

PROMOTING POLLUTION PREVENTION AMONG DISCHARGERS TO POTWs

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ABSTRACT

In almost all communities, publicly owned treatment works (POTWs) are the largest municipal investment devoted to environmental quality. Though these plants generally are designed to treat only conventional pollutants, significant quantities of toxic organic chemicals, metals, and metal compounds are discharged into sewers by businesses, governments, and households. These pollutants can cause violations of POTW water, air, and sludge regulatory standards. The best way to ensure that POTW violations of regulatory standards are avoided is "pollution prevention," i.e., not generating problematic chemical waste discharges in the first place rather than relying on downstream treatment facilities such as POTWs to manage the wastes that have been created. POTW staff can and should play a key role stimulating pollution prevention among sewer system users. This paper discusses how POTW operators can promote pollution prevention among the various types of sewer dischargers, including identifying the discharged toxic chemicals of greatest concern and their sources, utilizing all available regulatory tools and technical assistance resources, and obtaining cooperation and support for pollution prevention from local businesses, other governmental agencies, and the public.

Keywords: Pollution prevention, technical assistance, POTW regulatory compliance

INTRODUCTION

Since the early 1900's, U.S. communities have been building POTWs to treat and dispose of collected municipal wastewater. Even though nearly all POTWs are designed to treat only domestic sewage, manufacturing and service industries, government agencies, institutions such as hospitals, and households today use and discharge to sewers a wide range of synthetic organic chemicals, metals, and cyanides. Many of these chemicals pass untreated through POTWs into surface water, air, and POTW-generated sludges.

Because many POTWs are regulated for toxic chemical releases to water and sludge for particular uses under the Clean Water Act, and soon will be regulated for air releases under the Clean Air Act, untreatable discharges to sewers generally need to be minimized. Even POTWs that now meet their regulatory Limits eventually may need to reduce influent chemical quantities to meet future restrictions and accommodate local business and residential growth.

Chemical discharges can either be reduced through pollution control strategies, i.e., end-of-the-pipe treatment as typically occurs in industrial pretreatment, or by pollution prevention strategies which require identification and implementation of opportunities for toxic chemical use reduction. By its nature, pollution prevention usually has greater potential than wastewater treatment (or pretreatment) to achieve discharge reductions, and is multi-media in scope so intermedia transfers of pollutants are avoided. For these reasons, pollution prevention is usually superior to pollution control in terms of environmental protection. Additionally, pollution prevention is commonly superior to pollution control in terms of cost, both for users of toxic chemicals and for POTWs to meet their **own** regulatory limits. Table 1 contains a summary of generic pollution prevention activities, consistent with the definition of source reduction in the federal Pollution Prevention Act of **1990**.

In addition to meeting POTW regulatory standards, there are several other reasons for POTWs to assist sewer dischargers in pollution prevention. These reasons include preventing unnecessary exposures of POTW workers to toxic chemicals, protecting operation of POTW biological treatment processes, and enhancing municipal revenue through sale of "high quality," sludge products. Moreover, since POTW personnel are often the only officials with an inspection and advisory presence on environmental matters at most small businesses, POTW staff may be the only officials in many communities who can reduce the environmental impact of small businesses (including photo-processing shops, car body shops, beauty and shoe repair shops) through pollution prevention.

Table 1
Methods of Pollution Prevention

- * Substitute non-toxic or less toxic substances as raw materials
- * Reformulate or redesign so products are non-toxic or less toxic
- * Change processes so less or no toxic chemicals are used
- * Improve housekeeping so lesser quantities of toxic chemicals are used (e.g., prevent spills or change cleaning practices)
- * Recycle within processes (e.g., collect and condense gases for reuse)

While the following can be worthwhile activities, the term pollution prevention does *not include*:

- * Recycling on-site, if the recycling is not integral to a process
- * Recycling off-site
- * Recycling water If it does not reduce toxic chemical use or the quantity of waste generated
- * Improving methods of waste treatment for dischargers to sewers (e.g., using fewer and/or lesser quantities of toxic chemicals during waste treatment)
- * Using any form of combustion, even when energy is recovered for use in industrial or commercial processes
- * Segregating legally-defined “hazardous” and “non-hazardous” wastes

METHODOLOGY

In order to ensure that its pollution prevention efforts are effectively targeted to enhance present and future POTW regulatory compliance and/or environmental protection in general, it is essential to analyze influent flow and composition accurately and then to determine discharge sources for influent chemicals of greatest concern. Analyzing a single influent sample for toxic chemical concentrations produces only a snapshot of influent composition, however. Because chemical composition of influent varies depending on diurnal, weekly, and seasonal wastewater flows and chemical use patterns, as well as industrial chemistry changes that may or may not be seasonal, it is essential to utilize a sampling strategy that adequately characterizes plant influent and accounts for temporal changes. Table 2 is a chart identifying typical chemicals of concern for POTWs, some of which should be considered for inclusion in an influent sampling strategy.

