Residuals Perspective
Presentation to City of Raleigh

Stakeholder Meeting

A. R. Rubin, Professor Emeritus, NCSU

- How far we have come
- Regulated enough?
- Challenges

History

- Prior to 1970, limited regulation, from 1970 to 1991 regulated as solid waste
- Basis of Modern 503 Rule is Protection of health and environment
- Water/Energy/Nutrient Management
- Solids Management Essential
  - ALL systems generate residuals
    - Wastewater
    - Stormwater
    - MSW

Resource or Liability

- Resource
  - Energy
  - Nutrients
  - Sustainable
- Liability
  - 503/02T
  - Public health issues
    - Biological
    - Odor
    - Stress???
  - Groundwater/surface water issues
  - Regulated metals
  - Nutrient accumulation P
  - Emerging contaminants

503 Options, Issues, Requirements

- Metals/PFRP or PSRP/VAR
- MSW (258 Part D) Landfill/monofill
  - Gas recovery
  - Cover
- Reuse – LT/compost/Lime
- Storage (2 years or more)
- Incineration/Energy recovery
- Improved pre-application treatment
  - Thickening
  - Dewatering

PERMITS REQUIRED

- 40 CFR 257/258
- 40 CFR 503
- NCAC 0.2T 1100
- Adjoining states also
  - VA, GA robust programs
  - TN effective June, 2013
- USDA Nutrient requirements
- Testing requirements
  - TCLP
  - Nutrients
  - Regulated metals
  - Bacterial indicators
- Process monitoring and reporting
- Siting requirements
  - Slope
  - Soil
  - crop

Science-Risk based management

- USEPA Guidelines for Residuals
- USEPA Design Manual for Land Treatment Systems, WEF MOP
- State rules or recommendations
  - 15 A NCAC 2T 1100, DWQ residuals management

Digestion/Conditioning

- Digestion reduces odor potential
- Stabilizes organic matter
- Vector Attraction Reduction (VAR0 technique
- VAR required in 503 and 2T

Odor

- EPA Study–Piedmont Research Station/Rowan
  - Barely met VAR
  - High Odor
  - Applied at Agronomic rates onto isolated site
    - Odor present immediately following application
    - Dissipated from field border within 48 hours
    - Dissipated from field within 10 days

Anaerobic Digestion

- Energy recovery
- Power generation
- $CH_4 + O_2 \rightarrow CO_2 + HOH$
  - Reduces greenhouse gas emission
  - Rapidly emerging green energy option

Technical Concerns

- Field, farm, Watershed???
- Source availability (water soluble N, P and K)
- Transport factors (erosion, runoff, drainage, distribution – incorporation or surface application)

Nutrient Management Plans

- CNMPs proposed in future (N and P, Lime, S)
- To be prepared:
  - In accordance with NRCS Code 590 (P based NOW)
  - By a person certified by NRCS in nutrient management planning
- Submitted with application for site registration
- Use the P-Index for each application zone (field)
- CNMPs will be required for CAFO/AFO, intent is to be consistent between the two rules
- Universities, NRCS and Industry represented on local TAC's

Issues

- N and P essential for crop production
- Excess N or P may cause eutrophication or degrade shallow GW
- Agricultural sources implicated in eutrophication
- CNMP – USDA/EPA effort to manage N and P

Nitrogen Loading

- Yield based, NOT prescriptive
- Measured crop yield and quality
- Record keeping to optimize management

Nitrogen Needs of Crop

- Based on realistic yield expectations (R.Y.E)
  - For specific crops
  - On specific fields or soil types

Realistic Yields for CfB*: Cecil fine sandy loam, 2 to 6 percent slopes* in Orange County

Crop	Yield	Nitrogen Factor	Realistic Nitrogen Rate (lbs/acre)	Estimated Phosphorus Removal (lbs P_2O_5/acre)
Barley (Grain)	79 Bushels	1.49	118	30
Corn (Grain)	123 Bushels	1.11	136	54
Corn (Silage)	22.5 Tons	10.9	246	77
Cotton	735 Pounds	0.081	60	21
Sorghum (Silage)	19.2 Tons	7.6	146	58
Oats (Grain)	100 Bushels	1.13	113	25
Peanuts	0 Pounds	0	0	0
Rye (Grain)	59 Bushels	2.01	118	19
Small Grain (Silage)	10.8 Tons	11.1	120	58
Sorghum (Grain)	59 CWT	1.72	101	44

NC Technical Bulletin 323 – P Management (NRCS 590)

- P mangement and control
- Erosion
- Edge of Field
  - Slope length and topography
  - Vegetative buffer
- Retention by Fe
- Drainage
- P Loss total from each source

P Management

Loss (lb P/ac/yr)	index	Rating	Activity
0 - 1	0 - 25	low	No change, N base
1 - 2	26 - 50	Medium	No change, N Base
2 - 4	51 - 100	High	P base loss, crop removal
4 +	100 +	Very High	No P except as starter
Appeals possible			

Issues (cont.)

- Organisms – Health implications
- Chemicals
  - Many chemicals detected in TNSSS
    - EPA 822-R-08-014 (2009)
    - Intent was to better characterize biosolids
  - Example: Triclosan is in toothpaste, kitchen sanitizers, antibacterial soaps AT CONCENTRATIONS HIGHER THAN IN BIOSOLIDS or Arsenic in rice
    - Risk from biosolids???
    - From other PCP's ???
    - Food ???

Health Issues

- Reports of adverse health impacts are **unsubstantiated**
- EPA response team may investigate complaints
- NC reports
  - Orange county
  - Raleigh GW contamination with NO3 – N

Toward a Consensus View on the Infectious Risks Associated with Land Application of Sewage Sludge

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Towards a Consensus View on the Infectious Risks Associated with Land Application of Sewage Sludge

Viau et al. [Environ. Sci. & Technol. 45, 5459-5469 (2011)] provide an assessment on the potential for adverse health effects that could occur from land application of biosolids which they refer to as “sewage sludge.” While we agree with the authors that additional research would help clarify the safety of current regulations’ we believe the article is replete with assumptions not based on current knowledge and overly speculative.

Ian Pepper, ASU

Issues (cont.)

- Management
  - Self policing
  - I certify under penalty of law…
- Testing and Reporting
  - Monthly metals?
  - Annual report
- Oversight
  - State and federal

EMS – Powerful Option

- ISO 14000
- 17 Elements must be addressed
- 3rd party certification significant achievement
- Examine elements including public input
- Annual review and 5 year recertification

New Model?

- Sustainability
  - Energy
  - Nutrients
- Applicable to broad array of solids
- New model or just improvement
- Management critical
  - Personnel
  - Organization
  - Site, Soil, Crop