.*

# 5. How are biosolids regulated?



# Biosolids regulations

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## Federal (EPA)

- Title 40 CFR Part 503 (came from Clean Water Act).

## State

- In Florida, the Fla. Dept. of Environmental Protection enforces Chapter 62-640, Florida Administrative Code.

## County

- Whatever.....
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# Federal “503” regs (1993)

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- Biosolids metals concentration and maximum loading rates:
    - Arsenic, Cadmium, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Zinc.
  - Pathogen reduction.
  - Based on an extensive risk assessment and peer review (14 different exposure pathways).
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# Key differences between Florida laws and Federal regulations

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- ❑ Florida requires Agricultural Use Plan (AUP) in facility permit.
  - ❑ Special phosphorus considerations.
  - ❑ Setbacks to water bodies and wells are greater than 503 regs.
  - ❑ Public access to land treated with Class B biosolids restricted for 1 year.
  - ❑ Slope requirements.
  - ❑ Ground water depth requirements.
  - ❑ Post signs.
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# How do regulations assure safety?

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- Controls are in place to protect public health:
    - Prevent contact with pathogens.
    - Limit potential pollutant/metals impacts.
    - Limit potential nutrient impacts.
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# Pathogen controls

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- Pathogen reduction:
    - Class B – “PSRP” (significantly reduce).
    - Class A – “PFRP” (undetectable).
  - Vector attraction reduction.
  - Site restrictions (Class B):
    - Limited public access, setbacks, harvesting and grazing restrictions, slope, groundwater, etc.
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# Pollutant controls

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- Pollutant limits:
    - Ceiling limits (can't land apply if above).
    - Class AA limits (really clean biosolids).
  - Cumulative limits (metals build-up at application site).
  - Pre-treatment program.
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# Biosolids metals limits (ppm)

<b>Metal</b>	<b>Class AA ("EQ")</b>	<b>Ceiling for Class B</b>
Arsenic	41	75
Cadmium	39	85
Copper	1500	4300
Lead	300	840
Mercury	17	57
Molybdenum	75	75
Nickel	420	420
Selenium	100	100
Zinc	2800	7500

# Typical biosolids characteristics

<b>Characteristic</b>	<b>Anaerobically digested</b>	<b>Lime stabilized</b>
Solids (%)	25	25
Nitrogen (%)	5.6	3.8
Phosphorus (%)	2.2	1.0
Potassium (%)	0.2	0.4
Copper (ppm)	566	236
Molybdenum (ppm)	23	5
Zinc (ppm)	1484	321
Arsenic (ppm)	4	1
Cadmium (ppm)	11	4
Chromium (ppm)	91	10
Lead (ppm)	195	17
Nickel (ppm)	59	33
Mercury (ppm)	2	2
Selenium (ppm)	3	1
pH	8	12

# Metals loading limits for Class B

<b>Metal</b>	<b>Annual (kg/ha/yr)</b>	<b>Cumulative (kg/ha)</b>
Arsenic	2.0	41
Cadmium	1.9	39
Copper	75	1500
Lead	15	300
Mercury	0.85	17
Molybdenum	No limit	No limit
Nickel	21	420
Selenium	5.0	100
Zinc	140	2800

# Nutrient controls

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- Agronomic application rate:
    - Prevent N leaching.
    - Prevent P runoff.
  - Rate calculation based on:
    - Nutrient analysis of biosolids being applied.
    - Crop type.
    - N-based or P-based.
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# 6. Current biosolids land application issues

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<http://www.cuchara.org/pics/roll1/img04.jpg>

# Current land application practices

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- Primarily Class B biosolids.
  - Pasture grass is the number one crop in Florida.
  - Rates based on AUP.
  - Potential problems as we move from N-based to P-based application rates.
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# Observations

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- ❑ Heightened public concern and complaints.
  - ❑ Heightened county government concern and ordinances.
  - ❑ National concerns and criticisms.
  - ❑ News reports.
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# Public concerns and complaints

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- Nuisance concerns (trucks, odors).
  - Health concerns.
  - Environmental concerns.
  - Effect on property values.
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# County issues and ordinances

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- ❑ Counties (mostly rural) are responding to public concerns.
  - ❑ Decisions are made quickly under pressure, often based more on emotion than science.
  - ❑ Once enacted, ordinances are difficult to change.
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# National comments and criticisms about biosolids

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- Cornell Waste Management Institute.
  - News reports about poorly-managed sites.
  - 2002 National Academy of Sciences Report recommended:
    - Additional risk assessment.
    - More health studies.
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1996 National Academy of Sciences review of current practices, public health concerns, and regulatory standards

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*"The use of these materials in the production of crops for human consumption when practiced in accordance with existing federal guidelines and regulations, present negligible risk to the consumer, to crop production, and to the environment."*

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## 2002 National Academy of Sciences Report

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*"There is no documented scientific evidence that the Part 503 rule has failed to protect public health. However, additional scientific work is needed to reduce persistent uncertainty about the potential for adverse human health effects from exposure to biosolids."*

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# The future: Possible regulatory changes

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## Concepts from county ordinances:

- Minimum of Class A or AA biosolids.
  - Formal site permits.
  - Increased site restrictions.
  - Increased monitoring and reporting.
  - Specific transportation requirements.
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# Issues affecting sustainability of land application

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- Urban sprawl.
    - What is the life of Class B biosolids?
  - Odor.
    - Weakest link in the chain.
  - Fear factor.
    - Misconceptions travel much faster than the truth.
  - Perception (is reality).
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# For more information.....

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□ National Biosolids Partnership

■ [www.biosolids.org](http://www.biosolids.org)

□ Water Environment Federation

■ [www.wef.org](http://www.wef.org)

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