NEW ITEMS IN THE NBMA RESOURCE LIBRARY

Rufus Chaney August 2016

TITLE: Heavy metal relationships during land utilization of sewage sludge in the Northeast

Author: R.L. Chaney, S.B. Hornick and P.W. Simon

Source: R.C. Loehr (ed.). 1977. Land as a Waste Management Alternative. Ann Arbor Science Publishers, Inc., Ann Arbor, MI.

Abstract: Application of sewage sludges on farmland is increasing for several reasons" (a) use on farmland is usually the lowest cost option for ultimate disposal of sludge; (b) there is a desire to utilize "wastes" beneficially where possible as sludge can add needed macronutrients and micronutrients, improve soil physical properties, and support lost cost revegetation of problem soils; and (c) sludge available for use on land is increasing sharply as sewage treatment is improved, as ocean disposal and incineration become less environmentally acceptable, and as new sludge processing technology makes sludge use on land more convenient and less expensive [for example, the raw sludge composting developed at Beltsville].

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TITLE: Risk based standards for As, Pb, and Cd in urban soils

Author: Chaney, R.L. and J. A. Ryan

Source: DECHMA. 1994 ISBN 3-926959

Abstract: This paper summarizes the information and methods developed to estimate standards for Cd, Pb, and As in urban soils. Standards for soils to which humans are exposed have become increasingly important as the extensive contamination of these soils has been demonstrated in many countries. The principle pathways (or pathways of most intense transfer of bioavailable contaminant) include the direct ingestion of soil [US-EPA Pathway 3: Soil Human], the ingestion of crops grown on contaminated soils (home garden scenario) [US-EPA Pathway 2: Soil Plant Human], and the ingestion of livestock which consumed forages grown on contaminated soils [US-EPA Pathway 5: Soilo6AnimaloHuman], or livestock which directly ingested contaminated soils [US-EPA Pathway 4: Soil Plant Animal Human]. This paper describes the application of the Pathway Approach for Risk Assessment (which was created to support development of US limits for contaminants in soils amended with sewage sludges (or quality standards for sewage sludge products which may be marketed for use to fertilize or condition garden and lawn soils). The relevance of many sources of data were carefully evaluated because of false high estimates of phytoavailability when soluble metal salts have been recently added to soils, or false high bioavailability of metals when metal salts are fed to animals in purified diets. Further, it had been established that when plant uptake studies are conducted in the greenhouse, even with sludge-applied metals, plant uptake slopes are significantly higher than in the field. Thus, all transfer coefficients to plants or animals used in this reassessment involved sludges, sludge amended soils, urban soils, and plants grown on sludge amended soils in the field, if such data were available.

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TITLE: Impact of biosolids and tillage on soil organic matter fractions: implications of carbon saturation for conservation management in the Virginia Coastal Plain

Author: Brown, S.L., R.L. Chaney, J. S. Angle, and J.A. Ryan

Source: J. Environ. Qual. 1998 27:1071-1078

Abstract: A field study was conducted to assess the phytoavailability of Cd in long-term biosolids-amended plots managed at high and low pH. The experiment, established 13 to 15 yr prior to the present cropping, on a Christiana fine sandy loam soil (a clayey, kaolinitic, mesic Typic Paleudult) used a variety of biosolids. Two of the biosolids had total Cd concentrations of 13.4 and 210 mg kg^{-1}. A Cd salt treatment, with Cd added to soil at a

rate equivalent to the Cd added by the higher Cd biosolids applied at 100 Mg ha^{-1}, was also included. The lettuce (*Lactuca sativa* var. longifolia) cultivar (Paris Island Cos) used in the initial study was also used in the current study. Lettuce Cd was compared between treatments, and in relation to the soil Cd/soil organic C (OC) ratio. There has been no significant increase in plant Cd since the initial cropping. With 16%of the biosolids added OC remaining, lettuce grown on the soil amended with the more contaminated biosolids was not different than that of the initial cropping. Further, significantly less Cd was taken up by lettuce grown on biosolids-amended soil than lettuce grown on soil amended with equivalent rates of Cd salt. The Cd concentration in lettuce grown in the low Cd biosolids treatment was not different from the control. These results indicate that the potential hazards associated with food chain transfer of biosolids-applied Cd are substantially lower than equivalent Cd salt treatments, and that the hazards do not increase over time.

