

7. CONCLUSIONS

Potentially toxic organic compounds (PTOCs) have been observed in the influent of MWTPs in California. With the exception of trihalo-methanes, concentrations of PTOCs have been generally observed to decrease in passing from the influent to the effluent of the plant. A review of the literature has shown that the following processes are significant in removing volatile PTOCs from wastewater: volatilization, adsorption to solid particles and biomass, and biodegradation. For volatile PTOCs the literature, expert opinion, and limited data favor removal from wastewater primarily by volatilization with a lesser amount being degraded or removed with sludge. This conclusion was largely based on the following observations:

- 1) Biodegradation of PTOCs is known to be slow for unacclimated systems. Based upon the data collected for this study, acclimation of organisms was unlikely at the levels of PTOC concentrations typically observed in influents to MWTPs in California.
- 2) Volatile PTOCs have a low affinity for adsorption. The two PTOCs with the highest Henry's law constants, carbon tetrachloride and vinyl chloride, were observed to be the PTOCs that were the most efficiently removed in MWTPs.
- 3) An analysis of raw data obtained from previous studies indicated that adsorption to sludge accounts for only a small fraction (<10%) of the total removal of PTOCs during wastewater treatment. Furthermore, sludge treatment processes such as dissolved air flotation and sludge drying are conducive to volatile emissions of PTOCs. It was estimated that 0.8 million tons/year (tpy) of sludge were produced in California, and that 82 tpy of PTOCs were removed in sludge streams. The most common sludge disposal practice was landfilling, from which volatile emissions of PTOCs was also possible.

For those reasons, a conservative estimate of PTOC loss by volatilization was carried out by assuming that all removal of PTOCs in a MWTP would occur by volatilization.

Little is known regarding the fate of PTOCs in collection systems or after discharge to a receiving water. However, the limited data available suggests that volatile emissions from collection systems could be significant with respect to emissions during wastewater treatment, depending upon the type of collection system, degree of "breathing" losses from the collection system and possible degradation in the collection system. Further conclusions regarding the magnitude of these losses could not be made. The fate of PTOCS in receiving waters was also uncertain, though for most surface receiving waters one would expect a high degree of volatilization. However, a large portion of treated effluent in California was being discharged to the ocean by submerged outfalls.

This study has focussed upon the fate of PTOCs during wastewater treatment, with a particular emphasis on assessing the potential for in-plant volatile emissions and losses to sludge streams. The following points can be made on the basis of the literature reviewed and the data gathered:

- 1) PTOCs are potentially emitted from large MWTPS in industrialized areas in significant quantities in comparison with other known point sources on a statewide, county-by-county, or individual basis.
- 2) Counties in which MWTPs were predicted to be major sources of total and speciated PTOC emissions have now been identified.
- 3) MWTPs which were potentially significant individual sources of PTOC emissions have also been identified.
- 4) Sources of data that can be used to predict volatile PTOC emissions have been identified. The data base is expected to increase in future years leading to improved estimates of PTOC emissions.
- 5) Individual treatment processes that are most conducive to emissions have been identified. As a result, recommendations regarding areas

where further field sampling and research would be valuable, in order to reduce the uncertainties associated with PTOC emissions and to develop control techniques if they are deemed to be necessary, can be given.

Item 5 is discussed in detail in Section 8 and in Appendix G. Specific conclusions relating to items 1 through 4 are discussed in the remainder of this section.

A total volatilization assumption was necessary, as emissions estimates based upon sophisticated models could not be made because of limited, and sometimes non-existent, PTOC data. As federally mandated industrial pretreatment programs mature, more influent and effluent data will become available. The additional data should reduce uncertainties associated with the temporal representativeness of PTOC mass loading data at individual treatment plants (a major source of uncertainty in the values reported). However, substantial uncertainties in emissions estimates will probably continue to exist as a result of a lack of understanding regarding the roles of different removal mechanisms, sample and analysis techniques, and the necessity to extrapolate emissions to MWTPs that do not sample for PTOCs.

For this study, Pretreatment Annual Reports and surveys of regional water quality control boards, POTWs, and MWTPs allowed for PTOC data to be collected at MWTPs that treated 77% of the municipal wastewater that was discharged to POTWs in California. Extrapolation techniques were studied and applied to account for the remaining 23%. The uncertainties associated with emissions estimates were reviewed and estimated to be within a factor of two to four, depending on the PTOC, on a statewide basis. A summary of those findings is given below:

- 1) In recent years (1983-1986), an estimated 803 tons/year (tpy) of PTOCs were emitted during wastewater treatment throughout California. A review of past data suggested that emissions of PTOCs from MWTPs have been reduced significantly during the past decade.
- 2) An additional 600 tpy of total PTOCs were discharged in the effluent

streams of MWTPs throughout California. Such discharges may have led to significant additional emissions of PTOCs.

3) On a statewide basis, emissions were low (<3.0 tpy) for acrylonitrile, bromodichloromethane, carbon tetrachloride, chlorobenzene, dibromochloromethane, 1,1 dichloroethylene, and vinyl chloride. Emissions were relatively high (> 200 tpy) for methylene chloride and toluene. Emissions of benzene, chloroform, ethylbenzene, 1,2 dichloroethane, perchloroethylene, 1,1,1 trichloroethane, and trichloroethylene were in the range of 10 tpy to 100 tpy.

4) Total PTOC emissions from MWTPs were relatively low in most counties and from all but a few individual MWTPs. The regions of most significant emissions were the South Coast Air Basin, particularly Los Angeles County, and the region consisting of Alameda and Santa Clara Counties.

5) The Joint Water Pollution Control Plant (JWPCP) and the Hyperion Treatment Plant (HTP), both in Los Angeles County, appeared to be potentially significant sources of total and speciated PTOC emissions in comparison to existing point sources in the SCAQMD. However, the JWPCP utilized pure-oxygen activated sludge treatment with off-gas controls on many aerated processes. These control devices could have led to actual controlled emissions which that were significantly lower than the uncontrolled emissions estimated for this study. The HTP was scheduled to be modified to a pure-oxygen treatment facility by 1993, leading to future changes in the emissions from that source. A few other MWTPs could be significant point sources of PTOCs in comparison to other sources in their respective air basins.

6) Chlorination of wastewater led to significant increases in the concentration of chloroform in the effluent streams of those MWTPs that post-chlorinate. On a statewide basis, chlorination may have led to an increase in chloroform emissions from 36 tpy to approximately 50 tpy. Chlorination did not lead to significant production or emissions of bromodichloromethane or dibromochloromethane.

The study of MWTPs as sources of potentially toxic organic compound emissions to the atmosphere is a recent topic of concern. Large uncertainties continue to exist regarding several key elements associated with emissions from POTWs. Hopefully, this study will provide an improved understanding of the potential of MWTPs as PTOC emissions sources in California. However, in order to reduce uncertainties, to improve emissions estimates and gain a better understanding of the factors that affect the fate of PTOCs in POTWs, additional sampling and research is needed. The completion of this study has allowed for the identification of specific research needs and sampling efforts that would be valuable in the future. These will be discussed in the following section.

8. RECOMMENDATIONS

Precise estimates of emissions of volatile PTOCs from POTWs were not possible given the data base and level of understanding of the fate of PTOCs. Future sampling efforts would lead to a better understanding of the extent of PTOC emissions from POTWs, particularly from those which have the potential for large emissions. Additional research could build upon existing knowledge of the factors that affect the fate of PTOCs in POTWs, and investigate methods of controlling PTOC emissions. General recommendations in those areas are discussed in this section. More detailed recommendations for sampling at specific treatment facilities are provided at the end of Appendix G.

Collection Systems: Although we suspect that emissions from collection systems are relatively small, possibly the greatest uncertainty in total emission estimates stems from potential emissions from that source. To reduce the uncertainty, sampling should be undertaken in collection systems which serve industrial users known to discharge PTOCs. Collection system air exchange ("breathing") rates need to be measured to determine whether significant air exchange with the atmosphere occurs. Concurrent measurements of wastewater flowrates, surface levels and temperature gradients would be valuable for future modeling of air displacement. Concentrations in both the collection system atmosphere and the wastewater should be monitored as well in order to determine whether acclimation and significant biodegradation can occur before the wastewater reaches the treatment facility. In light of the size of the collection system and the characteristics of industrial users, collection systems in Los Angeles County may be the most appropriate for future sampling.

Emissions at MWTPs with Significant PTOC Loadings: The most appropriate method to study PTOC emissions that occur during wastewater treatment would be to complete an extensive gas and liquid-phase sampling effort at one or more MWTPs that were identified as having potentially high uncontrolled emissions. The results of this study indicated that the

Joint Water Pollution Control Plant, the Hyperion Treatment Plant, and the San Jose-Santa Clara Water Pollution Control Plant would be suitable candidates in that respect. Specific treatment processes which should be investigated through field sampling include bar screens, aerated grit chambers, aerated conveyance channels, primary clarifiers and clarifier weirs, conventional and pure-oxygen activated sludge systems, trickling filters, anaerobic digesters, chlorine contact chambers, and effluent outfall systems. The identification of treatment facilities with specific processes that should be considered for future sampling are listed at the end of Appendix G.

Pure-Oxygen Activated Sludge Treatment: Several of the MWTPs that were ranked highly as individual sources of PTOC emissions utilized pure-oxygen activated sludge treatment. Because those systems were covered and employed lower gas-to-liquid volume ratios than conventional activated sludge treatment processes, reduced PTOC emissions would be expected from such systems. The Hyperion Treatment Plant (HTP) was scheduled to be converted from a primary/conventional activated sludge system to a pure-oxygen activated sludge plant by 1993. To study the stripping efficiencies of conventional and pure-oxygen systems it would be valuable to complete gas and liquid-phase sampling at the HTP's aeration basins before and after the process modifications. Concurrent laboratory and pilot-scale studies of the effects of different oxygenation systems (i.e., surface oxygenators, and coarse and fine bubble diffusers) on volatilization might also suggest the most appropriate design considerations for simultaneously satisfying the requirements of efficient biological treatment and reduced PTOC emissions.

Biodegradation as an Emissions Control Technique: Biodegradation could be a feasible method for reducing PTOC emissions during secondary wastewater treatment. However, it is believed that conditions necessary to maintain a microbial population fully acclimated to PTOCs are rarely, if ever, met at municipal wastewater treatment plants. Research to study the factors that affect acclimation could lead to physical, chemical, or biological treatment modifications, e.g., sequenced batch reactor operation, which would increase the relative fraction of PTOCs degraded while reducing the fraction volatilized.

Production of PTOCs by Degradation: Biodegradation, particularly during anaerobic digestion, can lead to the production of PTOCs through sequential dehalogenation of other halogenated compounds. For instance, the more volatile vinyl chloride can be formed as a result of the degradation of perchloroethylene or trichloroethylene. Great uncertainties exist regarding losses of digester gases and the subsequent emissions of PTOCs such as vinyl chloride and 1,1 dichloroethylene. Knowledge of the degradation/formation process could be improved through laboratory or pilot-scale studies. Emissions of PTOCs from anaerobic digesters should be investigated through field sampling. Pressure-relief valves are a potential source of PTOC releases from digesters, as are openings on the roofs of floating roof digesters.

Off-Gas Control Devices: Spray scrubbers and activated carbon filters are control devices sometimes used to treat off-gases from those MWTPs characterized by covered treatment processes. The Joint Water Pollution Control Plant utilized both caustic scrubbers and activated carbon filters to treat off-gases. However, the efficiencies of those devices at removing PTOCs from off-gases were not known. Field studies to investigate the efficiencies of those devices are warranted, particularly at the JWPCP, where high uncontrolled emissions of PTOCs were estimated.

Formation of Trihalomethanes: The formation of chloroform during and after chlorination can occur at MWTPs. The results of this study indicated that chloroform formation could be significant, not only with respect to emissions of chloroform prior to chlorination, but also to other known sources of chloroform. Field studies of liquid-phase chloroform concentrations immediately before, during, and after chlorine injection, and gas-phase sampling for chloroform above and downwind of chlorine contact chambers would be valuable to further assess the magnitude of the chloroform formation problem. Treatment facilities that appeared to form chloroform in significant amounts relative to detectable influent mass loadings included the San Jose-Santa Clara WPCP, Sunnyvale WWTF, Sacramento Regional WWTF, East Bay MUD WWTF, and Fairfield-Suisun WWTF.

Research regarding the formation of chloroform could be valuable in order to identify important precursor compounds. In addition, methods to remove precursors prior to chlorination, or to modify disinfection processes in order to operate with less chlorine available for reaction to form THMs, could lead to reductions in chloroform formation and emissions.

Volatilization from Effluent Outfall and Receiving Waters: The results of this study indicated that approximately 600 tons/year of PTOCs were discharged in the effluent streams of MWTPs. The potential emissions of those PTOCs from effluent conveyance channels and from receiving waters was not well understood. A large fraction of the PTOCs were discharged to the ocean where they could have subsequently risen, volatilized, and been carried onshore. However, great uncertainty exists regarding the roles of chemical and biological reactions in the degradation of PTOCs in an ocean environment. Similarly, large quantities of sludge have been placed in the ocean. If sludge deposits have built up, it is conceivable that anaerobic decomposition will occur (perhaps at greatly reduced rates in comparison to sludge digesters) and produce bulk gas releases which will transport volatile PTOCs to the surface where they can subsequently be advected on shore. Additional research in these areas should be undertaken.

REFERENCES

Alexander, M., (1973), "Biodegradation: Problems of Molecular Recalcitrance and Microbial Fallibility," Adv. Appl. Microbiol., 7, 35.

Allen, C.C.; Green, D.A.; White, J.B.; and J.B. Coburn, (1986), Preliminary Assessment of Air Emissions from Aerated Waste Treatment Systems at Hazardous Waste Treatment Storage and Disposal Facilities, U.S. Environmental Protection Agency, Hazardous Waste Engineering Research Laboratory, Office of Research and Development, Cincinnati, Ohio.

Amy, G.L.; Chadik, P.A.; King, P.H.; and W.J. Cooper, (1984), "Chlorine Utilization During Trihalomethane Formation in the Presence of Ammonia and Bromide," Environmental Science Technology, 18(10), 781-786.

