

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER BUREAU
Inter-Office Memo

August 22, 2005

TO: File for National Pollutant Discharge Elimination System (NPDES) Permit
No. MI0048453
Designated Name: Pall Life Sciences Inc

FROM: Alec Malvetis, Lakes Erie and Huron Permits Unit, Water Bureau *a.m.*

SUBJECT: Determination of Best Available Technology Economically Achievable-Based
Effluent Limitations for 1,4-Dioxane

This memorandum is issued in order to provide information and explanation regarding the determination of best available technology economically achievable (BAT)-based effluent limitations for 1,4-dioxane established on a case-by-case basis based on best professional judgment (BPJ) consistent with 40 CFR 125.3(a)(2)(iii)(B). This "case-by-case basis" determination of BAT-based effluent limitations is established in order to apply appropriate effluent limitations for 1,4-dioxane in the reissued Pall Life Sciences Inc permit, NPDES Permit No. MI0048453.

Determination of the BAT-based effluent limitations is accomplished through calculation of the 99th upper percentile value based upon a delta-lognormal distribution of the pollutant data. This method was used for determination of both the daily maximum effluent limitation and the monthly average effluent limitation. This method is consistent with that utilized by the U.S. Environmental Protection Agency in similar applications.

The data set utilized in the determination included all daily effluent concentration data points from January 1, 2001, through December 31, 2004. Based upon various factors, including the significant figures involved in the BAT-based effluent limitations calculation, the quantification levels for this pollutant, the sensitivity of the effluent sample analyses, and the necessity for compliance determination, integer values in parts per billion (ppb) are utilized for the resulting effluent limitations. Calculation of the daily maximum and monthly average effluent limitations resulted in values of 23 ppb and 6 ppb, respectively, which are the effluent limitations for 1,4-dioxane that are applied in the draft NPDES permit.

The spreadsheets and data summaries used in the determination of these BAT-based effluent limitations are attached to this memo.

Background and Assumptions

In the consideration of an appropriate approach for establishment of the BAT-based effluent limitations, it was determined that remediation and treatment activities at other sites of 1,4-dioxane contamination in other states were not applicable in the determination of BAT-based effluent limitations for this permit. This is due to the fact that the Pall Life Sciences, Inc., (Pall) remediation is unique with respect to the magnitude of the remediation, particularly when considering the large effluent flow rate treated at this facility (i.e., up to 1,300 gallons per minute). Therefore, the determination of the BAT-based effluent limitations described herein is based upon the performance of this permittee's "core" Wagner Road treatment facility with

respect to the oxidation-mineralization of 1,4-dioxane and the associated effluent quality. In addition, the affordability of the treatment operation and the varying range of influent concentrations to this treatment system were considered.

Regarding affordability, from the inception of the discharge from the Wagner Road treatment system on June 13, 1997 through March 22, 2005, Pall operated a treatment system with a technology based upon use of chemical oxidation reactor units employing a combination of ultraviolet light (UV) and hydrogen peroxide (H_2O_2) to facilitate the oxidation reaction. Material costs associated with operation of this technology include the utility (i.e., electricity) costs associated with powering the UV lamps and the costs of the various treatment chemicals necessary to the process.

Regarding chemical application, in addition to the hydrogen peroxide chemical feed, sulfuric acid, caustic (sodium hydroxide), and sodium bisulfite chemical feeds are utilized in the process. Sulfuric acid is added to the purged groundwater stream prior to treatment in the oxidation reactors in order to optimize the oxidation reaction, while the sodium hydroxide and sodium bisulfite are utilized in order to comply with the NPDES permit's water quality-based effluent limitations for pH and hydrogen peroxide, respectively. Although the costs of operating this treatment system are substantial, these costs are considered to be "affordable" in the case of this remediation activity as Pall has been operating this system since June of 1997 with only short duration interruptions in the purge and treat operations and based upon the fact that Pall has made not made a concerted effort to demonstrate otherwise.

On March 22, 2005, Pall began employment of an oxidation technology that utilizes ozone (O_3) and hydrogen peroxide as the primary oxidizing agents. The initial months of use of this technology indicate that lower chemical application rates are necessary to facilitate the treatment process, including lower quantities of both hydrogen peroxide and sulfuric acid. Lower quantities of these two treatment additives result in lower quantities of both sodium bisulfite and sodium hydroxide necessary in order to assure compliance with the NPDES permit limitations for hydrogen peroxide and pH. Based upon these factors, operation of the O_3/H_2O_2 -based technology is also considered to be affordable.

Regarding influent concentrations to this treatment system, influent concentrations have varied considerably, since the inception of the discharge in June of 1997. During the first few months of discharge (i.e., June 13, 1997, through December 31, 1997), the concentrations of combined samples from the four extraction wells ranged from 12,000 ppb to 32,800 ppb, which is indicative of and consistent with the influent concentrations directed to the treatment system. Subsequent to 1997, additional purge wells were added to the system, and purged flows from all extraction wells were directed to the "Red Pond" prior to being directed to the treatment system. Therefore, concentrations of 1,4-dioxane in the Red Pond are indicative of and consistent with influent concentrations directed to the treatment system. In contrast to the 1997 influent concentrations, after several years of purging, concentrations during calendar year 2004 in the Red Pond (i.e., influent concentrations to the treatment system) averaged approximately 1,260 ppb.

Of note, although influent concentrations during the initial year of operation (1997) were considerably greater than influent concentrations during the last full calendar year of operation

(2004), effluent concentrations for both years (and all other years of operation) averaged less than 9 ppb. Due to the efficiency of the UV/H₂O₂-based technology in mineralizing influent 1,4-dioxane concentrations at the Wagner Road treatment system and due to Pall's own treatment maximization efforts, the varying range of influent concentrations directed to the treatment system since the inception of the discharge in June of 1997 appears to have little effect on the resulting effluent quality. Therefore, influent concentrations do not impact the determination of the BAT-based effluent limitations for this application.

Regarding the performance of the treatment system and the associated effluent quality, effluent concentration data from the date of the inception of the discharge from the Wagner Road treatment system in June of 1997 through the present day discharge in July of 2005 was considered for inclusion in the data set used to establish the BAT-based effluent limitations. However, the data set was narrowed to exclude some time periods. Specifically, effluent concentration data from the initial months following "start-up" of the treatment system was not utilized in the analysis due to the variability of effluent 1,4-dioxane concentrations on the various calendar days.

In addition, although the average effluent quality during calendar year 2000 was well within compliance with the NPDES permit's limitations, the average effluent quality during calendar year 2000 was for an undetermined reason somewhat elevated even when compared to the average effluent quality during the first months of discharge in 1997. As a result of these factors, the data set utilized in establishing the BAT-based effluent limitations is culled from calendar years 2001 through 2004. Specifically, the data set included all daily effluent concentration data points from January 1, 2001, through December 31, 2004.



Enclosure
Attachment

cc: Ms. Debora Snell, Jackson District Office, WB
Ms. Sybil Kolon, Jackson District Office, RRD
File