Document#: BIN.QU.TR.5.8

TITLE: Bioavailability as an issue in risk assessment and management of food cadmium: A review

Author: Reeves, P.G. and R.L. Chaney

Source: Sci. Total. Environ. 2008 398:13-19

Abstract: The bioavailability of cadmium (Cd) from food is an important determinant of the potential risk of this toxic element. This review summarizes the effects of marginal deficiencies of the essential nutrients zinc (Zn), iron (Fe), and calcium (Ca) on the enhancement of absorption and organ accumulation and retention of dietary Cd in laboratory animals. These marginal deficiencies enhanced Cd absorption as much as ten-fold from diets containing low Cd concentrations similar to that consumed by some human populations, indicating that people who are nutritionally marginal with respect to Zn, Fe, and Ca are at higher risk of Cd disease than those who are nutritionally adequate. Results from these studies also suggest that the bioavailability of Cd is different for different food sources. This has implications for the design of food safety rules for Cd in that if the dietary source plays such a significant role in the risk of Cd, then different foods would require different Cd limits. Lastly, the importance of food-level exposures of Cd and other potentially toxic elements in the study of risk assessment are emphasized. Most foods contain low concentrations of Cd that are poorly absorbed, and it is neither relevant nor practical to use toxic doses of Cd in experimental diets to study food Cd risks. A more comprehensive understanding of the biochemistry involved in the bioavailability of Cd from foods would help resolve food safety questions and provide the support for a badly needed advance in international policies regarding Cd in crops and foods.

Document#: BIN.QU.TR.5.9

TITLE: Phytoavailability of cadmium in long-term biosolids- amended soils

Author: Kukier, U., R.L. Chaney, J.A. Ryan, W.L. Daniels, R.H. Dowdy, T.C. Granato

Source: J. Environ. Qual. 2010 39:519-530

Abstract: Agronomic use of biosolids has raised concern that plant availability of biosolids-Cd will increase with time after cessation of biosolids application. It has been demonstrated that chemical extractability of Cd is persistently decreased in biosolids- amended soils. This study was conducted to determine if Cd phytoavailability in long-term biosolids-amended soils was also persistently decreased. Paired control and biosolids-amended soils were collected from three experimental sites where large cumulative rates of biosolids were applied about 20 yr ago. The pH of all soils [in 0.01 mol L−1 $Ca(NO_3)_2$] was adjusted to 6.5 ± 0.2. Increasing rates of Cd-nitrate (from 0 to 10.0 mg Cd kg^{-1} soil) enriched in 111Cd stable isotope were added to all soils, and Romaine lettuce (Lactuca sativa L. var. longifolia Lam.) was grown in pots to bioassay phytoavailable Cd. After harvest, Cd concentrations in shoots and labile pool of Cd (CdL) in soils were determined. The relationship between added salt-Cd and Cd concentrations in lettuce shoots was linear for all soils tested. Ratios of (shoot Cd):(soil Cd) slopes were highest in the control soils. Biosolids amendment decreased (shoot Cd):(soil Cd) slopes to varied extent depending on biosolids source, properties, and application rate. The decrease in slope in comparison to the control was an indication of the lower phytoavailability of Cd in biosolids-amended soils. A significant negative correlation existed between Cd uptake slopes and soil organic matter, free and amorphous Fe and Al oxides, Bray-P, and soil and plant Zn. Biosolids-Cd was highly labile (%L 80–95) except for Fulton County soil (%L =

61).
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