Biosolids Treated Mining Waste - Have We Solved or Created a Problem

Mark D. Sprenger[1], Sally Brown[2], Scott Fredericks[1], Harry Compton[1]

1 U.S. Environmental Protection Agency Environmental Response Team,

2 University of Washington College of Forest Resources.

In situ.amendments have been used on metal contaminated site to restore a vegetative cover at a number of Mining Sites across the United Stated.


It is currently accepted that the use of the biosolids amendment technology does result in sustained plant cover and thereby restoration the mining effected area for the use by wildlife.


These Sites include the Palmerton Zinc Site in Region III, the Jasper County Site in Region VII, and the California Gulch Site in Region VIII.
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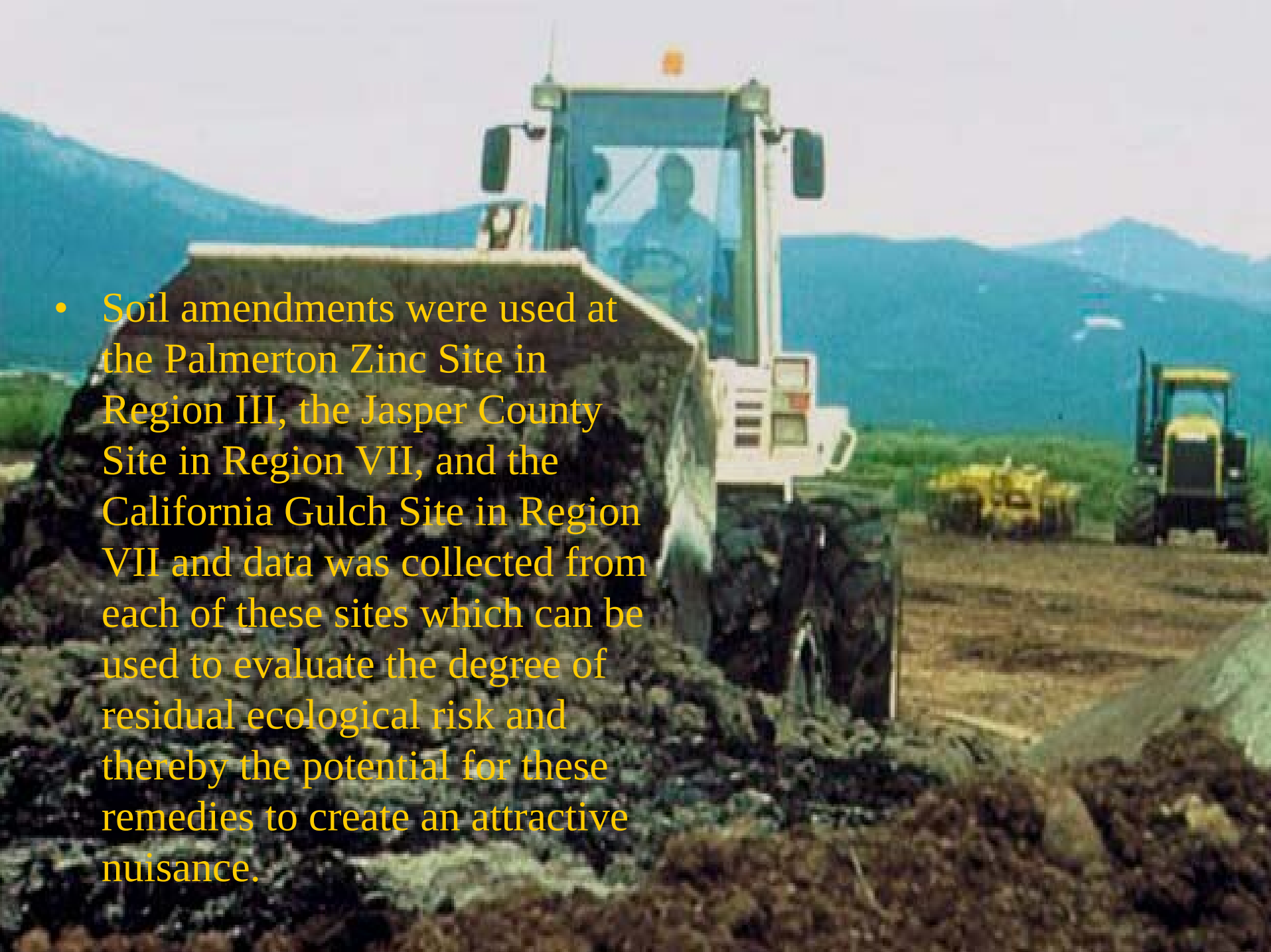
Palmerton, PA, 1980; Dead Ecosystem on Blue Mountain.

Zn-toxic pony near Palmerton in 1979.