Following adequate characterization of influent flow and composition, POTWs should perform a *mass* accounting per chemical of influent mass with POTW discharge water, air, and sludge monitoring data, using their volume data to convert concentrations to mass loadings (see Eq. 1). Note that this equation provides better information on chemical partitioning within POTWs when evaluated over a relatively long time period (i.e., more than several days because of the lag-time between POTW influent and resulting effluent and sludge).

$$\text{mass in influent}_{\text{chem1}} = \text{mass in effluent}_{\text{chem1}} + \text{mass in air}_{\text{chem1}} + \text{mass in sludge}_{\text{chem1}} \quad (\text{Eq. 1})$$

After this analysis of influent composition and in-plant POTW partitioning, a POTW should review its industrial pretreatment program and significant industrial user monitoring data (i.e., the regulated universe) to determine if the primary discharge sources for chemicals of greatest concern are these industrial dischargers. If these facilities do not account for

a relatively large percentage of the chemicals of greatest concern additional sampling and/or surveys to identify the other major discharge source(s) will be necessary, including sampling of non-regulated industrial, commercial or institutional (e.g., hospitals) sources, household discharges, urban run-off and other non-point sources entering sewers (e.g., in combined sewer systems), and stormwater that infiltrates sewers. Using both concentration and flow data, a mass accounting of discharge sources can be made with POTW influent mass.

$$\text{mass in influent}_{\text{chem}1} = \sum_{n=1}^N \text{mass in discharge sources}_{\text{chem}1} \quad (\text{Eq. 2})$$

Discharge sources are regulated and non-regulated dischargers, households, and non-point sources and stormwater entering sewers

Once POTW operators have an understanding of the sources of problematic chemicals, as well as whether these discharges are ongoing or intermittent, they can then develop targeted pollution prevention programs. If, for example, a significant proportion of the dischargers of toxic chemicals of greatest concern have pretreatment limits issued by POTWs, plants can use their legal authority in several ways to ensure pollution prevention. First, if local sewer ordinances allow, POTW operators can require facilities (e.g., those desiring new permits, undergoing permit renewal, selected industries, or dischargers of particular chemicals of concern such as bioaccumulative chemicals of concern as defined by the Great Lakes Initiative) to undertake pollution prevention planning as a condition of discharge. Pollution prevention planning, which now is required for certain types of industrial facilities in approximately half the states, ensures that facilities evaluate the feasibility and Cost of pollution prevention changes involving facility processes and set reduction goals for chemical use and release. Second, POTW operators can ensure that new and expanded facilities are designed to prevent pollution through particular pretreatment permit conditions (for example, standard best management practices that prevent pollution such as metals drag-out reduction strategies for plating operations). Third, in addition to levying penalties for violators of discharge limitations or other permit conditions, POTW operators can require violators to analyze and implement process-level pollution prevention changes to ensure compliance. Fourth, POTW operators can impose mass-based discharge limits to deter dilution and ensure that either pollution prevention or improved treatment occurs prior to discharge to sewer systems.

If the influent analyses show that a significant proportion of the influent loading of chemicals of greatest concern are due to unregulated industrial, commercial, or institutional dischargers, POTW operators should focus their pollution prevention activities on those types of facilities. These activities can include discharge regulation, e.g., for mercury discharges from large medical clinics and/or dental facilities, and/or educational efforts. Non-regulated business sectors that are excellent candidates for pollution prevention education include photoprocessors for silver discharges, dental and health clinics and laboratories for mercury discharges, and auto body shops for organic solvents and metals in paint wastes. Educational efforts can range from including a two-page summary of pollution prevention opportunities for a particular type of small business in routine correspondence, to POTW-led seminars and workshops co-sponsored by local trade associations, to full-scale technology fairs where suppliers of environmentally superior products (e.g., non-toxic solvents) demonstrate their products effectiveness (Kennedy, 1993). Education and technical assistance for these businesses also can occur during onsite inspections of the non-regulated universe by POTW personnel, or through referrals to other technical assistance providers for waste audits including the National Institute of Standards and Technology Manufacturing Technology Centers and non-regulatory state agencies such as Illinois' Hazardous Waste Research and Information Center. See The Pollution Prevention Yellow Pages for a listing of these technical assistance providers (Barnes, 1994).