Barrio-Lage, G.; Parsons, F.Z.; Nassar, R.S.; and P.A. Lorenzo, (1986), "Sequential Dehalogenation of Chlorinated Ethenes," Environmental Science Technology, 20(1), 96-99.

Bell, J.P.; and M. Tsezos, (1987), "Removal of Hazardous Organic Pollutants by Adsorption on Microbial Biomass," Water Sci. Tech., 19, 409-416.

Berglund, R.L.; Whipple, G.M.; Hansen, J.L.; Alsop, G.M.; Siegrist, T.W.; Wilker, B.E.; and C.R. Dempsey, (1985), "Fate of Low Solubility Chemicals in a Petroleum Chemical Wastewater Treatment Facility," Presented at the National Meeting of AIChE.

Blackburn, J.W.; Troxler, W.L.; Truong, K.N.; Zink, R.P.; Meckstroth, S.C.; Florance, J.R.; Groen, A.; Saylor, G.S.; Beck, R.W.; Minear, R.A.; Breen, A.; and O. Yagi, (1985), Organic Chemical Fate Prediction in Activated Sludge Treatment Processes, EPA/600/S2-85/102, U.S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, OH.

Caballero, R., (1987), County Sanitation Districts of Los Angeles County, personal communication.

California Air Resources Board, (1985), "Source Tests for Vinyl Chloride and Other VOCs at Sewage Treatment Plants," a CARB memorandum.

Chemical Rubber Company (CRC), (1977), CRC Handbook of Chemistry and Physics, ed. R. C. Weast, CRC Press, Inc., Cleveland.

Chow, B.M.; and P.V. Roberts, (1981), "Halogenated Byproduct Formation by ClO₂ and CL₂," Proceedings of the ASCE, 107, (EE4), 609-618.

Cooper, W.J.; Villate, J.T.; Ott, E.M.; Slifker, R.A.; Parsons, F.Z.; and G.A. Graves, (1985), "Formation of Organohalogen Compounds in Chlorinated Secondary Wastewater Effluent," Chapter 34 in Water Chlorination: Environmental Impact and Health Effect, ed. by R.L. Jolley et al, Lewis Publishers, Inc., Chelsea, Michigan, 483-497.

Digeronimo, M.J.; Boethling, R.S.; and M. Alexander, (1979), "Effects of Chemical Structure and Concentration on Microbial Degradation in Model Ecosystems," in Proceedings of the Workshop: Microbial Degradation of Pollutants in Marine Environments, ed. by A.W. Bourquin and P.H. Pritchard, EPA-600/9-79-012.

Dixon, G.; and B. Bremen, (1984), "Technical Background and Estimation Methods for Assessing Air Releases from Sewage Treatment Plants," Versar, Inc., Memorandum.

Dore, M.; Merlet, N.; De Laat, J.; and J. Goichon, (1982), "Reactivity of Halogens with Aqueous Micropollutants: A Mechanism for the Formation of Trihalomethanes," Journal of the American Water Works Assoc., 74(2), 103-107.

Federal Register, (1981), "Part II. Environmental Protection Agency. General Pretreatment Regulations for Existing and New Sources," 46(18), 9439-9460.

Feiler, H., (1979), Fate of Priority Pollutants in Publicly Owned Treatment Works (Pilot Study), EPA-440/1-79-300, U.S. Environmental Protection Agency, Office of Water and Waste Management, Washington, DC.

Frederick, R., (1985), "Removal of Pollutants by POTW's - Best Available Information," EPA Memorandum, U.S. Environmental Protection Agency, Washington, D.C.

Gurka, D.F., (1984), Interlaboratory Comparison Study: Methods for Volatile and Semivolatile Compounds, EPA-600/S4-84-027, U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Las Vegas, NV.

Hanmer, R.; Barrett, B.R.; Prothro, M.G.; and J.D. Gallup, (1983), Guidance Manual for Pretreatment Program Development, U.S. Environmental Protection Agency, Office of Water Enforcement and Permits.

Helz, G.R.; Uhler, A.D.; and R. Sugam, (1985), "Dechlorination and Trihalomethane Yields," Bull. Environ. Contam. Toxicol., 34(4), 497-503.

Itoh, S.I.; Naito, S.; and T. Unemoto, (1985), "Acetoacetic Acid as a Potential Trihalomethane Precursor in the Biodegradation Intermediates Produced By Sewage Bacteria," Water Research, 19(10), 1305-1309.

Jannasch, H.W., (1967), "Growth of Marine Bacteria at Limiting Concentrations of Organic Carbon in Seawater," Limnol. Oceanogr., 12, 264.

Jenkins, T.F.; Leggett, D.C.; and C.J. Martel, (1980), "Removal of Volatile Trace Organics from Wastewater by Overland Flow Land Treatment," J. Environ. Sci. Health, A15(3), 211-224.

Kavanaugh, M.C.; Trussell, A.R.; Kromer, J.; and R.R. Trussell, (1980), "An Empirical Kinetic Model of Trihalomethane Formation: Applications to Meet the Proposed THM Standard," Journal of the American Water Works Assoc., October, 578-582.

Kincannon, D.F.; Stover, E.L.; Nichols, V.; and D. Medley, (1983), "Removal Mechanisms for Toxic Priority Pollutants," Journal of the Water Pollution Control Federation, 55(2), 157-183.

Kincannon, D.F.; and E.L. Stover, (1983), Determination of Activated Sludge Biokinetic Constants for Chemical and Plastic Industrial Wastewater, EPA-600/2-83-073A, U.S. Environmental Protection Agency.

Lawson, C.T.; and S.A. Siegrist, (1981), "Removal Mechanism for Selected Priority Pollutants in Activated Sludge Systems," 1981 Natl. Conference on Environmental Engineering, Proceedings of the ASCE Environmental Engineering Division Specialty Conference, F.M. Saunders, ed., 356-363.

Lucas, A.D., (1981), Health Hazard Evaluation Report No. HETA 81-207-945, Metropolitan Sewer District, Cincinnati, Ohio. Cincinnati, Ohio: National Institute for Occupational Safety and Health.

Mackay, D.; Shiu, W.Y.; and R.P. Sutherland, (1979), "Determination of Air-Water Henry's Law Constants for Hydrophobic Pollutants," Environmental Science Technology, 13(3), 333-337.

Matthews, P.J., (1975), "Limits for Volatile Organic Liquids in Sewers. Part 1," Journal of Effluent Water Treat., 15(11), 565-567.

Merck Index, (1983), The Merck Index, eds. M. Windholz, S. Budavari, R. Blumetti, E. Otterbein, Merck and Co., Inc., New Jersey.

Nicholson, B.C.; Maguire, B.P.; and D.B. Bursill, (1984), "Henry's Law Constants for the Trihalomethanes: Effects of Water Composition and Temperature," Environmental Science Technology, 18(7), 518-521.

Patterson, J.W.; and P.S. Kodukala, (1981), "Biodegradation of Hazardous Organic Pollutants," Chemical Engineering Progress, 77(4), 48-55.

Pincince, A.B.; and C.J. Fournier, (1984), Chlorinated Organic Compounds in Digested, Heat-Conditioned, and Purifax-Treated Sludges, EPA-600/S2-84-117, U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory, Cincinnati, OH.

Porter, M., (1986), South Coast Air Quality Management District, personal communication.

Riznychok, W.M.; Mueller, J.A.; and J.J. Giunta, (1983), "Air Stripping of Volatile Organic Compounds from Sanitary and Industrial Effluents," Toxic Hazard. Waste, Proceedings of the Mid-Atlantic Ind. Waste Conference, 15th, M.D. LaGrega, et al., eds., 390-401.

Sax, N.I., (1975), Dangerous Properties of Industrial Materials, Van Nostrand Reinhold Co., Litton Educational Publishing, Inc., New York.

Schröder, H. Fr., (1987), "Chlorinated Hydrocarbons in Biological Sewage Purification - Fate and Difficulties in Balancing," Water Sci. Tech., 19, 429-438.

Skow, K.M., (1982), "Rate of Biodegradation," Chapter 9 in Handbook of Chemical Property Estimation Methods, ed. by W.J. Lyman, W.F. Reehl, and D.H. Rosenblatt, McGraw-Hill Book Company, New York.

Strier, M.P.; and J.D. Gallup, (1983), "Removal Pathways and Fate of Organic Priority Pollutants in Treatment Systems: Chemical Considerations." Proc. Ind. Waste Conf., 37, 813-824.

Takehisa, M.; Arai, H.; Arai, M.; Miyata, T.; Sakumoto, A.; Hashimoto, S.; Nishimura, K.; Watanabe, H.; Kawakami, W.; and I. Kuriyama, (1985), "Inhibition of Trihalomethane Formation in City Water By Radiation-Ozone Treatment and Rapid Composting of Radiation Disinfected Sewage Sludge," Radiat. Phys. Chem., 25,, 1-3, 63-71.

Tchobanoglous, G; and E.D. Schroeder, (1985), Water Quality, Addison-Wesley Publishing Company, Menlo Park, 123-150 and 616-617.

Thomas, R.G., (1982), "Volatilization from Water," Chap. 15 in Handbook of Chemical Property Estimation Methods, Ed. by W.J. Lyman, W.F. Reehl, and D.H. Rosenblatt. McGraw-Hill Book Co., New York.

Verschueren, K., (1977), Handbook of Environmental Data of Organic Chemicals, Van Nostrand Reinhold Company, New York.

U.S. Environmental Protection Agency, (1980), Carbon Adsorption Isotherms for Toxic Organics, EPA-600/8-80-023, Municipal Environmental Research Laboratory, Cincinnati, Ohio.

U.S. Environmental Protection Agency, (1982), Fate of Priority Pollutants in Publicly Owned Treatment Works, vol. 1, EPA 440/1-82/303, U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, D.C.

U.S. Environmental Protection Agency, (1983), Treatability Manual, EPA-600/2-82-001a, Office of Research and Development, Washington, D.C.

U.S. Environmental Protection Agency, (1986), Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works, EPA/530-SW-86-004, U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, D.C.

Weber, W.J.; Corfis, N.H.; and B.E. Jones, (1983), "Removal of Priority Pollutants in Integrated Activated Sludge-Activated Carbon Treatment Systems," Journal WPCF, 55(4), 369-376.

Weber, W.J.; Jones, B.E.; and L.E. Katz, (1987), "Fate of Toxic Organic Compounds in Activated Sludge and Integrated PAC Systems," Water Sci. Tech., 19, 471-482.

Zwiacher, W.E.; L.D. Yuhas; J. Whittaker; J. Fakhoury; B. Rogers; R. Olivares; E. Sunico; and S. Weiss, (1985), South Coast Air Quality Management District Engineering Division Report on Emissions of Potentially Toxic/Hazardous Air Contaminants in the South Coast Air Basin. 1984 Update.

SUPPLEMENTAL READING

Clark, C.S.; Bjornson, H.S.; Linnemann, Jr., C.C.; and P.S. Gartside, (1984), Evaluation of Health Risks Associated with Wastewater Treatment and Sludge Composting, EPA-600/S1-84-014, U.S. Environmental Protection Agency, Health Effects Research Laboratory, Research Triangle Park, NC.

Eckenfelder, W.W.; and A. Wadkins, (1983), "The Removal of Priority Pollutants in the Activated Sludge Process," Australian Water and Wastewater Association Technical Papers, Tenth Federal Convention, Sydney, Australia.

Edzwald, J.K., (1984), Removal of Trihalomethane Precursors by Direct Filtration and Conventional Treatment, EPA-600/2-84-068, U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory, Cincinnati, OH.

Glaze, W.H.; Burieson, J.L.; Henderson, J.E.; Jones, P.C.; and W. Kinstley, (1982), Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products, EPA-600/4-82-072, U.S. Environmental Protection Agency.

Jekel, M.R.; and P.V. Roberts, (1980), "Total Organic Halogen as a Parameter for the Characterization of Reclaimed Waters: Measurement, Occurrence, Formation, and Removal," Environmental Science Technology, 14(8), 970-975.

Jordan, E.C., (1982), Fate of Priority Pollutants in Publicly-Owned Treatment Works, EPA-440/1-82/302, U.S. Environmental Protection Agency, Effluent Guidelines Division, Washington, D.C.

Levins, P.; Adams, J.; Brenner, P.; Coons, S.; Thrun, K.; and A. Wechsler, (1979), Sources of Toxic Pollutants Found in Influent to Sewage Treatment Plants 2. Muddy Creek Drainage Basin, Cincinnati, Ohio, EPA/440/4-81/004, U.S. Environmental Protection Agency, Office of Water Planning and Standards, Washington, D.C.

Levins, P.; Adams, J.; Brenner, P.; Coons, S.; Thrun, K.; and J. Varone, (1979), Sources of Toxic Pollutants Found in Influent to Sewage Treatment Plants 3. Coldwater Creek Drainage Basin, St. Louis, Missouri, EPA/440/4-81-005, U.S. Environmental Protection Agency, Office of Water Planning and Standards, Washington, D.C.

Levins, P.; Adams, J.; Brenner, P.; Coons, S.; Thrun, K.; and J. Varone, (1979), Sources of Toxic Pollutants Found in Influent to Sewage Treatment Plants 4. R.M. Clayton Drainage Basin, Atlanta, Georgia, EPA/440/4-81-006, U.S. Environmental Protection Agency, Office of Water Planning and Standards, Washington, D.C.

Levins, P.; Adams, J.; Brenner, P.; Coons, S.; Freitas, C.; Thrun, K.; and J. Varone, (1979), Sources of Toxic Pollutants Found in Influent to Sewage Treatment Plants 5. Hartford Water Pollution Control Plant, Hartford, Connecticut, EPA/440/4-81/007, U.S. Environmental Protection Agency, Office of Water Planning and Standards, Washington, D.C.

Levins, P.; Adams, J.; Brenner, P.; Coons, S.; Harris, G.; Jones, C.; Thrun, K.; and A. Wachsler, (1979), Sources of Toxic Pollutants Found in Influent to Sewage Treatment Plants 6. Integrated Interpretation, EPA/440/4-81/007, U.S. Environmental Protection Agency, Office of Water Planning and Standards, Washington, D.C.

Lewis, J., (9/1985) "Pretreatment of Industrial Waste," EPA Journal, 5-7.

