

Groundwater Monitoring At Solid Waste Disposal Sites

The DNR's Waste and Materials Management (WMM) program received project funding ten times from 1985 to 2003 through the joint solicitation process. These projects have benefited the program in many ways, primarily impacting regulations and monitoring practices.

The first two studies (Friedman, 1985-87; Battista, 1988-89) revealed for the first time that groundwater around many Wisconsin landfills was contaminated by VOCs. The studies also showed that VOC contamination of groundwater was more common at unlined municipal solid waste landfills than at other types of landfills. A follow-up VOC study (Connelly 1993-94) showed that VOC levels have decreased at most of the unlined landfills, though at many of the sites VOC levels do not show continued decline. There was no VOC contamination definitely attributable to leachate migration at any of the older, engineered landfills confirming that these sites are performing as WMM program staff had hoped. The results of the three VOC studies were used to establish requirements for VOC sampling at new and existing landfills. These studies also indicated that inorganic compounds could be useful in predicting VOC contamination at landfills. Therefore, until EPA rules began requiring VOC monitoring in 1996, the WMM program allowed sites to sample for inorganic parameters as part of routine monitoring and not sample VOCs unless inorganics were elevated. The VOC studies provided valuable data that were used to convince EPA to reduce the number of VOCs required for monitoring at municipal solid waste landfills in Wisconsin. This reduction in monitoring (the use of inorganics and the reduced number of VOCs when they are required) allowed landfill owners considerable cost savings while maintaining equivalent environmental protection. Additionally, the VOC data were used to require responsible parties to define the degree and extent of contamination and remediate groundwater contamination at their landfills.

Research on methods of assessing groundwater quality data and data quality control completed in the third VOC study has been helpful to WMM program staff and consultants in interpreting groundwater quality data from landfills and other facilities. This study also showed the need to require laboratories to report data between the limit of detection and the limit of quantification.

An assessment of Wisconsin's Groundwater Monitoring Plan program (Pugh, 1992) for active non-approved landfills provided the documentation of a set procedure for selecting monitoring sites. This information was useful in meetings held to convince municipalities that they had not been singled out for further evaluation of groundwater contamination and to demonstrate that the process used for selecting landfills for monitoring was objective.

Three studies from 1991 to 1994 on the potential groundwater impacts at deer pits, yard waste sites, and construction and demolition landfills (Pugh, 1992-3; Pugh, 1994) were conducted because little or no data existed on the potential impact to groundwater from these sites. Research provided the information necessary to revise rules and establish policy regarding monitoring and siting of construction and demolition (C/D) landfills, deer pits, and yard waste sites in Wisconsin. The groundwater study of deer pits showed that impacts were minimal and helped the WMM program decide not to require liners and loosen some construction and reporting requirements. Similarly, the yard waste site study showed only minor groundwater impacts, which led the WMM program to encourage active management of these sites rather than stiffen regulations. The study of construction and demolition landfills showed some groundwater impacts at large sites but little or no impacts at smaller sites. These findings led to revisions of DNR regulations in 1996 allowing lined intermediate size C/D landfills, which can provide the economic benefits of a large site without the potential negative impacts of very large sites. Based on the research, the

regulations were written to require groundwater monitoring of inorganic parameters at small size C/D landfills but only require VOC sampling when establishing background. Since these studies have been conducted, many states and the EPA have contacted the WMM program about the information collected.

Another study undertaken by the WMM program (Connelly, 1994) was a comparison of groundwater sampling methods for collecting metals samples at monitoring wells. The study was in response to EPA's October 1991 ban on field filtering of groundwater samples that became effective in October 1994. The WMM program opposed this ban because many Wisconsin monitoring wells produce very turbid water which can lead to false positive results for metals if samples are not filtered. Additionally, the new EPA-recommended procedure, low-flow pumping, requires a significant amount of additional equipment. The study showed that the low-flow pumping method was appropriate in many circumstances but could not be used to sample slowly recovering wells. The results showed that turbidity was the best indicator that a well has been sufficiently purged. The results of the investigation were used to revise groundwater sampling procedures required by the WMM program. Additionally, the study helped establish Wisconsin as one of two leading states playing a major role in advising EPA on revisions to their groundwater sampling requirements at municipal solid waste landfills.

A follow-up study by the WMM program (Svavarsson, 1995) compared low flow pumping and bailing for VOC groundwater sampling at landfills. The study indicated that, in contrast to what some were claiming, there was very little difference in the results when using the two different methods. These findings were incorporated into the new groundwater sampling code and allowed the use of either method for sampling VOCs. This reduced the cost that landfill owners would otherwise have had to bear to purchase and operate low-flow pumping equipment.

A joint project between WMM and UW Stevens Point evaluated the effectiveness of chemical oxygen demand (COD) as an indicator parameter at landfills (Connelly and Stephens, 2000). One reason for evaluating COD is that mercury waste is generated when COD is analyzed in the laboratory. The DNR's overall goal was to reduce the amount of mercury that gets into the environment. Eliminating COD sampling at the 400+ landfills that currently sample for it would help the agency meet that goal. Findings from the first year of the study indicated that there is potential to eliminate COD monitoring at some types of landfills. The second year of the study evaluated possible alternatives to sampling for COD. Dissolved organic carbon (DOC) appears to be an acceptable alternative in certain circumstances. WMM staff incorporated the recommendations of this study into code changes that went into effect in February 2006.

Between July 2000 and July 2001 the Bureau studied 31 landfills accepting municipal solid waste, to try to determine whether VOC contamination in groundwater at these landfills is increasing, decreasing or remaining stable (Connelly 2001). Investigators chose sites with 10 years of data and summarized the trends over this period of time. One purpose of this study was to determine whether natural attenuation is occurring in groundwater near leaking landfills. The study showed that natural attenuation processes were occurring at most of the landfills as evidenced by the large number of stable or decreasing concentration trends. However, the concentrations took longer to stabilize and stabilized at higher levels than at other types of VOC contamination sites described in the literature.

WMM received funding for the period October 2002 to October 2003 to study groundwater quality at solid waste landfills to determine whether they are a source of pesticide contamination. Eleven sites were sampled in the spring and summer of 2003 and the findings summarized in a 2005 GEMS Newsletter article. Groundwater samples were analyzed for 14 common Wisconsin

pesticides using immunoassays and additional GC/MS methods. Preliminary findings indicated that leaking landfills may be contributing alachlor, aldicarb, atrazine and 2,4-D to groundwater. The study researchers believed a follow-up study was needed to provide more evidence to help make concrete recommendations about which pesticides to sample for. However, staff and funding have not become available to do the follow-up study.