

Properties of Biosolids



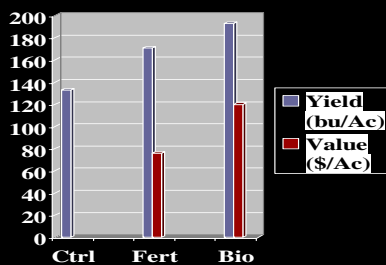
Biosolids Nutrient Composition

Nutrient	Conc range (%)	Mean conc (%)	Lbs/dt
N	1.5-7.9	5.3	106
P	0.6-4.5	2.0	41
K	0.1-1.1	0.4	7
S	0.3-1.9	0.9	18

Micronutrient Composition

Nutrient	Range (ppm)	Mean (ppm)	Lbs/dt
Cu	242-1,310	543	1.1
Fe	7,000-65,600	23,200	46
Mn	206-2,780	787	1.6
Mo	5-39	14	0.03
Zn	264-3,230	1,004	2.0

Comparison of Biosolids and Fertilizer on Corn Yield and Value



Constituents of Concern

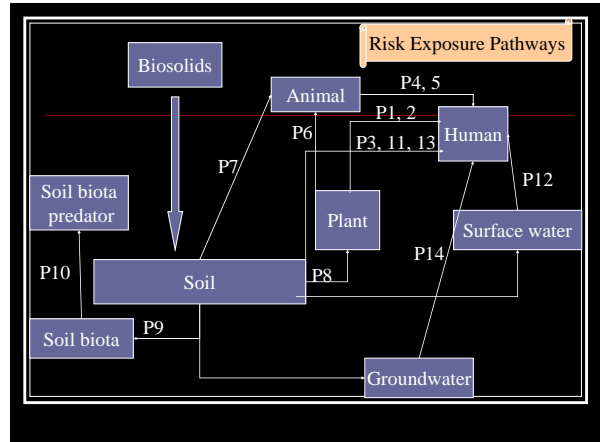


- Pollutants
 - Trace elements
 - Organic toxics
- Nutrients
- Pathogens
- Odors and bioaerosols

Pollutants: U.S. EPA Risk Assessment (1982-1993)



- Screened 350+ pollutants based on expected toxicity
- Identified exposure pathways
- Developed hazard indices
- Developed risk assessment methodology
- Performed risk assessment to develop regulatory standards



Toxic Trace Element Concerns



- Phytotoxicity
- Food chain
- Direct consumption

Trace Element Standards and Concentrations in Biosolids

Pollutant	CCL (ppm)	APL (ppm)	NSSS (ppm)
As	75	41	10
Cd	85	39	7
Pb	840	300	134
Hg	57	17	5
Se	100	100	5

Trace Element Standards and Concentrations in Biosolids

Pollutant	CCL (ppm)	APL (ppm)	NSSS (ppm)
Cu	4300	1500	741
Ni	420	420	43
Zn	7500	2800	1202
Mo	75	40	9

Most Limiting Trace Elements

Trace element	Typical soil background conc (ppm)	Soil conc at loading (ppm)	Time to reach limit (yrs)
Cu	17-65	750	181
Pb	8-22	150	201
Zn	19-82	1,400	208
Hg	0.06-0.15	9	320

Organic pollutants deleted from 503 rule for one of the following:

1. No longer used/manufactured for use in U.S.
2. Infrequently detected in biosolids (NSSS)
3. Not present in sufficiently high concentrations to exceed risk-based limits (NSSS)

Round Two Assessment (1999)

- Dioxin-like compounds: 7 dioxins, 10 dibenzofurans and 12 coplanar PCBs
- Set 300 parts per trillion Toxic Equivalents (TEQ) limit
- Average sludge ~ 30 ppt TEQ
- Soil ~5 ppt

Nutrient Management



- DCR-based plans required for VDH and DEQ permits
- N-, P-, and lime-based
- Includes crop needs and BMPs that account for soil slope, crop residue, and season of application

Pathogen-based Biosolids Types

- Class B
 - PSRP: digestion, lime stabilization, heat
 - Greatly (90-99%) reduces, but does not eliminate, pathogens
 - Protection achieved through harvesting, grazing, and public access restrictions
- Class A
 - PFRP: composting, lime stabilization, heat
 - Reduces pathogens to non-detectable concentrations
 - Being achieved by many Class B facilities

Sources and Pathways of Pathogen Dissemination