Lurker, P.A.; Clark, C.S.; and V.J. Elia, (1982), "Atmosphere Release of Chlorinated Organic Compounds from the Activated Sludge Process," Journal WPCF, 54(12), 1566-1573.

Lurker, P.A.; Clark, C.S.; Elia, V.J.; Gartside, P.S.; and Kinman, R.N., (1984), "Aerial Organic Chemical Release from Activated Sludge," Water Res., 18(4), 489-494.

Meuser, J.W.; and W.M. Cooke, (1981), Fate of Semivolatile Priority Pollutants in a Wastewater Treatment Plant, EPA-600/2-81-056, U.S. Environmental Protection Agency, Cincinnati, OH.

Overcash, M.R.; Weber, J.B.; and W. Tucker, (1986), Toxic and Priority Organics in Municipal Sludge Land Treatment Systems, EPA/600/S2-86/010, U.S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, OH.

Sievers, R.E.; Barkley, R.M.; Eiceman, G.A.; Haack, L.P.; Shapiro, R.H.; and H.F. Walton, (1978), "Generation of Volatile Organic Compounds from Nonvolatile Precursors in Water by Treatment With Chlorine or Ozone," Water Chlorination: Proceedings of the Conference on Environ. Impact Health Eff., 2, R.L. Jolley, et al., eds., 615-624.

Singh, H.B.; Jaber, H.M.; and J.E. Davenport, (1984), Reactivity/Volatility Classification of Selected Organic Chemicals: Existing Data, EPA-600/S3-84-082, U.S. Environmental Protection Agency, Environmental Sciences Research Laboratory, Research Triangle Park, NC.

Wilson, J.L., (1981), Determination of Volatile Organics in Industrial and Municipal Wastewaters, EPA-600/4-81-071, U.S. Environmental Protection Agency, Office of Research and Development, Cincinnati, OH.

APPENDIX A: Glossary

APPENDIX A: GLOSSARY

The following definitions are intended to serve those readers with a limited knowledge of wastewater treatment. To avoid confusion, many of the definitions are not general, and refer only to descriptions appropriate to wastewater treatment.

Absorption: Dissolution of a substance into the body of another.

Acclimation: The process by which biomass adjusts to the utilization of an organic contaminant.

Activated carbon (AC): Porous wood or coal char particles used to collect soluble substances through the process of adsorption. AC is typically categorized as granular (GAC) or powdered (PAC).

Activated sludge system (AS): A commonly used biological process in which a suspended, aerobic, microbial culture is used to treat primary effluent.

Adsorption: The physical and/or chemical process in which a substance is accumulated at an interface between distinct phases.

Advanced treatment: Tertiary treatment. Treatment used to accomplish further removal of suspended and dissolved materials remaining after secondary treatment.

Aeration: The addition of oxygen to a wastewater in order to meet the biological requirements of aerobic biomass, or to meet effluent dissolved oxygen requirements. Diffused bubble and surface agitation by mechanical means are two common aeration methods. Both air and pure oxygen have been utilized for aeration purposes. The former is also employed for particle suspension.

Aerobic processes: Biological treatment processes that occur in the presence of oxygen. Certain bacteria (obligate aerobes) can survive only in the presence of dissolved oxygen.

Anaerobic processes: Biological treatment processes that occur in the absence of oxygen. Certain bacteria (obligate anaerobes) can survive only in the absence of dissolved oxygen.

Anaerobic digestion: The stabilization of organic matter in sludge, carried out under anaerobic conditions. Methane and carbon dioxide are the principal conversion products.

Bar screen: A screen used to catch and remove large solids (e.g., rags) from wastewater. Bar screens are an initial treatment process employed in order to reduce the possibility of pump or other equipment damage.

Batch reactor: A reactor characterized by no inflow or outflow, and completely mixed conditions.

Biochemical oxygen demand (BOD): The amount of oxygen used in the metabolism of biodegradable organic compounds.

Biodegradation: A biologically induced change in the chemical structure of a specific compound.

Biological treatment: The use of microbial cultures to remove organic material from wastewater.

Biomass: Living organisms, usually microbial, that play an active role in treating wastewater through the biodegradation of organic matter.

Biomass yield: The mass of biomass cells produced per unit mass of organic matter removed (utilized) by the biomass.

Building sewers: Building connections. Building sewers connect to the building plumbing and are used to convey wastewater from the buildings to lateral sewers.

Chemical oxygen demand (COD): The oxygen equivalent of the organic matter that can be oxidized by a certain test procedure.

Chlorination: The addition of chlorine to wastewater to achieve disinfection, odor control, corrosion control, bacterial reduction, and several other objectives. The most common use of chlorine addition is for the disinfection (destruction) of disease-causing organisms prior to discharge from the treatment plant to a receiving water.

Clarifier: A sedimentation basin. Clarifiers are used to separate suspended particles from wastewater by gravitational settling.

Collection system: The network of sewerage piping used to convey wastewater from discharging sources to a treatment facility.

Combined sewers: Sewers used for the collection of both wastewater and storm water.

Combined sludge: A mixture of both primary and secondary sludge.

Commercial user: A privately-owned commercial establishment that discharges to a POTW collection system. Commercial users include such dischargers as restaurants, dry cleaners, gasoline and motor vehicle services, supermarkets, and office buildings.

Comminuter: A device used to reduce the size of solids in wastewater.

Desorption: The process of detachment from a solid surface.

Digested sludge: Sludge which has been stabilized as a result of anaerobic digestion.

Digester gas: Gas formed as a result of the degradation of organic matter during anaerobic digestion. The principal components of digester gas are methane and carbon dioxide.

Effluent: The wastewater stream which flows out of the treatment plant, or from a specific treatment stage (e.g., primary effluent).

Equalization basin: A wastewater holding basin used to dampen flowrate variations.

Exfiltration: The process in which wastewater is lost from the collection system to the ground as a result of defective pipes, pipe joints, connections, or other means.

Facultative process: Biological-treatment processes in which the organisms are indifferent to the presence of dissolved oxygen.

Grit: Solids with relatively large specific gravities (e.g., sand, gravel, cinders, seeds, eggshells, bone chips, coffee grounds, food wastes, etc.).

Grit chamber: A device used to remove grit from the wastewater stream. Grit chambers are typically aerated in order to provide a mixing pattern in which grit particles are removed by centrifugal action and friction against the chamber wall.

Industrial user: An industrial establishment, usually involved with product manufacture, that discharges to a POTW collection system. Examples of industrial users are electroplaters, oil refineries, textile mills, power plants, and pulp mills.

Infiltration: The process in which water enters a collection system from the ground due to defective pipes, pipe joints, connections, or other means.

Influent: The raw wastewater entering a treatment plant, or the treated wastewater entering a specific treatment stage (e.g., secondary influent).

Institutional user: A private or public institution which is not classified as commercial, industrial, or residential, that discharges to a POTW collection system. Examples of institutional users are hospitals, educational institutions, prisons, and military bases.

Interceptor sewer: Large sewers that are used to intercept a number of main or trunk sewers and convey the wastewater to treatment or other disposal facilities.

Lateral sewers: Branch sewers. The first element of a wastewater collection system. Lateral sewers collect wastewater from one or more building sewers and convey it to a main sewer.

Main sewers: Sewers used to convey wastewater from one or more lateral sewers to trunk or interceptor sewers.

NEEDS: An EPA data base which consists of information regarding the treatment characteristics of municipal wastewater treatment and collection systems.

Nitrification: The conversion of nitrogen in the form of ammonia to nitrate.

Outfall: The effluent wastewater stream that is conveyed from a treatment plant to an ultimate receiving system.

Overland flow: The treatment of wastewater by application to sloped terraces. The wastewater flows across the vegetated surfaces where physical, chemical, and biological processes improve the quality of the wastewater.

Pass-through: The process in which a compound is not removed during treatment (i.e., it passes through the entire treatment plant from the influent to the effluent stream).

Percolation pond: A holding basin designed to remove wastewater by percolation to the underlying soil column.

Pretreatment: The treatment of industrial-wastewater streams prior to discharge to a municipal sewerage system.

Pretreatment annual report (PAR): A report submitted by POTWs, with design flows greater than 5 MGD, to the EPA, California Water Resources Control Board, and the RWQCB. PARs typically consist of information regarding the enforcement of industrial pretreatment programs, and the monitoring of pollutants in influent and effluent wastewater streams.

Primary sludge: Solid material removed as a result of sedimentation (gravitational settling) prior to secondary treatment.

Primary treatment: The removal of a portion of the suspended solids and organic matter in wastewater as it enters a treatment plant. Primary treatment is usually accomplished through physical processes (e.g., bar screens and primary clarifiers).

Priority pollutant: One of approximately 126 pollutants identified to be regulated by categorical discharge standards established by the EPA. Priority pollutants were selected on the basis of their known or suspected carcinogenicity, mutagenicity, or teratogenicity.

Publicly-Owned Treatment Works (POTW): A system which is owned by a public entity, and which involves wastewater collection systems, treatment systems, or both.

Pure-oxygen activated sludge system: An activated sludge system which utilizes nearly pure oxygen, rather than air, to sustain aerobic microbial processes.

Purifax process: A patented commercial process in which chlorine gas is added to wastewater sludge, septage, or digester supernatant to stabilize and condition the material before dewatering and disposal.

Recycle: The return of effluent to the influent or some intermediate point

Residential user: A POTW user that discharges household wastewaters from toilets, drains, etc..

Retention time (hydraulic): The average time that a "parcel" of wastewater exists in a treatment process or group of processes. The hydraulic residence time is taken to be the process volume divided by the wastewater flowrate into the process.

Rotating biological contactor (RBC): A series of closely spaced circular disks which are partially submerged in wastewater and slowly rotated to promote contact with the air. Biological growths become attached to the surfaces of the disks, and act to degrade organic matter present in the wastewater.

Secondary sludge: Solid material removed as a result of sedimentation (gravitational settling) or other secondary clarification process. Secondary sludge typically contains a large amount of biomass, in addition to non-viable solids.

Secondary treatment: Further treatment, of the effluent from primary treatment, to remove the residual organic matter and suspended material. Secondary treatment typically consists of the use of biological processes.

Separated sewers: Sewers intended solely for the collection of wastewater.

Shock loading: The upset of a biological treatment process due to a high dose of a contaminant which is detrimental to biomass in the system.

Sludge: The solid material removed, collected, and disposed of during wastewater treatment.

Stabilization: The biological process by which the organic matter in sludges is stabilized, usually by conversion to gases and cell tissue.

Tertiary treatment: See advanced treatment.

Total suspended solids: The concentration sum of all solid materials that are suspended, as opposed to dissolved, in a wastewater.

Trickling filter: An aerobic, attached-growth, biological-treatment process used to remove organic matter or to achieve nitrification. The trickling filter consists of a bed of highly permeable media in which microorganisms are attached and through which wastewater is percolated.

Trihalomethane: A compound with the chemical structure of methane with three of the hydrogen atoms replaced by halogens.

Trunkline: Trunk sewer. A Large sewer that is used to convey wastewater from main sewers to treatment or disposal facilities, or to larger intercepting sewers.

User: A source of wastewater that is discharged to a municipal sewerage system.

Volatilization: The process whereby liquids and solids vaporize and escape to the atmosphere.

Wastewater: Used, unwanted water discharged to municipal sewerage systems by residential, commercial, industrial and institutional users.

Wastewater treatment: An improvement in the quality of wastewater due to a combination of physical, chemical, and biological processes.

APPENDIX B: Regulations for the National Pretreatment Program

Wednesday
January 28, 1981

Part II

**Environmental
Protection Agency**

General Pretreatment Regulations for
Existing and New Sources

the date of issuance of the June 23, 1978 regulations.

Douglas M. Costle,
Administrator.

January 13, 1981.

40 CFR Part 403 is revised to read as follows:

**PART 403—GENERAL
PRETREATMENT REGULATIONS FOR
EXISTING AND NEW SOURCES OF
POLLUTION**

Sec.

403.1 Purpose and applicability.

403.2 Objective of general pretreatment regulation.

403.3 Definitions.

403.4 State or local law.

403.5 National pretreatment standards: prohibited discharges.

403.6 National pretreatment standards: categorical standards.

403.7 Revision of categorical pretreatment standards to reflect POTW removal of pollutants.

403.8 POTW pretreatment programs: development by POTW.

403.9 POTW pretreatment programs and/or authorization to revise pretreatment standards: submission for approval.

403.10 Development and submission of NPDES State pretreatment programs.

403.11 Approval procedures for POTW programs and revisions of categorical pretreatment standards.

403.12 Reporting requirements for POTW's and industrial users.

403.13 Variances from categorical pretreatment standards for fundamentally different factors.

403.14 Confidentiality.

403.15 Net/Gross calculation.

403.16 Upset provision.

Appendix A—PRM 75-34.

Appendix B—65 Toxic pollutants.

Appendix C—34 Industrial categories.

Appendix D—Selected industrial subcategories exempted from regulated pursuant to paragraph 8 of the *NRDC v. Costle* consent decree.

Authority: Section 54(c)(2) of the Clean Water Act of 1977 (Pub. L. 95-217).

§§ 204(b)(1)(C), 208(b)(2)(C)(iii), 301(b)(1)(A)(ii), 301(b)(2)(A)(ii), 301(b)(2)(C), 301(h)(5), 301(i)(2), 304(e), 304(g), 307, 308, 309, 402(b), 405, and 501(a) of the Federal Water Pollution Control Act (Pub. L. 92-500) as amended by the Clean Water Act of 1977.

§ 403.1 Purpose and applicability.

(a) This part implements sections 204(b)(1)(C), 208(b)(2)(C)(iii), 301(b)(1)(A)(ii), 301(b)(2)(A)(ii), 301(h)(5) and 301(i)(2), 304 (e) and (g), 307, 308, 309, 402(b), 405, and 501(a) of the Federal Water Pollution Control Act as amended by the Clean Water Act of 1977 (Pub. L. 95-217) or "The Act." It establishes responsibilities of Federal, State, and local government, industry and the public to implement National Pretreatment Standards to control

pollutants which pass through or interfere with treatment processes in Publicly Owned Treatment Works (POTWs) or which may contaminate sewage sludge.