- Soil amendments were used at the Palmerton Zinc Site in Region III, the Jasper County Site in Region VII, and the California Gulch Site in Region VII and data was collected from each of these sites which can be used to evaluate the degree of residual ecological risk and thereby the potential for these remedies to create an attractive nuisance.

Palmerton, PA, 1980; Dead Ecosystem on Blue Mountain.

Palmerton, PA, 1990; Early large scale application of biosolids + flyash established grasses on Blue Mountain.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However, since the soil metal concentrations of metals will be high and in fact may not be substantially reduced; there is justifiable concern for the creation of an attractive nuisance for wildlife.


Another difficulty is that comparison to reference areas does not assist in the evaluation. Exposures in treated and revegetated areas will be higher than uncontaminated areas.


The potential for the creation of an attractive nuisance and/or the concern for the residual ecological risk, has a direct bearing on the determination of the acceptability of amendment technologies as Site remedy options.

Plamerton Zinc Area 2

(mean concentration mg/kg dw)

	Soil	plants	microtus (whole body)
Cd	64	3	BD
Cu	1700	36	9.3
Pb	850	40	7.5
Zn	45000	600	177

Plant and Soil Cd concentrations for native grasses July 2001 (values and standard errors are shown for n=4)

	Soil	Plant
• Warm Season		0.45 +/- 0.18
• Orchard Grass		1.15 +/- 0.37
• Big Blue Stem		0.16 +/- 0.01
• Little Blue Stem		0.14 +/- 0.05
• Big Blue Stem (center creek)		1.72 +/- 0.68
• Turkey Foot		0.22 +/- 0.04
• Indian Grass		0.11 +/- 0.02
• Sideoats Gama		0.23 +/- 0.02
• Fescue		1.64 +/- 1.07

Plant and Soil Pb concentrations for native grasses July 2001 (values and standard errors are shown for n=4)

	Soil	Plant
• Warm Season	253 +/- 25	10.93 +/- 7.31
• Orchard Grass	519 +/- 207	5.44 +/- 1.88
• Big Blue Stem	620 +/-153	12.96 +/- 7.72
• Little Blue Stem	259 +/- 30	6.85 +/- 1.89
• Big Blue Stem (center creek)	766 +/- 276	9.56 +/- 4.19
• Turkey Foot	247 +/- 46	10.80 +/- 5.03
• Indian Grass	412 +/- 68	11.01 +/- 8.36
• Sideoats Gama	302 +/- 41	6.38 +/- 0.88
• Fescue	711 +/- 70	4.70 +/- 0.29

Plant and Soil Zn concentrations for native grasses July 2001

	Soil	Plant
• Warm Season	725 +/- 197	91 +/- 28
• Orchard Grass	354 +/- 73	197 +/- 53
• Big Blue Stem	1565 +/- 132	247 +/- 81
• Little Blue Stem	574 +/- 107	217 +/- 60
• Big Blue Stem (center creek)	4440 +/- 1920	119 +/- 27
• Turkey Foot	458 +/- 123	153 +/- 17
• Indian Grass	2345 +/- 1026	213 +/- 34
• Sideoats Gama	752 +/- 67	282 +/- 43
• Fescue	922 +/- 172	172 +/- 76

Mammal Trapping

- Overall Trapping Success
  18.9 %
- Total of 98 animals retained (five species)
- 94 kidney samples submitted for histopathology evaluation
- 37 subset of the 94 kidneys sent for Cd, Pb, and Zn analyses

Metals in Soil and Kidney (mg/kg dw)

	Area			
	A	B	C	D
Cd				
Kidney – median	12	19	3.6	6.9
(range)	(1.4 – 28)	(3.4 – 32)	(1.7 – 11)	(2.2 – 36)
shrew n=1				60
Soil	15	15	3.2	4.9
Pb				
Kidney – median	3.8	15	1.8	0.6
shrew n=1				5.6
Soil	300	2100	160	110
Zn				
Kidney – median	71	73	74	70
shrew n=1				115
Soil	2100	2200	510	630

Kidney Summary Relative to Cd

27 kidneys with no apparent pathology
(Cd range 1.4 – 36 mg/kg dw)

7 kidneys with pathologoly consistent with metals exposure
(Cd range 2.1 – 60 mg/kg dw)

2 kidneys with evidence of metals exposure
(Cd 2.7 and 4 mg/kg dw)

Lead

- Literature suggests that a kidney Pb concentration of between 25 mg/kg dw (Ma, 1989) and 90 mg/kg dw (Beyer et. al. 1996) is diagnostic for Pb poisoning.

- Of the 37 kidneys analyzed only two animals had kidney concentrations which exceeded the lower of the two literature benchmarks (26 and 28 mg/kg).

