

Identification and Behaviour of Endocrine Disrupting Compounds in Soil-Groundwater-Surfacewater-Systems

Diethelm Weltin¹, Martin Gehring², Lars Tennhardt², Dirk Vogel², Bernd Bilitewski²

¹dr. weltin umweltanalysen, Frankfurt/Main, corresponding author

²Dresden University of Technology, Institute of Waste Management and Contaminated Site Treatment

Effects of environmental chemicals on the hormone system of humans and animals have become a main focus of research as well as the public over the past years. A large number of natural (e.g. endogenous hormones) and xenobiotic compounds have been identified as endocrine disrupting compounds (Keith, 1997, BMBF, 2001). Many substances counted among the xenobiotics often have been known for other harmful effects (e.g. PCP, DDT, PCB, Dioxins, Furans, TBT, alkylphenols, bisphenol A, phthalates).

Many impacts on reproduction and development of animals particularly in the aquatic systems have been observed and verified by laboratory experiments. Feminisation phenomena like induction of vitellogenin synthesis in male fish caused by natural and synthetic steroids and alkylphenols were reported (PURDOM ET AL., 1994; HARRIES ET AL., 1997). OEHLMANN ET AL. (1996) observed masculinisation effects of female molluscs caused by TBT. Several species of fish showed developmental dysfunctions as inhibition of testes growth and intersex (JOBLING ET AL., 1998; GERCKEN & SORDYL, 2001). After the so-called 'Estrogen hypothesis' (SHARPE & SKAKKEBAEK, 1993) extensive studies have been undertaken to answer the question whether there is a correlation between exposition to environmental estrogenic substances and dysfunctions of the reproduction system (e.g. decreasing sperm counts and sperm quality) observed in many western civilisations.

Discharges from wastewater treatment plants, leachate from landfills and emissions into ground and surface water by agricultural utilisation of sewage sludge are discussed to be pathways into the aquatic environment. In Germany more than 1.7 Mio t dry matter (68 %) of sewage sludge were utilised in agriculture or landscaping in 1998 (UBA, 1999, THOMÉ-KOZMINSKY, 1999, ESCH & LOLL, 2001). Hence there is a significant impact of EDC to the soil so a potential vertical transport of those substances and therefore a contamination of the groundwater cannot be ruled out.

Intensive studies with lysimeters were undertaken in order to examine the changes in content of EDC in leachate and soil over time after application of (contaminated) sewage sludge. The results of the lysimeter studies are leading to the fact that mobilisation of the alkylphenols and ethinylestradiol towards deeper soil horizons occurred. The extremely low concentrations of bisphenol A in the soil and the absence of estradiol strongly indicates biodegradation of these substances. Nevertheless there is no significant impact on groundwater because no significant output via the leachate could have been detected.