(b) This regulation applies: (1) to pollutants from non-domestic sources covered by Pretreatment Standards which are indirectly discharged into or transported by truck or rail or otherwise introduced into POTWs as defined below in § 403.3; (2) to POTWs which receive wastewater from sources subject to National Pretreatment Standards; (3) to States which have or are applying for National Pollutant Discharge Elimination System (NPDES) programs approved in accordance with section 402 of the Act; and (4) to any new or existing source subject to Pretreatment Standards. National Pretreatment Standards do not apply to sources which Discharge to a sewer which is not connected to a POTW Treatment Plant.

§ 403.2 Objectives of general pretreatment regulations.

By establishing the responsibilities of government and industry to implement National Pretreatment Standards this regulation fulfills three objectives: (a) to prevent the introduction of pollutants into POTWs which will interfere with the operation of a POTW, including interference with its use or disposal of municipal sludge; (b) to prevent the introduction of pollutants into POTWs which will pass through the treatment works or otherwise be incompatible with such works; and (c) to improve opportunities to recycle and reclaim municipal and industrial wastewaters and sludges.

§ 403.3 Definitions.

For the purpose of this regulation:

(a) Except as discussed below, the general definitions, abbreviations, and methods of analysis set forth in 40 CFR Part 401 shall apply to this regulation.

(b) The term "Act" means Federal Water Pollution Control Act, also known as the Clean Water Act, as amended, 33 U.S.C. 1251, et seq.

(c) The term "Approval Authority" means the Director in an NPDES State with an approved State pretreatment program and the appropriate Regional Administrator in a non-NPDES State or NPDES State without an approved State pretreatment program.

(d) The term "Approved POTW Pretreatment Program" or "Program" or "POTW Pretreatment Program" means a program administered by a POTW that meets the criteria established in this regulation (§§ 403.3 and 403.9) and which has been approved by a Regional Administrator or State Director in

accordance with § 403.11 of this regulation.

(e) The term "Director" means the chief administrative officer of a State or Interstate water pollution control agency with an NPDES permit program approved pursuant to section 402(b) of the Act and an approved State pretreatment program.

(f) The term "Enforcement Division Director" means one of the Directors of the Enforcement Divisions within the Regional offices of the Environmental Protection Agency or this person's delegated representative.

(g) The term "Indirect Discharge" or "Discharge" means the introduction of pollutants into a POTW from any non-domestic source regulated under section 307(b), (c) or (d) of the Act.

(h) The term "Industrial User" or "User" means a source of Indirect Discharge.

(i) The term "Interference" means an inhibition or disruption of the POTW, its treatment processes or operations, or its sludge processes, use or disposal which is a cause of or significantly contributes to either a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or to the prevention of sewage sludge use or disposal by the POTW in accordance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II more commonly referred to as the Resource Conservation and Recovery Act (RCRA) and including State regulations contained in any State sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, and the Toxic Substances Control Act. An Industrial User significantly contributes to such a permit violation or prevention of sludge use or disposal in accordance with above-cited authorities whenever such User:

(1) Discharges a daily pollutant loading in excess of that allowed by contract with the POTW or by Federal, State or local law;

(2) Discharges wastewater which substantially differs in nature or constituents from the User's average Discharge; or

(3) Knows or has reason to know that its Discharge, alone or in conjunction with Discharges from other sources, would result in a POTW permit violation or prevent sewage sludge use or disposal in accordance with the above-cited authorities as they apply to the POTW's selected method of sludge management.

(j) The term "National Pretreatment Standard," "Pretreatment Standard," or "Standard" means any regulation containing pollutant discharge limits promulgated by the EPA in accordance with section 307 (b) and (c) of the Act, which applies to Industrial Users. This term includes prohibitive discharge limits established pursuant to § 403.5.

(k) The term "New Source" means any building, structure, facility, or installation from which there is or may be a Discharge, the construction of which commenced:

(1) After promulgation of Pretreatment Standards under section 307(c) of the Act which are applicable to such source; or

(2) After proposal of Pretreatment Standards in accordance with section 307(c) of the Act which are applicable to such source, but only if the Standards are promulgated in accordance with section 307(c) within 120 days of their proposal.

(l) The terms "NPDES Permit" or "Permit" means a permit issued to a POTW pursuant to section 402 of the Act.

(m) The term "NPDES State" means a State (as defined in 40 CFR § 122.3) or Interstate water pollution control agency with an NPDES permit program approved pursuant to section 402(b) of the Act.

(n) The term "Pass Through" means the Discharge of pollutants through the POTW into navigable waters in quantities or concentrations which are a cause of or significantly contribute to a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation). An Industrial User significantly contributes to such permit violation where it:

(1) Discharges a daily pollutant loading in excess of that allowed by contract with the POTW or by Federal, State, or local law;

(2) Discharges wastewater which substantially differs in nature and constituents from the User's average Discharge;

(3) Knows or has reason to know that its Discharge, alone or in conjunction with Discharges from other sources, would result in a permit violation; or

(4) Knows or has reason to know that the POTW is, for any reason, violating its final effluent limitations in its permit and that such Industrial User's Discharge either alone or in conjunction with Discharges from other sources, increases the magnitude or duration of the POTW's violations.

(o) The term "Publicly Owned Treatment Works" or "POTW" means a treatment works as defined by section

212 of the Act, which is owned by a State or municipality (as defined by section 502(4) of the Act). This definition includes any devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes and other conveyances only if they convey wastewater to a POTW Treatment Plant. The term also means the municipality as defined in section 502(4) of the Act, which has jurisdiction over the Indirect Discharges to and the discharges from such a treatment works.

(p) The term "POTW Treatment Plant" means that portion of the POTW which is designed to provide treatment (including recycling and reclamation) of municipal sewage and industrial waste.

(q) The term "Pretreatment" means the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW. The reduction or alteration may be obtained by physical, chemical or biological processes, process changes or by other means, except as prohibited by § 403.5(d). Appropriate pretreatment technology includes control equipment, such as equalization tanks or facilities, for protection against surges or slug loadings that might interfere with or otherwise be incompatible with the POTW. However, where wastewater from a regulated process is mixed in an equalization facility with unregulated wastewater or with wastewater from another regulated process, the effluent from the equalization facility must meet an adjusted pretreatment limit calculated in accordance with § 403.5(e).

(r) The term "Pretreatment Requirements" means any substantive or procedural requirement related to Pretreatment, other than a National Pretreatment Standard, imposed on an Industrial User.

(s) The term "Regional Administrator" means the appropriate EPA Regional Administrator.

(t) The term "Submission" means: (1) a request by a POTW for approval of a Pretreatment Program to the EPA or a Director; (2) a request by a POTW to the EPA or a Director for authority to revise the discharge limits in categorical Pretreatment Standards to reflect POTW pollutant removals; or (3) a request to the EPA by an NPDES State for approval of its State pretreatment program.

§ 403.4 State or local law.

Nothing in this regulation is intended to affect any Pretreatment Requirements, including any standards

or prohibitions, established by State or local law as long as the State or local requirements are not less stringent than any set forth in National Pretreatment Standards, or any other requirements or prohibitions established under the Act or this regulation. States with an NPDES permit program approved in accordance with section 402 (b) and (c) of the Act, or States requesting NPDES programs, are responsible for developing a State pretreatment program in accordance with § 403.10 of this regulation.

§ 403.5 National pretreatment standards: prohibited discharges.

(a) *General prohibitions.* Pollutants introduced into POTW's by a non-domestic source shall not Pass Through the POTW or Interfere with the operation or performance of the works. These general prohibitions and the specific prohibitions in paragraph (b) of this section apply to all non-domestic sources introducing pollutants into a POTW whether or not the source is subject to other National Pretreatment Standards or any national, State, or local Pretreatment Requirements.

(b) *Specific prohibitions.* In addition, the following pollutants shall not be introduced into a POTW:

(1) Pollutants which create a fire or explosion hazard in the POTW;

(2) Pollutants which will cause corrosive structural damage to the POTW, but in no case Discharges with pH lower than 5.0, unless the works is specifically designed to accommodate such Discharges;

(3) Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in Interference;

(4) Any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a Discharge at a flow rate and/or pollutant concentration which will cause Interference with the POTW.

(5) Heat in amounts which will inhibit biological activity in the POTW resulting in Interference, but in no case heat in such quantities that the temperature at the POTW Treatment Plant exceeds 40°C (104°F) unless the Approval Authority, upon request of the POTW, approves alternate temperature limits.

(c) *When Specific Limits Must be Developed by POTW.* (1) POTW's developing POTW Pretreatment Programs pursuant to § 403.8 shall develop and enforce specific limits to implement the prohibitions listed in § 403.5 (a) and (b).

(2) All other POTW's shall, in cases where pollutants contributed by Users result in Interference or Pass-Through, and such violation is likely to recur,

develop and enforce specific effluent limits for Industrial User(s), and all other users, as appropriate, which, together with appropriate changes in the POTW Treatment Plant's Facilities or operation, are necessary to ensure renewed and continued compliance with the POTW's NPDES permit or sludge use or disposal practices.

(3) Specific effluent limits shall not be developed and enforced without individual notice to persons or groups who have requested such notice and an opportunity to respond.

(d) *Local Limits.* Where specific prohibitions or limits on pollutants or pollutant parameters are developed by a POTW in accordance with paragraph (c) above, such limits shall be deemed Pretreatment Standards for the purposes of section 307(d) of the Act.

(e) *EPA and State Enforcement Actions.* If, within 30 days after notice of an Interference or Pass Through violation has been sent by EPA or the NPDES State to the POTW, and to persons or groups who have requested such notice, the POTW fails to commence appropriate enforcement action to correct the violation, EPA or the NPDES State may take appropriate enforcement action.

(f) *Compliance Deadlines.* Compliance with the provisions of this section is required beginning on [44 days after publication in the Federal Register], except for paragraph (b)(5) of this section which must be complied with by August 25, 1981.

§ 403.6 National Pretreatment Standards: Categorical Standards.

National Pretreatment Standards specifying quantities or concentrations of pollutants or pollutant properties which may be Discharged to a POTW by existing or new Industrial Users in specific industrial subcategories will be established as separate regulations under the appropriate subpart of 40 CFR Chapter I, Subchapter N. These Standards, unless specifically noted otherwise, shall be in addition to the general prohibitions established in § 403.5 of this regulation.

(a) Category Determination Request.

(1) *Application Deadline.* Within 60 days after the effective date of a Pretreatment Standard for a subcategory under which an Industrial User may be included, or within 60 days after the Federal Register notice announcing the availability of the technical development document for that subcategory, whichever is later, the existing Industrial User or POTW may request that the Enforcement Division Director or Director, as appropriate, provide written certification on whether

the Industrial User falls within that particular subcategory. A new source must request this certification prior to commencing discharge. Where a request for certification is submitted by a POTW, the POTW shall notify any affected Industrial User of such submission. The Industrial User may provide written comments on the POTW submission to the Enforcement Division Director or Director, as appropriate, within 30 days of notification.

(2) *Contents of application.* Each request shall contain a statement:

(i) Describing which subcategories might be applicable; and

(ii) Citing evidence and reasons why a particular subcategory is applicable and why others are not applicable. Each such statement shall contain an oath stating that the facts contained therein are true on the basis of the applicant's personal knowledge or to the best of his information and belief. The oath shall be that set forth in § 403.7(b)(2)(ii), except that the phrase "§ 403.7(d)" shall be replaced with "§ 403.6(a)."

(3) *Deficient Requests.* The Enforcement Division Director or Director will only act on written requests for determinations that contain all of the information required. Persons who have made incomplete submissions will be notified by the Enforcement Division Director or Director that their requests are deficient and, unless the time period is extended, will be given 30 days to correct the deficiency. If the deficiency is not corrected within 30 days or within an extended period allowed by the Enforcement Division Director or the Director, the request for a determination shall be denied.

(4) Final Decision.

(i) When the Enforcement Division Director or Director receives a submittal he or she will, after determining that it contains all of the information required by paragraph (2) of this section, consider the submission, any additional evidence that may have been requested, and any other available information relevant to the request. The Enforcement Division Director or Director will then make a written determination of the applicable subcategory and state the reasons for the determination.

(ii) Where the request is submitted to the Director, the Director shall forward the determination described in this paragraph to the Enforcement Division Director who may make a final determination. The Enforcement Division Director may waive receipt of these determinations. If the Enforcement Division Director does not modify the Director's decision within 60 days after receipt thereof, or if the Enforcement Division Director waives receipt of the

determination, the Director's decision is final.

(iii) Where the request is submitted by the Industrial User or POTW to the Enforcement Division Director or where the Enforcement Division Director elects to modify the Director's decision, the Enforcement Division Director's decision will be final.

(iv) The Enforcement Division Director or Director, as appropriate, shall send a copy of the determination to the affected Industrial User and the POTW. Where the final determination is made by the Enforcement Division Director, he or she shall send a copy of the determination to the Director.

(5) *Requests for Hearing and/or Legal Decision.* Within 30 days following the date of receipt of notice of the final determination as provided for by paragraph (a)(4)(iv) of this section, the Requester may submit a petition to reconsider or contest the decision to the Regional Administrator who shall act on such petition expeditiously and state the reasons for his or her determination in writing.

(b) *Deadline for Compliance With Categorical Standards.* Compliance by existing sources with categorical Pretreatment Standards shall be within 3 years of the date the Standard is effective unless a shorter compliance time is specified in the appropriate subpart of 40 CFR Chapter I, Subchapter N but in any case no later than July 1, 1984. Direct Discharges with NPDES permits modified or reissued to provide a variance pursuant to section 301(i)(2) of the Act shall be required to meet compliance dates set forth in any applicable categorical Pretreatment Standard. Existing sources which become Industrial Users subsequent to promulgation of an applicable categorical Pretreatment Standard shall be considered existing Industrial Users except where such sources meet the definition of a New Source as defined in § 403.3(k). Compliance with categorical Pretreatment Standards for New Sources will be required upon promulgation.

(c) *Concentration and Mass Limits.* Pollutant discharge limits in categorical Pretreatment Standards will be expressed either as concentration or mass limits. Wherever possible, where concentration limits are specified in standards, equivalent mass limits will be provided so that local, State or Federal authorities responsible for enforcement may use either concentration or mass limits. Limits in categorical Pretreatment Standards shall apply to the effluent of the process regulated by the Standard, or as otherwise specified by the Standard.