Zinc

- No discernible differences in Zn accumulation were evident within the data. despite the soil concentration range of 510 mg/kg in Area C to 2,200 mg/kg in Area B.

Ryegrass *(Lolium perenne)* Assays - Germination

Sample	Untreated (%)	Treated (%)
CL	0	85.7
CO	0	71.4*
MB/ME	-	100.0
RA/RB	-	90.5
Ref. A	-	95.2
Upst. Ref.	-	90.5
Lab Con.	85.7	95.2

* significantly < reference samples and/or control sample

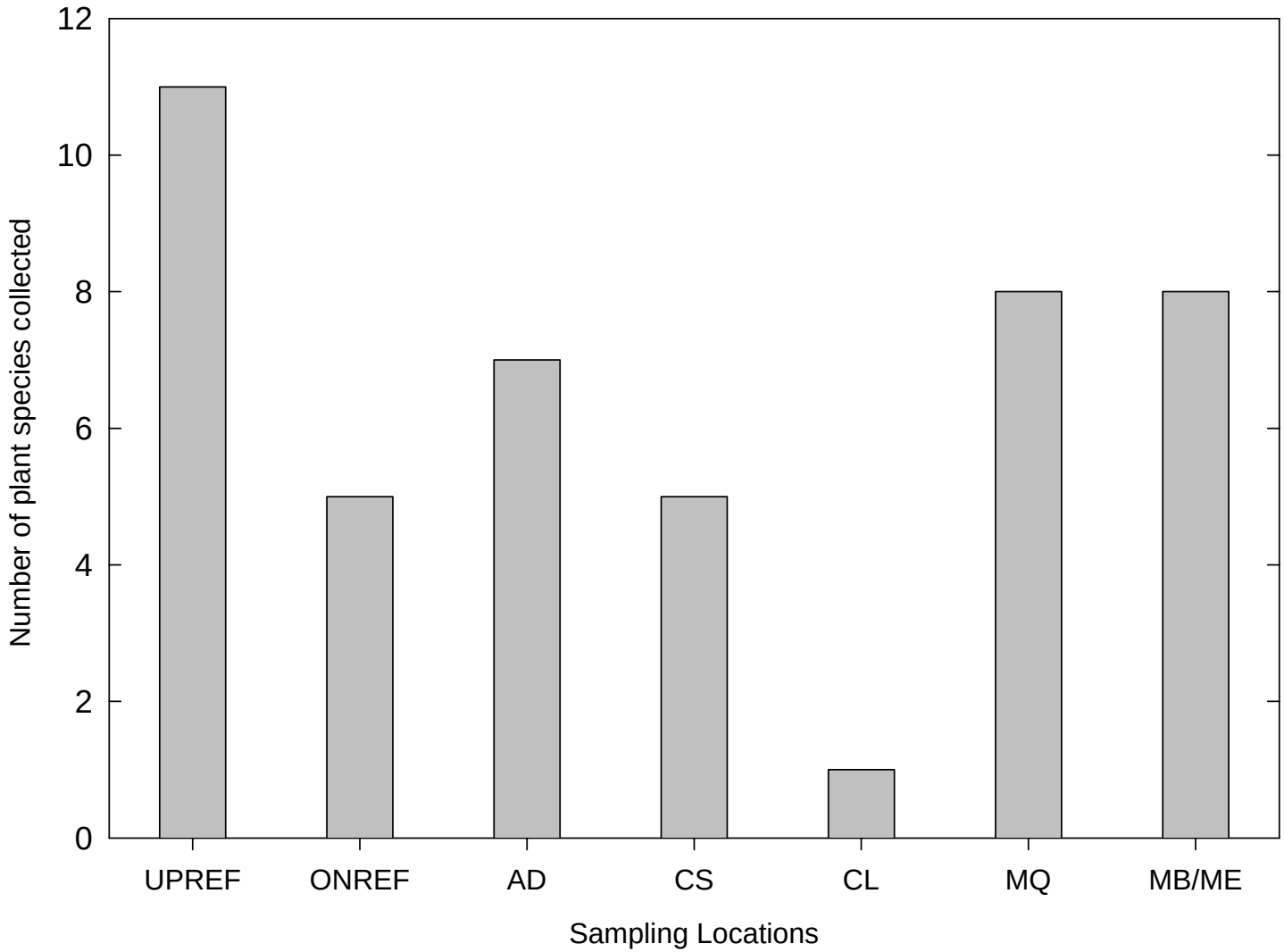

Figure 1. Number of plant species at the California Gulch Superfund Site in August 2001. The values are the number of total plant species identified from the three sampling points at each location.

Overall, the data generated do not support the conclusion that the treated areas are an “attractive nuisance” (exhibit unacceptable ecological risk).