DIOXIN/FURAN CONTAMINATION IN THE VICINITY OF AN ELECTRIC WIRE RECLAMATION INCINERATOR.

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ABSTRACT

A contamination assessment including atmospheric dispersion modeling and soil sampling was conducted in the vicinity of an incinerator used to burn insulation from electrical wire. High resolution GC/MS techniques were employed to evaluate soil samples for polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) and a 2,3,7,8 TCDD equivalence was computed for comparison with regulatory limits. The results indicated that area wide contamination from stack emissions presented minimal risk, however, some localized contamination from ash handling was detected.

1.0 INTRODUCTION

As part of the U.S. EPA National Dioxin Strategy, Tier 4 Program, sites were randomly selected for investigation of dioxin contamination.[1] An incinerator site in central Illinois was sampled and results indicated the potential for dioxin and furan contamination. The samples included ash samples from the incinerator settling chamber and nearby soil samples. As a result of these preliminary findings the U.S. EPA, under the authority of The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) required that the incinerator be shut down and that a study be undertaken to further investigate and define the extent of contamination.

The wire reclamation incinerator which was used from 1975 through 1987 is composed of a primary burn chamber and a secondary afterburner chamber. Insulated copper electrical wire would be charged on a batch basis and ignited using diesel fuel. After the insulation was fully burned the batch would be removed and the residual ash vibrated or

washed from the copper wire onto a concrete pad where it was collected for recycle. The incinerator was not equipped with particulate air pollution control equipment. The incinerator stack is approximately 5 meters in height above grade level with an exit diameter of approximately .45 meters.

Of particular concern was the potential for widespread contamination due to PCDD and PCDF associated with fly ash from the incinerator stack. As a result of the U.S. EPA action an extensive study plan was developed and implemented to define the area of suspected contamination and to determine if airborne transport was a significant pathway as compared to localized ash handling in the immediate vicinity of the incinerator. The study included an atmospheric dispersion modeling analysis to determine areas of potential airborne impact and an extensive soil sampling program in these predicted areas as well as soil samples in the ash handling area.

2.0 CONTAMINATION ASSESSMENT

There are two potential pathways of potential contamination from the incinerator 1) airborne emissions from the exhaust stack and subsequent deposition onto the soil and 2) direct contamination of the soil in the immediate vicinity of the incinerator due to ash handling. A study plan was developed to identify exhaust plume impact locations using atmospheric dispersion models and to take soil samples at these locations as well as locations close to the incinerator. Information was gathered relative to the operational aspects of the incinerator in order to estimate potential airborne emissions. The study evaluated the amount and type of wire burned, the number of charges, and the daily operational aspects. In addition, incinerator effluent characteristics were acquired from stack tests conducted on a similar incinerator. This information included exit temperature, exit flow rate, and velocity.

The atmospheric model selected for this study was the Industrial Source Complex (ISC) model which was developed and is currently sanctioned by the U.S. EPA.[2] This model can predict short term and long term concentrations in the vicinity of a point source. Meteorological data from a nearby airport was acquired and was used in combination with the ISC model. Daytime meteorological data were

employed since the incinerator was not operated during nighttime hours. The meteorological data included a five year history from a reporting station within five miles of the incinerator. The atmospheric model predicted that maximum ground level concentrations from the incinerator emissions would occur at distances from 75 meters (short term maximum) up to 200 meters (annual average maximum).

Based on the atmospheric modeling predictions a series of soil samples were collected and analyzed for 2,3,7,8 TCDD and copper. It was suspected that some copper would be emitted from the incinerator stack and thus would be an indicator or tracer of deposited material from the incinerator emissions. Since copper is not normally found in the native soil in significant concentrations it was felt that analyzing the soil samples for this parameter would help to verify if areas of maximum incinerator plume interaction were indeed being sampled.

Five soil samples were collected at the points of maximum concentrations at varying downwind distances from the incinerator. All samples showed less than detectable levels of 2,3,7,8 TCDD. A graphic plot of copper concentrations versus distance from the incinerator verified that the maximum concentrations were found well within the sampling range (approx. 80 meters from the incinerator).

Subsequent to the sampling described above a concern was raised by the U.S. EPA as to the extent of contamination from ash handling and surface runoff from the concrete pad onto adjacent soil areas. Furthermore, the regulatory agency was concerned about the total equivalent concentration taking into account toxicities of the various PCDD and PCDF isomers. As a result of this concern a second round of soil sampling was undertaken which focused on the immediate area of the incinerator (within 30 meters). The second round of sampling included ten surface soil samples and one sample at a 1 foot depth in an area suspected to have the highest concentration based on the preliminary Tier 4 sampling results. All samples were collected in accordance with a rigorous quality assurance program plan developed with and approved by the U.S. EPA. All samples were analyzed using high resolution GC/MS methods and the 2,3,7,8 TCDD equivalence was computed for all samples.[3] The U.S. EPA interim method 8290 was used for equivalence computations.

3.0 RESULTS AND DISCUSSION

The second round of soil samples indicated a maximum 2,3,7,8 TCDD equivalence of 12 ppb. This sample was collected from a point immediately adjacent to the concrete pad where the incinerator ash was handled and is in and area that would have the highest expected ash concentration due to surface run-off. This was the only sample which exceeded the 5 ppb equivalence level which U.S. EPA has identified as a level of concern for industrial areas. The next highest sample was 3.1 ppb of 2,3,7,8 TCDD equivalence. This sample was also collected in an area immediately adjacent to the concrete pad within 10 meters of the incinerator. All soil samples collected from more than 10 meters from the incinerator indicated 2,3,7,8 TCDD equivalent concentrations of less than 1 ppb.

The results of the atmospheric modeling and the first round soil sampling confirmed that airborne emissions from the incinerator stack are not a pathway of concern for PCDD/PCDF contamination. Once these results were reviewed the attention focused on the migration of potentially contaminated ash onto nearby soils. A second round of sampling using high resolution GC/MS verified that a minor amount of contamination was present from the ash handling but this contamination was generally below action levels and was confined to a very small area and was directly related to ash handling and runoff.

REFERENCES

1 Final Test Report, National Dioxin Study, Tier 4: Combustion Sources, Radian Corporation, Research Triangle Park, NC, March 1987

2 Users Network for Applied Modeling of Air Pollution (UNAMAP), Version 6, U.S. EPA, 1986, National Technical Information Service, Springfield, VA, NTIS #PB-222361

3 Method 8290 (Draft), Analytical Procedures and Quality Assurance for Multimedia Analysis of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by High Resolution Gas Chromatography/High Resolution Mass Spectrometry, Yves Tondeur, U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas Nevada, June 1987