If POTW staff have appropriate training in pollution prevention (Barnes, 1994), it is possible to perform on-site pollution prevention audits during site inspections and to provide pollution prevention advice to businesses during facility construction and expansion. It is particularly useful for POTW staff to become familiar with pollution prevention strategies for business sectors that are prevalent within a sewer district (e.g., metal finishing in the Chicago area, electronics industry suppliers in "Silicon Valley," tanneries in Milwaukee, etc.). Pollution prevention information available by business sector is improving rapidly. Over the next few years, sector-specific resource centers that focus on pollution prevention as the best means for environmental and occupational health compliance will become operational. The National Metal Finishing Resource Center (Ann Arbor, MI), a collaborative partnership between the federal government and four industry groups, opened in June 1995 and by early 1996 will offer electronic, fax-back, and toll-free phone assistance. Other business sectors slated for similar resource centers in the near future include printing and automotive services. Additionally, state technical assistance centers set up under the federal Clean Air Act Amendments of 1990 and other state technical assistance agencies generally can

provide basic background information on pollution prevention for a variety of small business sectors. including generic best-practices for all businesses (e.g.. covering of evaporative materials. avoiding chlorinated solvents. decreasing cleaning frequency if possible. using direct applicators rather than sprayers. ect.).

If studies show particular consumer products represent high percentages of problematic discharges to particular sewer districts, those POTWs should undertake public education campaigns emphasizing alternatives to consumer products containing the problematic components. For example, in the 1980s. Seattle determined that up to 64 percent Of the arsenic that appeared in its POTW sludge came from households -- from powdered laundry detergents. dishwashing detergents. and bleach (U.S. GAO. 1991) -- so the POTW was then in a position **to** educate households about alternatives **to** those products. If non-point sources such as pesticide applications or oil and metals from urban run-off enter combined sewers. POTW staff should work with community administrators to ensure that relevant municipal operations are designed for pollution prevention. which sets a good example for others living or working in communities. Additionally, municipal pollution prevention efforts can be publicized for education purposes.

POTWs also should practice pollution prevention in their own operations as an exemplary example for sewer system users. Pollution prevention changes in POTW operations can include:

- * Reducing or eliminating chlorination of wastewater with corresponding increases in beach and water supply monitoring to protect public health:
- * Consulting with a variety of suppliers of materials and process equipment to POTWs to ensure that the most environmentally-friendly supplies (including process additives) are purchased. Suppliers should be able to help POTW operators evaluate whether different materials or processes reduce: chemical use. toxicity. or non-recycled content: hazardous waste volume or toxicity: solid waste volume: volatile organic compound and/or hazardous air pollutant emissions volume or toxicity; wastewater volume or toxicity: and energy use.
- * Utilizing spill prevention. inventory control (e.g.. tracking materials with expiration dates). and other good housekeeping measures to minimize on-site waste generation of toxic chemicals.

POTWs. like other office complexes. also can practice pollution prevention by reducing energy use in lighting by using energy efficient bulbs and less toxic cleaners. and landscaping so pesticide and fertilizer use is minimized or eliminated.

Authority for Pollution Prevention Activities

POTWs clearly have the authority to develop local limits that prohibit the discharge of chemicals which interfere with their ability to comply with water or air permits. or disposal or marketing of their sludge. This reasonably broad authority can be used by POTWs to ensure that discharges to sewers think about and implement pollution prevention strategies to meet the performance-based requirements of the pretreatment program: If local sewer ordinances allow, for example. POTWs can require facilities to undertake pollution prevention planning as a condition of discharge. Additionally, the need to comply with sewer ordinances or local limits can be used by POTW operators to work with sewer dischargers to create a positive. collaborative atmosphere for pollution prevention process changes.

POTW operators should review their current authorities and regulations to identify opportunities for incorporating pollution prevention approaches into their programs and, if necessary, seek expanded authorities to ensure increased emphasis on pollution prevention as the best means of compliance with sewer discharge requirements. Palo Alto. California. for example. revised its local Sewer Use Ordinance in late 1990 and 1991 to require pollution prevention studies from industrial and commercial facilities. set a new local limit for silver, and establish specific process-related requirements for commercial photoprocessors (Bobel, 1994).