(d) *Dilution Prohibited as Substitute for Treatment.* Except where expressly authorized to do so by an applicable categorical Pretreatment Standard, no Industrial User shall ever increase the use of process water or, in any other way, attempt to dilute a Discharge as a partial or complete substitute for adequate treatment to achieve compliance with a categorical Pretreatment Standard. The Control Authority (as defined in § 403.12(a)) may impose mass limitations on Industrial Users which are using dilution to meet applicable Pretreatment Standards or in other cases where the imposition of mass limitations is appropriate.

(e) *Combined Wastestream Formula.* Where process effluent is mixed prior to treatment with wastewaters other than those generated by the regulated process, fixed alternative discharge limits may be derived by the Control Authority, as defined in § 403.12(a), or by the Industrial User with the written concurrence of the Control Authority. These alternative limits shall be applied to the mixed effluent. When deriving alternative categorical limits, the Control Authority or Industrial User shall calculate both an alternative daily maximum value using the daily maximum value(s) specified in the appropriate categorical Pretreatment Standard(s) and an alternative consecutive sampling day average value using the long-term average value(s) specified in the appropriate categorical Pretreatment Standard(s). The Industrial User shall comply with the alternative daily maximum and long-term average limits fixed by the Control Authority until the Control Authority modifies the limits or approves an Industrial User modification request. Modification is authorized whenever there is a material or significant change in the values used in the calculation to fix alternative limits for the regulated pollutant. An Industrial User must immediately report any such material or significant change to the Control Authority. Where appropriate new alternative categorical limits shall be calculated within 30 days.

(1) *Alternative limit calculation.* For purposes of these formulas, the "average daily flow" means a reasonable measure of the average daily flow for a 30-day period. For new sources, flows shall be estimated using projected values. The alternative limit for a specified pollutant will be derived by the use of either of the following formulas:

(i) *Alternative Concentration Limit:*

$$C_T = \left(\frac{\sum_{i=1}^N C_i P_i}{\sum_{i=1}^N F_i} \right) \left(\frac{F_T - F_D}{F_T} \right)$$

where

C_T = the alternative concentration limit for the combined wastestream.

C_i = the categorical Pretreatment Standard concentration limit for a pollutant in the regulated stream i .

F_i = the average daily flow (at least a 30-day average) of stream i to the extent that it is regulated for such pollutant.

F_D = the average daily flow (at least a 30-day average) from boiler blowdown streams, non-contact cooling streams, sanitary wastestreams (where such streams are not regulated by a categorical Pretreatment Standard) and from any process wastestreams which were or could have been entirely exempted from categorical Pretreatment Standards pursuant to paragraph 8 of the *NRDC v. Costle* Consent Decree (12 ERC 1833) for one or more of the following reasons (see Appendix D):

- (1) the pollutants of concern are not detectable in the effluent from the Industrial User (paragraph (8)(a)(iii));
- (2) the pollutants of concern are present only in trace amounts and are neither causing nor likely to cause toxic effects (paragraph (8)(a)(iii));
- (3) the pollutants of concern are present in amounts too small to be effectively reduced by technologies known to the Administrator (paragraph (8)(a)(iii)); or
- (4) the wastestream contains only pollutants which are compatible with the POTW (paragraph (8)(b)(i)).

F_T = the average daily flow (at least a 30-day average) through the combined treatment facility (includes F_i , F_D and unregulated streams).

N = the total number of regulated streams.

(ii) *Alternative Mass Limit:*

$$M_T = \left(\frac{\sum_{i=1}^N M_i}{\sum_{i=1}^N F_i} \right) \left(\frac{F_T - F_D}{F_T} \right)$$

where

M_T = the alternative mass limit for a pollutant in the combined wastestream.

M_i = the categorical Pretreatment Standard mass limit for a pollutant in the regulated

stream i (the categorical pretreatment mass limit, multiplied by the appropriate measure of production).

F_i = the average flow (at least a 30-day average) of stream i to the extent that it is regulated for such pollutant.

F_D = the average flow (at least a 30-day average) from boiler blowdown streams, non-contact cooling streams, sanitary wastestreams (where such streams are not regulated by a categorical Pretreatment Standard) and from any process wastestreams which were or could have been entirely exempted from categorical Pretreatment Standards pursuant to paragraph 8 of the *NRDC v. Costle* Consent Decree (12 ERC 1833) for one or more of the following reasons (see Appendix D):

- (1) the pollutants of concern are not detectable in the effluent from the Industrial User (paragraph (8)(a)(iii));
- (2) the pollutants of concern are present only in trace amounts and are neither causing nor likely to cause toxic effects (paragraph (8)(a)(iii));
- (3) the pollutants of concern are present in amounts too small to be effectively reduced by technologies known to the Administrator (paragraph (8)(a)(iii)); or
- (4) the wastestream contains only pollutants which are compatible with the POTW (paragraph (8)(b)(i)).

F_T = the average flow (at least a 30-day average) through the combined treatment facility (includes F_i , F_D and unregulated streams).

N = the total number of regulated streams.

(2) *Alternate Limits Below Detection Limit.* An alternative pretreatment limit may not be used if the alternative limit is below the analytical detection limit for any of the regulated pollutants.

(3) *Self-monitoring.* Self-monitoring required to insure compliance with the alternative categorical limit shall be as follows:

- (i) The type and frequency of sampling, analysis and flow measurement shall be determined by reference to the self-monitoring requirements of the appropriate categorical Pretreatment Standard(s);
- (ii) Where the self-monitoring schedules for the appropriate Standards differ, monitoring shall be done according to the most frequent schedule;
- (iii) Where flow determines the frequency of self-monitoring in a categorical Pretreatment Standard, the sum of all regulated flows (F_i) is the flow which shall be used to determine self-monitoring frequency.

§ 403.7 Revision of categorical pretreatment standards to reflect POTW removal of pollutants.

This section provides the criteria and procedures to be used by a POTW in revising the pollutant discharge limits specified in categorical Pretreatment Standards to reflect Removal of pollutants by the POTW.

(a) *Definitions.* For the purpose of this section: (1) "Removal" shall mean a reduction in the amount of a pollutant in the POTW's effluent or alteration of the nature of a pollutant during treatment at the POTW. The reduction or alteration can be obtained by physical, chemical or biological means and may be the result of specifically designed POTW capabilities or it may be incidental to the operation of the treatment system. Removal as used in this subpart shall not mean dilution of a pollutant in the POTW. The demonstration of Removal shall consist of data which reflect the Removal achieved by the POTW for those specific pollutants of concern included on the list developed pursuant to section 307(a) of the Act. Each categorical Pretreatment Standard will specify whether or not a Removal Allowance may be granted for indicator or surrogate pollutants regulated in that Standard.

(2) "Consistent Removal" shall mean the average of the lowest 50 percent of the removals measured according to paragraph (d)(2) of this section. All sample data obtained for the measured pollutant during the time period prescribed in paragraph (d)(2) of this section must be reported and used in computing Consistent Removal. If a substance is measurable in the influent but not in the effluent, the effluent level may be assumed to be the limit of measurement, and those data may be used by the POTW at its discretion and subject to approval by the Approval Authority. If the substance is not measurable in the influent, the data may not be used. Where the number of samples with concentrations equal to or above the limit of measurement is between 8 and 12, the average of the lowest 6 removals shall be used. If there are less than 8 samples with concentrations equal to or above the limit of measurement, the Approval Authority may approve alternate means for demonstrating Consistent Removal. The term "measurement" refers to the ability of the analytical method or protocol to quantify as well as identify the presence of the substance in question.

(3) "Overflow" means the intentional or unintentional diversion of flow from the POTW before the POTW Treatment Plant.

(b) *Revision of Categorical Pretreatment Standards to Reflect POTW Pollutant Removal.* Any POTW receiving wastes from an Industrial User to which a categorical Pretreatment Standard applies may, subject to the conditions of this section, revise the discharge limits for a specific pollutant(s) covered in the categorical Pretreatment Standard applicable to that User. Revisions will only be made where the POTW demonstrates Consistent Removal of each pollutant for which the discharge limit in a categorical Pretreatment Standard is to be revised at a level which justifies the amount of revision to the discharge limit. In addition, revision of pollutant discharge limits in categorical Pretreatment Standards by a POTW may only be made provided that:

(1) *Application.* The POTW applies for, and receives, authorization from the Regional Administrator and/or Director to revise the discharge limits in Pretreatment Standards, for specific pollutants, in accordance with the requirements and procedures set out in this section and §§ 403.9 and 403.11; and

(2) *POTW Pretreatment Programs.* The POTW has a Pretreatment Program approved in accordance with §§ 403.8, 403.9, and 403.11; provided, however, a POTW may conditionally revise the discharge limits for specific pollutants, even though a Pretreatment Program has not been approved, in accordance with the following terms and conditions. These provisions also govern the issuance of provisional authorizations under § 403.7(d)(2)(vii):

(i) All Industrial Users who wish to receive a conditional or provisional revision of categorical Pretreatment Standards must submit to the POTW the information required in § 403.12(b)(1)-(7) pertaining to the categorical Pretreatment Standard as modified by the conditional or provisional removal allowance, except that the compliance schedule required by § 403.12(b)(7) is not required where a provisional allowance is requested. The submission shall indicate what additional technology, if any, will be needed to comply with the categorical Pretreatment Standards as revised by the POTW:

(ii) The POTW must compile and submit data demonstrating removal in accordance with the requirements of paragraphs (d)(1)-(7) of this section. The POTW shall submit to the Approval Authority a removal report which comports with the signatory and certification requirements of § 403.12 (l) and (m). This report shall contain a certification by any of the persons specified in § 403.12(1) or by an

independent engineer containing the following statement: "I have personally examined and am familiar with the information submitted in the attached document, and I hereby certify under penalty of law that this information was obtained in accordance with the requirements of § 403.7(d). Moreover, based upon my inquiry of those individuals immediately responsible for obtaining the information reported herein, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.";

(iii) The POTW must submit to the Approval Authority an application for pretreatment program approval meeting the requirements of §§ 403.8 and 403.9(a) or (b) in a timely manner, not to exceed the time limitation set forth in a compliance schedule for development of a pretreatment program included in the POTW's NPDES permit;

(iv) If a POTW grants conditional or provisional revision(s) and the Approval Authority subsequently makes a final determination, after notice and an opportunity for a hearing, that the POTW failed to comply with the conditions in paragraphs (b)(2)(ii) or (iii) of this section, or that its sludge use or disposal practices are not in compliance with the provisions of paragraph (b)(4) of this section, the revision shall be terminated by the Approval Authority and all Industrial Users to whom the revised discharge limits had been applied shall achieve compliance with the applicable categorical Pretreatment Standard(s) within a reasonable time (not to exceed the period of time prescribed in the applicable categorical Pretreatment Standard(s)) as specified by the Approval Authority. However, the revision(s) shall not be terminated where the POTW has not made a timely application for program approval if the POTW has made demonstrable progress towards and has demonstrated and continues to demonstrate an intention to submit an approvable pretreatment program as expeditiously as possible within an additional period of time, not to exceed one year, established by the Approval Authority;

(v) If a POTW grants conditional or provisional revision(s) and the POTW Approval Authority subsequently makes a final determination, after notice and an opportunity for a hearing, that the Industrial User(s) failed to comply with conditions in paragraph (b)(2)(i) of this section, including in the case of a conditional revision, the dates specified in the compliance schedule required by

403.12(b)(7), the revision shall be terminated by the POTW or the Approval Authority for the non-complying Industrial Users and all non-complying Industrial Users to whom the revised discharge limits had been applied shall achieve compliance with the applicable categorical Pretreatment Standard(s) within the time period specified in such Standard(s). The revision(s) shall not be terminated where a violation of the provisions of this subparagraph results from causes entirely outside of the control of the Industrial User or the Industrial User has demonstrated substantial compliance; and

(vi) The POTW shall submit to the Approval Authority by December 31 of each year the name and address of each Industrial User that has received a conditionally or provisionally revised discharge limit. If the revised discharge limit is revoked, the POTW must submit the information in paragraph (b)(2)(i) above to the Approval Authority.

(3) *Compensation for overflow.* POTW's which at least once annually overflow untreated wastewater to receiving waters may claim Consistent Removal of a pollutant only by complying with either paragraphs (b)(3)(i) or (ii) below. However, this subsection shall not apply where Industrial User(s) can demonstrate that Overflow does not occur between the Industrial User(s) and the POTW Treatment Plant.

(i) The Industrial User provides containment or otherwise ceases or reduces Discharges from the regulated processes which contain the pollutant for which an allowance is requested during all circumstances in which an Overflow event can reasonably be expected to occur at the POTW or at a sewer to which the Industrial User is connected. Discharges must cease or be reduced, or pretreatment must be increased, to the extent necessary to compensate for the removal not being provided by the POTW. Allowances under this provision will only be granted where the POTW submits to the Approval Authority evidence that:

(A) All Industrial Users to which the POTW proposes to apply this provision have demonstrated the ability to contain or otherwise cease or reduce, during circumstances in which an Overflow event can reasonably be expected to occur. Discharges from the regulated processes which contain pollutants for which an allowance is requested;

(B) The POTW has identified circumstances in which an Overflow event can reasonably be expected to occur, and has a notification or other

viable plan to insure that Industrial Users will learn of an impending Overflow in sufficient time to contain, cease or reduce Discharging to prevent untreated Overflows from occurring. The POTW must also demonstrate that it will monitor and verify the data required in paragraph (b)(3)(i)(C) herein to insure that Industrial Users are containing, ceasing or reducing operations during POTW System Overflow; and

(C) All Industrial Users to which the POTW proposes to apply this provision have demonstrated the ability and commitment to collect and make available upon request by the POTW, State Director or EPA Regional Administrator daily flow reports or other data sufficient to demonstrate that all Discharges from regulated processes containing the pollutant for which the allowance is requested were contained, reduced or otherwise ceased, as appropriate, during all circumstances in which an Overflow event was reasonably expected to occur; or

(ii)(A) The Consistent Removal claimed is reduced pursuant to the following equation:

$$r_c = r_m \frac{8760 - Z}{8760}$$

Where:

r_m = POTW's Consistent Removal rate for that pollutant as established under paragraphs (a)(1) and (d)(2) of this section

r_c = removal corrected by the Overflow factor

Z = hours per year that Overflow occurred between the Industrial User(s) and the POTW Treatment Plant, the hours either to be shown in the POTW's current NPDES permit application or the hours, as demonstrated by verifiable techniques, that a particular Industrial User's Discharge Overflows between the Industrial User and the POTW Treatment Plant; and

(B)(1) After July 1, 1983, Consistent Removal may be claimed only where efforts to correct the conditions resulting in untreated Discharges by the POTW are underway in accordance with the policy and procedures set forth in "PRM 75-34" or "Program Guidance Memorandum-61" (same document) published on December 18, 1975 by EPA Office of Water Program Operations (WH-546). (See Appendix A.) Revisions to discharge limits in categorical Pretreatment Standards may not be made where efforts have not been committed to by the POTW to minimize pollution from Overflows. At minimum,

by July 1, 1983, the POTW must have completed the analysis required by PRM 75-34 and be making an effort to implement the plan.

(2) If, by July 1, 1983, a POTW has begun the PRM 75-34 analysis but due to circumstances beyond its control has not completed it, Consistent Removal, subject to the approval of the Approval Authority, may continue to be claimed according to the formula in paragraph (b)(3)(ii)(A) above so long as the POTW acts in a timely fashion to complete the analysis and makes an effort to implement the non-structural cost-effective measures identified by the analysis; and so long as the POTW has expressed its willingness to apply, after completing the analysis, for a construction grant necessary to implement any other cost-effective Overflow controls identified in the analysis should federal funds become available, so applies for such funds, and proceeds with the required construction in an expeditious manner. In addition, Consistent Removal may, subject to the approval of the Approval Authority, continue to be claimed according to the formula in paragraph (b)(3)(ii)(A) above where the POTW has completed and the Approval Authority has accepted the analysis required by PRM 75-34 and the POTW has requested inclusion in its NPDES permit of an acceptable compliance schedule providing for timely implementation of cost-effective measures identified in the analysis. (In considering what is timely implementation, the Approval Authority shall consider the availability of funds, cost of control measures, and seriousness of the water quality problem.); and

(4) *Compliance with applicable sludge requirements.* Such revision will not contribute to the POTW's inability to comply with its NPDES permit or with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations) as they apply to the sludge management methods being used: section 405 of the Clean Water Act; the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation Recovery Act (RCRA) and including State regulations contained in any State sludge management plan prepared pursuant to Subtitle D of SWDA); the Clean Air Act and the Toxic Substances Control Act. The POTW will be authorized to revise discharge limits only for those pollutants that do not contribute to the violation of

its NPDES permit or any of the above statutes.

(c) POTW application for authorization to revise discharge limits.

(1) Application for authorization to revise discharge limits for Industrial Users who are or in the future may be subject to categorical Pretreatment Standards, or approval of discharge limits conditionally or provisionally revised for Industrial Users by the POTW pursuant to paragraphs (b)(2) and (d)(2)(vii) shall be submitted by the POTW to the Approval Authority.

(2) Each POTW may submit such an application no more than once per year with respect to either:

(i) any categorical Pretreatment Standard promulgated in the prior 18 months;

(ii) any new or modified facilities or production changes resulting in the Discharge of pollutants which were not previously discharged and which are subject to promulgated categorical Standards; or

(iii) any significant increase in Removal efficiency attributable to specific identifiable circumstances or corrective measures (such as improvements in operation and maintenance practices, new treatment or treatment capacity, or a significant change in the influent to the POTW Treatment Plant).

(3) The Approval Authority may, however, elect not to review such application(s) upon receipt, in which case the POTW's conditionally or provisionally revised discharge limits will remain in effect until reviewed by the Approval Authority. This review may occur at any time in accordance with the procedures of § 403.11, but in no event later than the time of any pretreatment program approval or any NPDES permit reissuance thereafter.

(4) If the Consistent Removal claimed is based on an analytical technique other than the technique specified for the applicable categorical Pretreatment Standard, the Approval Authority may require the POTW perform additional analyses.

(d) Contents of application to revise discharge limits. Requests for authorization to revise discharge limits in categorical Pretreatment Standards must be supported by the following information:

(1) *List of Pollutants.* A list of pollutants for which discharge limit revisions are proposed.

(2) *Consistent Removal Data.* Influent and effluent operational data demonstrating Consistent Removal or other information, as provided for in paragraph (a)(2) of this section, which demonstrates Consistent Removal of the

pollutants for which discharge limit revisions are proposed. This data shall meet the following requirements:

(i) Representative Data: Seasonal. The data shall be representative of yearly and seasonal conditions to which the POTW is subjected for each pollutant for which a discharge limit revision is proposed.

(ii) Representative Data: Quality and Quantity. The data shall be representative of the quality and quantity of normal effluent and influent flow if such data can be obtained. If such data are unobtainable, alternate data or information may be presented for approval to demonstrate Consistent Removal as provided for in paragraph (a)(2) of this section.

(iii) Sampling Procedures: Composite. (A) The influent and effluent operational data shall be obtained through 24-hour flow-proportional composite samples. Sampling may be done manually or automatically, and discretely or continuously. For discrete sampling, at least 12 aliquots shall be composited. Discrete sampling may be flow-proportioned either by varying the time interval between each aliquot or the volume of each aliquot. All composites must be flow-proportional to either stream flow at time of collection of influent aliquot or to the total influent flow since the previous influent aliquot. Volatile pollutant aliquots must be combined in the laboratory immediately before analysis.

(B)(1) Twelve samples shall be taken at approximately equal intervals throughout one full year. Sampling must be evenly distributed over the days of the week so as to include non-workdays as well as workdays. If the Approval Authority determines that this schedule will not be most representative of the actual operation of the POTW Treatment Plant, an alternative sampling schedule will be approved.

(2) In addition, upon the Approval Authority's concurrence, a POTW may utilize an historical data base amassed prior to the effective date of this section provided that such data otherwise meet the requirements of this paragraph. In order for the historical data base to be approved it must present a statistically valid description of daily, weekly and seasonal sewage treatment plant loadings and performance for at least one year.

(C) Effluent sample collection need not be delayed to compensate for hydraulic detention unless the POTW elects to include detention time compensation or unless the Approval Authority requires detention time compensation. The Approval Authority may require that each effluent sample

be taken approximately one detention time later than the corresponding influent sample when failure to do so would result in an unrepresentative portrayal of actual POTW operation. The detention period is to be based on a 24-hour average daily flow value. The average daily flow used will be based upon the average of the daily flows during the same month of the previous year.

(iv) Sampling Procedures: Grab. Where composite sampling is not an appropriate sampling technique, a grab sample(s) shall be taken to obtain influent and effluent operational data. Collection of influent grab samples should precede collection of effluent samples by approximately one detention period. The detention period is to be based on a 24-hour average daily flow value. The average daily flow used will be based upon the average of the daily flows during the same month of the previous year. Grab samples will be required, for example, where the parameters being evaluated are those, such as cyanide and phenol, which may not be held for any extended period because of biological, chemical or physical interactions which take place after sample collection and affect the results. A grab sample is an individual sample collected over a period of time not exceeding 15 minutes.

(v) Analytical methods. The sampling referred to in paragraphs (d)(2)(i)-(iv) and (d)(5) of this section and an analysis of these samples shall be performed in accordance with the techniques prescribed in 40 CFR Part 136 and amendments thereto. Where 40 CFR Part 136 does not contain sampling or analytical techniques for the pollutant in question, or where the Administrator determines that the Part 136 sampling and analytical techniques are inappropriate for the pollutant in question, sampling and analysis shall be performed using validated analytical methods or any other applicable sampling and analytical procedures, including procedures suggested by the POTW or other parties, approved by the Administrator.

(vi) Calculation of removal. All data acquired under the provisions of this section must be submitted to the Approval Authority. Removal for a specific pollutant shall be determined either, for each sample, by measuring the difference between the concentrations of the pollutant in the influent and effluent of the POTW and expressing the difference as a percent of the influent concentration, or, where such data cannot be obtained, Removal may be demonstrated using other data

or procedures subject to concurrence by the Approval Authority as provided for in paragraph (a)(2) of this section.

(vii) *Exception to sampling data requirement: provisional removal demonstration.* For pollutants which are not currently being discharged (new or modified facilities, or production changes) application may be made by the POTW for provisional authorization to revise the applicable categorical Pretreatment Standard prior to initial discharge of the pollutant. Consistent Removal may be based provisionally on data from treatability studies or demonstrated removal at other treatment facilities where the quality and quantity of influent are similar. In calculating and applying for provisional removal allowances, the POTW must comply with the provisions of paragraphs (b)(1)-(4) of this section. Within 18 months after the commencement of Discharge of the pollutants in question, Consistent Removal must be demonstrated pursuant to the requirements of paragraphs (a)(2) and (d)(2)(i)-(vi) of this section.

(3) *List of industrial subcategories.* A list of the industrial subcategories for which discharge limits in categorical Pretreatment Standards will be revised, including the number of Industrial Users in each such subcategory and an identification of which of the pollutants on the list prepared under paragraph (d)(1) of this section are Discharged by each subcategory.

(4) *Calculation of revised discharge limits.* Proposed revised discharge limits for each of the subcategories of Industrial Users identified in paragraph (d)(3) of this section calculated in the following manner:

(i) The proposed revised discharge limit for a specified pollutant shall be derived by use of the following formula:

$$Y = \frac{x}{1-r}$$

where:

x = pollutant discharge limit specified in the applicable categorical Pretreatment Standard

r = POTW's Consistent Removal rate for that pollutant as established under paragraphs (a)(2), (d)(2) and, if appropriate, (b)(3)(ii)(A) of this section. (percentage expressed as a decimal)

Y = revised discharged limit for the

specified pollutant (expressed in same units as x)

(ii) In calculating revised discharge limits, such revision for POTW Removal of a specified pollutant shall be applied equally to all existing and new Industrial Users in an industrial subcategory subject to categorical Pretreatment Standards which Discharge that pollutant to the POTW.

(5) *Data on sludge characteristics.* Data showing the concentrations and amounts in the POTW's sludge of the pollutants for which discharge limit revisions are proposed and for which EPA, the State or locality have published sludge disposal or use criteria applicable to the POTW's current method of sludge use or disposal. These data shall meet the following requirements.

(i) The data shall be obtained through a composite sample taken during the same sampling periods selected to measure Consistent POTW Removals in accordance with the requirements of paragraph (d)(2) of this section. Each composite sample will contain a minimum of 12 discrete samples taken at equal time intervals over a 24 hour period. Where a composite sample is not an appropriate sampling technique, grab samples shall be taken.

(ii) Sampling and analysis of the samples referred to in paragraph (d)(5)(i) of this section shall be performed in accordance with the sampling and analytical techniques described previously in paragraph (d)(2)(v) of this section.

(6) *Description of sludge management.* A specific description of the POTW's current methods of use or disposal of its sludge and data demonstrating that the current sludge use or disposal methods comply and will continue to comply with the requirements of paragraph (b)(4) of this section.

(7) *Certification statement.* The certification statement required by paragraph (b)(2)(ii) of this section stating that the pollutant Removals and associated revised discharge limits have been or will be calculated in accordance with this regulation and any guidelines issued by EPA under Section 304(g) of the Act.

(e) *Procedure for authorizing modification of standards.* (1) Application for authorization to revise National Pretreatment Standards shall comply with § 403.9(d) and paragraphs (c) and (d) of this section. Notice, public comment, and review by the Approval

Authority shall comply with § 403.11.

(2) POTW's which have received a construction grant from funds authorized for any fiscal year beginning after September 30, 1978, will only be considered for authorization to modify National Standards after they have completed the analysis required by section 201(g)(5) of the Act and demonstrated that modification of the discharge limits in National Standards will not preclude the use of innovative or alternative technology. In addition, where sludge disposal or treatment technology is or will be acquired or constructed with construction grant funds, POTW's should refer to § 35.917(d)(6) and Appendix A of Part 35 of Title 40 of the Code of Federal Regulations to determine the funding eligibility of sludge disposal or treatment facilities.

(3) The Approval Authority shall, at such time as it elects to review the Submission under paragraph (c) of this section, or at the time of POTW pretreatment program approval or NPDES permit reissuance thereafter, authorize the POTW to revise Industrial User discharge limits, as submitted pursuant to paragraph (d)(4) of this section, which comply with the provisions of this section.

(4) Nothing in these regulations precludes an Industrial User or other interested party from assisting the POTW in preparing and presenting the information necessary to apply for authorization to revise categorical Pretreatment Standards.

(f) *Continuation and withdrawal of authorization.* (1) *Monitoring and reporting of consistent removal.* Following authorization to revise the discharge limits in Pretreatment Standards, the POTW shall continue to monitor and report on (at such frequencies and over such intervals as may be specified by the Regional Administrator, but in no case less than two times per year) the POTW's Removal capabilities for all pollutants for which authority to revise the Standards was granted. Such monitoring and reporting shall be in accordance with § 403.12 (i) and (j) pertaining to pollutant removal capability reports.

(2) *Re-evaluation of revisions.* Approval of authority to revise Pretreatment Standards will be re-examined whenever the POTW's NPDES Permit is reissued, unless the Regional Administrator determines the need to re-evaluate the authority pursuant to paragraph (f)(5) of this section. In order

to maintain a removal allowance, the POTW must comply with all federal, State and local Statutes, regulations and permits applicable to the POTW's selected method of sludge use or disposal. In addition, where Overflows of untreated waste by the POTW continue to occur the Regional Administrator may condition continued authorization to revise discharge limits upon the POTW performing additional analysis and/or implementing additional control measures as is consistent with EPA policy on POTW Overflows.

(3) *Inclusion in POTW permit.* Once authority to revise discharge limits for a specified pollutant is granted, the revised discharge limits for Industrial Users of the system as well as the Consistent Removal documented by the POTW for that pollutant and the other requirements of paragraph (b) of this section, shall be included in the POTW's NPDES Permit upon the earliest reissuance or modification (at or following Program approval) and shall become enforceable requirements of the POTW's NPDES Permit.