Case Study: Milwaukee

The Greater Milwaukee Toxics Minimization Task Force (1991). an advisory body sponsored by the Milwaukee Metropolitan Sewerage District (MMSD) and made up of local representatives of industry. business. labor unions. State and local agencies. environmental groups, and engineering and law firms produced a Toxics Reduction Strategy document for

MMSD. This strategy document contains 22 specific recommended actions for MMSD to promote pollution prevention, including expected timeframes and implementation costs.

The document was based on background research performed by Task Force committees, including a Data Base Committee which developed a mass accounting of three chemicals of concern (two metals and one organic) to assess the reliability of MMSD databases to support a pollution prevention program. Following a methodology similar to that described above, the Task Force and MMSD staff performed mass accounting calculations for chromium, copper, and phenanthrene. The Data Base Committee found that for chromium and copper, Equations 1 and 2 produced reasonable agreement using available data. For phenanthrene, however, there was only reasonable agreement for Equation 1 (with limited sampling), because data were unavailable on the sewer discharge sources of Equation 2.

The Task Force now functions as an independent citizens group and serves as a forum for all sectors of the community to discuss and evaluate pollution prevention issues. The business/community/government partnership model utilized by Milwaukee ensures a broad base of support for ongoing POTW activities that promote pollution prevention among sewer dischargers.

Case Study: Duluth

The Western Lake Superior Sanitary District (WLSSD), which covers a 500 square mile area in the greater Duluth, Minnesota region, performed the type of analysis described by Equations 1 and 2 to identify ways to reduce POTW discharges of mercury to Lake Superior. After testing for mercury throughout its wastewater collection system, including required testing for mercury within the WLSSD Industrial Pretreatment Program and mercury sampling of Significant Industrial Users, the POW found the discharge results listed in Table 3 (Tuominen, 1995).

	1993 Study	July-October 1994	May 1995
Potlatch Paper Mill		13.8	<3.56
LSPI Paper Mill		11.0	<0.90
Haarman & Reimer		0.40	0.03
Dental offices	16.0		
WLSSD operations		12.3	17.2
Households		7.6 (est.)	11.3 (10/94)

Based on the 1994 information listed in Table 3, WLSSD implemented a targeted program to reduce mercury. Among its actions, WLSSD, Potlatch Corporation, and University of Minnesota at Duluth collaborated to identify the source of Potlatch's high mercury levels: mercury-contaminated sulfuric acid from one of three of Potlatch's sulfuric acid vendors. Potlatch no longer uses this acid vendor and has developed mercury minimization requirements for all its raw material suppliers. Additionally, WLSSD has initiated an outreach effort to dentists to eliminate mercury from their discharges and to develop mercury recycling/disposal procedures, and has developed a program to reduce household and commercial use and discharge of mercury-containing products. Lastly, WLSSD continues to investigate other potential sources of mercury discharges to the POTW.

DISCUSSION AND RECOMMENDATIONS

The results of a survey of national and Great Lakes POTWs on their pollution prevention activities indicate that POTW operators have successfully incorporated pollution prevention into existing programs such as their industrial pretreatment and monitoring work (Skavronek, 1992). Rather than add new programs or staff, many POTWs have trained and used inspectors to provide technical assistance in pollution prevention on a voluntary basis to inspected facilities.

Because POTW staff have regulatory oversight and enforcement responsibilities, dischargers are sometimes concerned that on-site pollution prevention analyses may lead to discovery of violations. For this reason, it may be advantageous to dedicate particular POTW staff to pollution prevention technical assistance for sewer dischargers. These staff would be separate from POTW inspectors who are part of POTW enforcement staff.

There are two primary ways for POTW operators to assess progress in pollution prevention, i.e., quantifying discharger reductions per chemical and quantifying POTW influent composition reduction per chemical. Approximately half of the respondents in the POIW survey use each of these measurement approaches (Skavroneck, 1992).

Because it is likely that the composition of the household contribution of chemicals to POTW influent will not vary widely throughout the country, the authors recommend that a national non-profit (e.g., Consumers Union) or a governmental organization undertake analyses of household effluents and determine the sources of toxic chemicals. Once this information is available, the Association of Metropolitan Sewerage Agencies or other POTW organizations can initiate a dialogue with Product manufacturers or their associations to reduce or eliminate specific toxic chemicals in products.

CONCLUSION

Because each sewer district has a different mixture of businesses, institutions, and households, it is important for POTWs to know as accurately as possible the mass contribution of each of these dischargers to toxic chemicals of greatest concern in plant influent. Following completion of such an analysis, POTWs should implement a targeted, multi-faceted pollution prevention program to reduce toxic chemical discharges to sewers and other environmental media.

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