(4) *EPA review of state removal allowance approvals.* Where the NPDES State has an approved pretreatment program, the Regional Administrator may agree, in the Memorandum of Agreement under 40 CFR 123.7, to waive the right to review and object to Submissions for authority to revise discharge limits under this section. Such an agreement shall not restrict the Regional Administrator's right to comment upon or object to permits issued to POTW's except to the extent permitted under 40 CFR 123.7(b)(3)(i)(D).

(5) *Modification or withdrawal of revised limits.*—(i) *Notice to POTW.* The Approval Authority shall notify the POTW if, on the basis of pollutant removal capability reports received pursuant to paragraph (f)(1) of this section or other information available to it, the Approval Authority determines:

(A) that one or more of the discharge limit revisions made by the POTW, or the POTW itself, no longer meets the requirements of this section, or

(B) that such discharge limit revisions are causing or significantly contributing to a violation of any conditions or limits contained in the POTW's NPDES Permit. A revised discharge limit is significantly contributing to a violation of the POTW's permit if it satisfies the definition set forth in § 40.33 (i) or (n).

(ii) *Corrective action.* If appropriate corrective action is not taken within a reasonable time, not to exceed 60 days unless the POTW or the affected Industrial Users demonstrate that a longer time period is reasonably

necessary to undertake the appropriate corrective action, the Approval Authority shall either withdraw such discharge limits or require modifications in the revised discharge limits.

(iii) *Public notice of withdrawal or modification.* The Approval Authority shall not withdraw or modify revised discharge limits unless it shall first have notified the POTW and all Industrial Users to whom revised discharge limits have been applied, and made public, in writing, the reasons for such withdrawal or modification, and an opportunity is provided for a hearing. Following such notice and withdrawal or modification, all Industrial Users to whom revised discharge limits had been applied, shall be subject to the modified discharge limits or the discharge limits prescribed in the applicable categorical Pretreatment Standards, as appropriate, and shall achieve compliance with such limits within a reasonable time (not to exceed the period of time prescribed in the applicable categorical Pretreatment Standard(s) as may be specified by the Approval Authority).

(g) *Removal allowances in State-run pretreatment programs under § 403.10(e).* Where an NPDES State with an approved pretreatment program elects to implement a local pretreatment program in lieu of requiring the POTW to develop such a program (see § 403.10(e)) the POTW shall nevertheless be responsible for demonstrating Consistent Removal as provided for in this section. The POTW will not, however, be required to develop a pretreatment program as a precondition to obtaining approval of the allowance as required by paragraph (b)(2) of this section. Instead, before a removal allowance is approved, the State will be required to demonstrate that sufficient technical personnel and resources are available to ensure that modified discharge limits are correctly applied to affected Users and that Consistent Removal is maintained.

§ 403.8 POTW pretreatment programs: development by POTW.

(a) *POTW's required to develop a pretreatment program.* Any POTW (of combination of POTW's operated by the same authority) with a total design flow greater than 5 million gallons per day (mgd) and receiving from Industrial Users pollutants which Pass Through or Interfere with the operation of the POTW or are otherwise subject to Pretreatment Standards will be required to establish a POTW Pretreatment Program unless the NPDES State exercises its option to assume local responsibilities as provided for in § 403.10(e). The Regional Administrator

or Director may require that a POTW with a design flow of 5 mgd or less develop a POTW Pretreatment Program if he or she finds that the nature or volume of the industrial influent, treatment process upsets, violations of POTW effluent limitations, contamination of municipal sludge, or other circumstances warrant in order to prevent interference with the POTW or Pass Through. In addition, any POTW desiring to modify categorical Pretreatment Standards for pollutants Removed by the POTW (as provided for by § 403.7) must have an approved POTW Pretreatment Program prior to obtaining final approval of a removal allowance. POTW's may receive conditional approval of a removal allowance, as provided for by § 403.7(b)(2), prior to obtaining POTW Pretreatment Program Approval. A POTW may receive § 403.7(g) authority to revise Pretreatment Standards without being required to develop a POTW Pretreatment Program where the NPDES State has assumed responsibility for running a local program in lieu of the POTW in accordance with § 403.10(e).

(b) *Deadline for Program Approval.* A POTW which meets the criteria of paragraph (a) of this section must receive approval of a POTW Pretreatment Program no later than 3 years after the reissuance or modification of its existing NPDES-permit but in no case later than July 1, 1983. POTW's whose NPDES permits are modified under section 301(h) of the Act, shall have a Pretreatment Program within less than 3 years as provided for in 40 CFR Part 125, Subpart G (44 FR 34783 (1979)). The POTW Pretreatment Program shall meet the criteria set forth in paragraph (f) of this section and will be administered by the POTW to ensure compliance by Industrial Users with applicable Pretreatment Standards and Requirements.

(c) *Incorporation of approved programs in permits.* A POTW may develop an approvable POTW Pretreatment Program any time before the time limit set forth in paragraph (b) of this section. If (1) the POTW is located in a State which has an approved State permit program under section 402 of the Act and an approved State pretreatment program in accordance with § 403.10; or (2) the POTW is located in a State which does not have an approved permit program under section 402 of the Act; the POTW's NPDES Permit will be reissued or modified by the NPDES State or EPA, respectively, to incorporate the approved Program conditions as enforceable conditions of the Permit. If

the POTW is located in an NPDES State which does not have an approved State pretreatment program, the approved POTW Pretreatment Program shall be incorporated into the POTW's NPDES Permit as provided for in § 403.10(d).

(d) *Incorporation of compliance schedules in permits.* If the POTW does not have an approved Pretreatment Program at the time the POTW's existing Permit is reissued or modified, the reissued or modified Permit will contain the shortest reasonable compliance schedule, not to exceed three years or July 1, 1983, whichever is sooner, for the approval of the legal authority, procedures and funding required by paragraph (f) of this section. Where the POTW is located in an NPDES State currently without authority to require a POTW Pretreatment Program, the Permit shall incorporate a modification or termination clause as provided for in § 403.10(d) and the compliance schedule shall be incorporated when the Permit is modified or reissued pursuant to such clause.

(e) *Cause for Reissuance or Modification of Permits.* Under the authority of section 402(b)(1)(C) of the Act, the Approval Authority may modify, or alternatively, revoke and reissue a POTW's Permit in order to:

(1) put the POTW on a compliance schedule for the development of a POTW Pretreatment Program where the addition of pollutants into a POTW by an Industrial User or combination of Industrial Users presents a substantial hazard to the functioning of the treatment works, quality of the receiving waters, human health, or the environment;

(2) coordinate the issuance of a section 201 construction grant with the incorporation into a permit of a compliance schedule for POTW Pretreatment Program;

(3) incorporate a modification of the permit approved under sections 301(h) or 301(i) of the Act;

(4) incorporate an approved POTW Pretreatment Program in the POTW permit or

(5) incorporate a compliance schedule for the development of a POTW pretreatment program in the POTW permit.

(f) *POTW pretreatment program requirements.* A POTW Pretreatment Program shall meet the following requirements:

(1) *Legal Authority.* The POTW shall operate pursuant to legal authority enforceable in Federal, State or local courts, which authorizes or enables the POTW to apply and to enforce the requirements of sections 307 (b) and (c),

and 402(b)(6) of the Act and any regulations implementing those sections. Such authority may be contained in a statute, ordinance, or series of contracts or joint powers agreements which the POTW is authorized to enact, enter into or implement, and which are authorized by State law. At a minimum, this legal authority shall enable the POTW to:

(i) Deny or condition new or increased contributions of pollutants, or changes in the nature of pollutants, to the POTW by Industrial Users where such contributions do not meet applicable Pretreatment Standards and Requirements or where such contributions would cause the POTW to violate its NPDES permit;

(ii) Require compliance with applicable Pretreatment Standards and Requirements by Industrial Users;

(iii) Control, through permit, contract, order, or similar means, the contribution to the POTW by each Industrial User to ensure compliance with applicable Pretreatment Standards and Requirements;

(iv) Require (A) the development of a compliance schedule by each Industrial User for the installation of technology required to meet applicable Pretreatment Standards and Requirements and (B) the submission of all notices and self-monitoring reports from Industrial Users as are necessary to assess and assure compliance by Industrial Users with Pretreatment Standards and Requirements, including but not limited to the reports required in § 403.12;

(v) Carry out all inspection, surveillance and monitoring procedures necessary to determine, independent of information supplied by Industrial Users, compliance or noncompliance with applicable Pretreatment Standards and Requirements by Industrial Users. Representatives of the POTW shall be authorized to enter any premises of any Industrial User in which a Discharge source or treatment system is located or in which records are required to be kept under § 403.12(m) to assure compliance with Pretreatment Standards. Such authority shall be at least as extensive as the authority provided under section 308 of the Act;

(vi) (A) Obtain remedies for noncompliance by any Industrial User with any Pretreatment Standard and Requirement. All POTW's shall be able to seek injunctive relief for noncompliance by Industrial Users with Pretreatment Standards and Requirements. In cases where State law has authorized the municipality or POTW to pass ordinances or other local legislation, the POTW shall exercise such authorities in passing legislation to

seek and assess civil or criminal penalties for noncompliance by Industrial Users with Pretreatment Standards and Requirements. POTW's without such authorities shall enter into contracts with Industrial Users to assure compliance by Industrial Users with Pretreatment Standards and Requirements. An adequate contract will provide for liquidated damages for violation of Pretreatment Standards and Requirements and will include an agreement by the Industrial User to submit to the remedy of specific performance for breach of contract.

(B) Pretreatment Requirements which will be enforced through the remedies set forth in paragraph (f)(1)(vi)(A) will include but not be limited to, the duty to allow or carry out inspections, entry, or monitoring activities; any rules, regulations, or orders issued by the POTW; or any reporting requirements imposed by the POTW or these regulations. The POTW shall have authority and procedures (after informal notice to the discharger) immediately and effectively to halt or prevent any Discharge of pollutants to the POTW which reasonably appears to present an imminent endangerment to the health or welfare of persons. The POTW shall also have authority and procedures (which shall include notice to the affected Industrial Users and an opportunity to respond) to halt or prevent any Discharge to the POTW which presents or may present an endangerment to the environment or which threatens to interfere with the operation of the POTW. The Approval Authority shall have authority to seek judicial relief for noncompliance by Industrial Users when the POTW has acted to seek such relief but has sought a penalty which the Approval Authority finds to be insufficient. The procedures for notice to dischargers where the POTW is seeking *ex parte* temporary judicial injunctive relief will be governed by applicable state or federal law and not by this provision; and

(vii) Comply with the confidentiality requirements set forth in § 403.14.

(2) *Procedures.* The POTW shall develop and implement procedures to ensure compliance with the requirements of a Pretreatment Program. At a minimum, these procedures shall enable the POTW to:

(i) Identify and locate all possible Industrial Users which might be subject to the POTW Pretreatment Program. Any compilation, index or inventory of Industrial Users made under this paragraph shall be made available to the Regional Administrator or Director upon request;

(ii) Identify the character and volume of pollutants contributed to the POTW by the Industrial Users identified under § 403.8(f)(2)(i). This information shall be made available to the Regional Administrator or Director upon request.

(iii) Notify Industrial Users identified under § 403.8(f)(2)(i) of applicable Pretreatment Standards and any applicable requirements under section 204(b) and 405 of the Act and Subtitles C and D of the Resource Conservation and Recovery Act.

(iv) Receive and analyze self-monitoring reports and other notices submitted by Industrial Users in accordance with the self-monitoring requirements in § 403.12.

(v) Randomly sample and analyze the effluent from Industrial Users and conduct surveillance and inspection activities in order to identify, independent of information supplied by Industrial Users, occasional and continuing noncompliance with Pretreatment Standards. The results of these activities shall be made available to the Regional Administrator or Director upon request.

(vi) Investigate instances of noncompliance with Pretreatment Standards and Requirements, as indicated in the reports and notices required under § 403.12, or indicated by analysis, inspection, and surveillance activities described in paragraph (f)(2)(v) of this section. Sample taking and analysis and the collection of other information shall be performed with sufficient care to produce evidence admissible in enforcement proceedings or in judicial actions; and

(vii) Comply with the public participation requirements of 40 CFR Part 25 in the enforcement of National Pretreatment Standards. These procedures shall include provision for at least annually providing public notification, in the largest daily newspaper published in the municipality in which the POTW is located, of Industrial Users which, during the previous 12 months, were significantly violating applicable Pretreatment Standards or other Pretreatment Requirements. For the purposes of this provision, a significant violation is a violation which remains uncorrected 45 days after notification of noncompliance; which is part of a pattern of noncompliance over a twelve month period; which involves a failure to accurately report noncompliance; or which resulted in the POTW exercising its emergency authority under § 403.8(f)(1)(iv)(B).

(3) *Funding.* The POTW shall have sufficient resources and qualified personnel to carry out the authorities

and procedures described in paragraphs (f)(1) and (2) of this section. In some limited circumstances, funding and personnel may be delayed where (i) the POTW has adequate legal authority and procedures to carry out the Pretreatment Program requirements described in this section, and (ii) a limited aspect of the Program does not need to be implemented immediately (see § 403.9(b)).

§ 403.9 POTW pretreatment programs and/or authorization to revise pretreatment standards: submission for approval.

(a) *Who Approves Program.* A POTW requesting approval of a POTW Pretreatment Program shall develop a program description which includes the information set forth in paragraphs (b)(1)-(4) of this section. This description shall be submitted to the Approval Authority which will make a determination on the request for program approval in accordance with the procedures described in § 403.11.

(b) *Contents of POTW program submission.* The program description must contain the following information:

(1) A statement from the City Solicitor or a city official acting in a comparable capacity (or the attorney for those POTWs which have independent legal counsel) that the POTW has authority adequate to carry out the programs described in § 403.8. This statement shall:

(i) Identify the provision of the legal authority under § 403.8(f)(1) which provides the basis for each procedure under § 403.8(f)(2);

(ii) Identify the manner in which the POTW will implement the program requirements set forth in § 403.8, including the means by which Pretreatment Standards will be applied to individual Industrial Users (e.g., by order, permit, ordinance, contract, etc.); and

(iii) Identify how the POTW intends to ensure compliance with Pretreatment Standards and Requirements, and to enforce them in the event of noncompliance by Industrial Users;

(2) A copy of any statutes, ordinances, regulations, contracts, agreements, or other authorities relied upon by the POTW for its administration of the Program. This Submission shall include a statement reflecting the endorsement or approval of the local boards or bodies responsible for supervising and/or funding the POTW Pretreatment Program if approved;

(3) A brief description (including organization charts) of the POTW organization which will administer the Pretreatment Program. If more than one agency is responsible for administration

of the Program the responsible agencies should be identified, their respective responsibilities delineated, and their procedures for coordination set forth; and

(4) A description of the funding level and full- and part-time manpower available to implement the Program;

(c) *Conditional POTW program approval.* The POTW may request conditional approval of the Pretreatment Program pending the acquisition of funding and personnel for certain elements of the Program. The request for conditional approval must meet the requirements set forth in paragraph (b) of this section except that the requirements of paragraph (b) may be relaxed if the Submission demonstrates that:

(1) A limited aspect of the Program does not need to be implemented immediately;

(2) The POTW had adequate legal authority and procedures to carry out those aspects of the Program which will not be implemented immediately; and

(3) Funding and personnel for the Program aspects to be implemented at a later date will be available when needed. The POTW will describe in the Submission the mechanism by which this funding will be acquired. Upon receipt of a request for conditional approval, the Approval Authority will establish a fixed date for the acquisition of the needed funding and personnel. If funding is not acquired by this date, the conditional approval of the POTW Pretreatment Program and any removal allowances granted to the POTW, may be modified or withdrawn.

(d) *Content of removal allowance submission.* The request for authority to revise categorical Pretreatment Standards must contain the information required in § 403.7(d).

(e) *Approval authority action.* Any POTW requesting POTW Pretreatment Program approval shall submit to the Approval Authority three copies of the Submission described in paragraph (b) and, if appropriate, (d) of this section. Upon a preliminary determination that the Submission meets the requirements of paragraph (b) and, if appropriate, (d) of this section, the Approval Authority shall:

(1) Notify the POTW that the Submission has been received and is under review; and

(2) Commence the public notice and evaluation activities set forth in § 403.11.

(f) *Notification where submission defective.* If, after review of the Submission as provided for in paragraph (e) of this section, the Approval Authority determines that the Submission does not comply with the

requirements of paragraphs (b) or (c), and, if appropriate, (d), of this section, the Approval Authority shall provide notice in writing to the applying POTW and each person who has requested individual notice. This notification shall identify any defects in the Submission and advise the POTW and each person who has requested individual notice of the means by which the POTW can comply with the applicable requirements of paragraphs (b), (c), and, if appropriate, (d) of this section.

(g) *Consistency with water quality management plans.* (1) In order to be approved the POTW Pretreatment Program shall be consistent with any approved water quality management plan developed in accordance with 40 CFR Parts 130, 131, as revised, where such 208 plan includes Management Agency designations and addresses pretreatment in a manner consistent with 40 CFR Part 403. In order to assure such consistency the Approval Authority shall solicit the review and comment of the appropriate 208 Planning Agency during the public comment period provided for in § 403.11(b)(1)(ii) prior to approval or disapproval of the Program.

(2) Where no 208 plan has been approved or where a plan has been approved but lacks Management Agency designations and/or does not address pretreatment in a manner consistent with this regulation, the Approval Authority shall nevertheless solicit the review and comment of the appropriate 208 planning agency.

§ 403.10 Development and submission of NPDES State pretreatment programs.

(a) *Approval of State Programs.* No State NPDES program shall be approved under section 402 of the Act after the effective date of these regulations unless it is determined to meet the requirements of paragraph (f) of this section. Notwithstanding any other provision of this regulation, a State will be required to act upon those authorities which it currently possesses before the approval of a State Pretreatment Program.

(b) *Deadline for requesting approval.* Any NPDES State with a permit program approved under section 402 of the Act prior to December 27, 1977, which requires modification to conform to the requirements set forth in paragraph (f) of this section will be required to submit a request for approval of a modified program (hereafter State Pretreatment Program approval) by March 27, 1979 unless an NPDES State must amend or enact a law to make required modifications, in which case the NPDES

State shall request State Pretreatment Program approval by March 27, 1980.

(c) *Failure to request approval.* The EPA shall exercise the authorities available to it to apply and enforce Pretreatment Standards and Requirements until the necessary implementing action is taken by the State. Failure of a State to seek approval of a State Pretreatment Program as provided for in paragraph (b) and failure of an approved State to administer its State Pretreatment Program in accordance with the requirements of this section constitutes grounds for withdrawal of NPDES program approval under section 402(c)(3) of the Act.

(d) *Modification clause in POTW permits prior to submission deadline.* (1) Before the submission deadline for State Pretreatment Program approval set forth in paragraph (b) of this section, any Permit issued to a POTW which meets the requirements of § 403.8(a) by an NPDES State without an approved State pretreatment program shall include a modification clause. This clause will require that such Permits be promptly modified or, alternatively, revoked and reissued after the submission deadline for State Pretreatment Program approval set forth in (b) of this section to incorporate into the POTW's Permit an approved POTW Pretreatment Program or a compliance schedule for the development of a POTW Pretreatment Program according to the requirements of § 403.8 (b) and (d) and § 403.12(h). The following language is an acceptable clause for the purposes of this subparagraph:

This permit shall be modified, or alternatively, revoked and reissued, by September 27, 1979 (or September 27, 1980, as appropriate) to incorporate an approved POTW Pretreatment Program or a compliance schedule for the development of a POTW Pretreatment Program as required under section 402(b)(8) of the Clean Water Act and implementing regulations or by the requirements of the approved State Pretreatment Program, as appropriate.

(2) All Permits subject to the requirements of paragraph (d)(1) of this section which do not contain the modification clause referred to in that paragraph will be subject to objection by EPA under section 402(d) of the Act as being outside the guidelines and requirements of the Act.

(3) Permits issued by an NPDES State after the Submission deadline for State Pretreatment Program approval (set forth in paragraph (b) of this section) shall contain conditions of an approved Pretreatment Program or a compliance schedule for developing such a program in accordance with § 403.8 (b) and (d) and § 403.12(h).

(e) *State Program in lieu of POTW Program.* Notwithstanding the provision of § 403.8(a), a State with an approved Pretreatment Program may assume responsibility for implementing the POTW Pretreatment Program requirements set forth in § 403.8(f) in lieu of requiring the POTW to develop a Pretreatment Program. However, this does not preclude POTW's from independently developing Pretreatment Programs.

(f) *State Pretreatment Program requirements.* In order to be approved, a request for State Pretreatment Program Approval must demonstrate that the State Pretreatment Program has the following elements:

(1) *Legal authority.* The Attorney General's Statement submitted in accordance with subparagraph (g)(1)(i) shall certify that the Director has authority under State law to operate and enforce the State Pretreatment Program to the extent required by this Part and by 40 CFR § 123.9. At a minimum, the Director shall have the authority to:

(i) Incorporate POTW Pretreatment Program conditions into permits issued to POTW's; require compliance by POTW's with these incorporated permit conditions; and require compliance by Industrial Users with Pretreatment Standards;

(ii) Ensure continuing compliance by POTW's with pretreatment conditions incorporated into the POTW Permit through review of monitoring reports submitted to the Director by the POTW in accordance with § 403.12 and ensure continuing compliance by Industrial Users with Pretreatment Standards through the review of self-monitoring reports submitted to the POTW or to the Director by the Industrial Users in accordance with § 403.12;

(iii) Carry out inspection, surveillance and monitoring procedures which will determine, independent of information supplied by the POTW, compliance or noncompliance by the POTW with pretreatment conditions incorporated into the POTW Permit; and carry out inspection, surveillance and monitoring procedures which will determine, independent of information supplied by the Industrial User, whether the Industrial User is in compliance with Pretreatment Standards;

(iv) Seek civil and criminal penalties, and injunctive relief, for noncompliance by the POTW with pretreatment conditions incorporated into the POTW Permit and for noncompliance with Pretreatment Standards by Industrial Users as set forth in § 403.8(f)(1)(vi). The Director shall have authority to seek judicial relief for noncompliance by Industrial Users even when the POTW

has acted to seek such relief (e.g., if the POTW has sought a penalty which the Director finds to be insufficient);

(v) Approve and deny requests for approval of POTW Pretreatment Programs submitted by a POTW to the Director;

(vi) Deny and recommend approval of (but not approve) requests for Fundamentally Different Factors variances submitted by Industrial Users in accordance with the criteria and procedures set forth in § 403.13; and

(vii) Approve and deny requests for authority to modify categorical Pretreatment Standards to reflect removals achieved by the POTW in accordance with the criteria and procedures set forth in §§ 403.7, 403.9 and 403.11.

(2) *Procedures.* The Director shall have developed procedures to carry out the requirements of sections 307 (b) and (c), and 402(b)(1), 402(b)(2), 402(b)(8), and 402(b)(9) of the Act. At a minimum, these procedures shall enable the Director to:

(i) Identify POTW's required to develop Pretreatment Programs in accordance with § 403.8(a) and notify these POTW's of the need to develop a POTW Pretreatment Program. In the absence of a POTW Pretreatment Program, the State shall have procedures to carry out the activities set forth in § 403.8(f)(2);

(ii) Provide technical and legal assistance to POTW's in developing Pretreatment Programs;

(iii) Develop compliance schedules for inclusion in POTW Permits which set forth the shortest reasonable time schedule for the completion of tasks needed to implement a POTW Pretreatment Program. The final compliance date in these schedules shall be no later than July 1, 1983;

(iv) Sample and analyze:

(A) Influent and effluent of the POTW to identify, independent of information supplied by the POTW, compliance or noncompliance with pollutant removal levels set forth in the POTW permit (see § 403.7); and

(B) The contents of sludge from the POTW and methods of sludge disposal and use to identify, independent of information supplied by the POTW, compliance or noncompliance with requirements applicable to the selected method of sludge management;

(v) Investigate evidence of violations of pretreatment conditions set forth in the POTW Permit by taking samples and acquiring other information as needed. This data acquisition shall be performed with sufficient care as to produce evidence admissible in an enforcement proceeding or in court;

(vi) Review and approve requests for approval of POTW Pretreatment Programs and authority to modify categorical Pretreatment Standards submitted by a POTW to the Director; and

(vii) Consider requests for Fundamentally Different Factors variances submitted by Industrial Users in accordance with the criteria and procedures set forth in § 403.13.

(3) *Funding.* The Director shall assure that funding and qualified personnel are available to carry out the authorities and procedures described in paragraphs (f)(1) and (2) of this section.

(g) *Content of State Pretreatment Program Submission.* The request for State Pretreatment Program approval will consist of:

(1) (i) A statement from the State Attorney General (or the Attorney for those State agencies which have independent legal counsel) that the laws of the State provide adequate authority to implement the requirements of this Part. The authorities cited by the Attorney General in this statement shall be in the form of lawfully adopted State statutes or regulations which shall be effective by the time of approval of the State Pretreatment Program; and

(ii) Copies of all State statutes and regulations cited in the above statement;

(iii) Notwithstanding paragraphs (g)(1)(i) and (ii) of this section; if the State has the statutory authority to implement the requirements of this Part, and if the State at the time of submission of this request has an approved NPDES Program, then regulations setting forth the requirements of this section need not be promulgated by the State if the Administrator finds that the State has submitted a complete description of procedures to administer its program in conformance with the requirements of this section. States without an approved NPDES program will be required to comply with the requirements of paragraphs (g)(1)(i) and (ii) of this section.

(2) A description of the funding levels and full- and part-time personnel available to implement the program; and

(3) Any modifications or additions to the Memorandum of Agreement (required by 40 CFR 123.6) which may be necessary for EPA and the State to implement the requirements of this Part.

(h) *EPA Action.* Any approved NPDES State requesting State Pretreatment Program approval shall submit to the Regional Administrator three copies of the Submission described in paragraph (g) of this section. Upon a preliminary determination that the Submission

meets the requirements of paragraph (g) the Regional Administrator shall:

(1) Notify the Director that the Submission has been received and is under review; and

(2) Commence the program revision process set out in 40 CFR § 123.13. For purposes of that section all requests for approval of State Pretreatment Programs shall be deemed substantial program modifications. A comment period of at least 30 days and the opportunity for a hearing shall be afforded the public on all such proposed program revisions.

(i) *Notification where submission is defective.* If, after review of the Submission as provided for in paragraph (h) of this section, EPA determines that the Submission does not comply with the requirements of paragraphs (f) or (g) of this section EPA shall so notify the applying NPDES State in writing. This notification shall identify any defects in the Submission and advise the NPDES State of the means by which it can comply with the requirements of this Part.

§ 403.11 Approval Procedures for POTW Pretreatment Programs and POTW Revision of Categorical Pretreatment Standards.

The following procedures shall be adopted in approving or denying requests for approval of POTW Pretreatment Programs and revising Categorical Pretreatment Standards, including requests for authorization to grant conditional revised discharge limitations and provisional limitations:

(a) *Deadline for review of submission.* The Approval Authority shall have 90 days from the date of public notice of any Submission complying with the requirements of § 403.9(b) and, where removal allowance approval is sought, with §§ 403.7(d) and 403.9(d), to review the Submission. The Approval Authority shall review the Submission to determine compliance with the requirements of § 403.8(b) and (f), and, where removal allowance approval is sought, with § 403.7(a)-(e) and (g). The Approval Authority may have up to an additional 90 days to complete the evaluation of the Submission if the public comment period provided for in paragraph (b)(1)(ii) of this section is extended beyond 30 days or if a public hearing is held as provided for in paragraph (b)(2) of this section. In no event, however, shall the time for evaluation of the Submission exceed a total of 180 days from the date of public notice of a Submission meeting the requirements of § 403.9(b) and, in the case of removal allowance application, §§ 403.7(d) and 403.9(d).

(b) *Public notice and opportunity for hearing.* Upon receipt of a Submission

the Approval Authority shall commence its review. Within 5 days after making a determination that a Submission meets the requirements of § 403.9(b), and where removal allowance approval is sought, §§ 403.7(d) and 403.9(d), or at such later time under § 403.7(c) that the Approval Authority elects to review the removal allowance Submission, the Approval Authority shall:

(1) Issue a public notice of request for approval of the Submission:

(i) This public notice shall be circulated in a manner designed to inform interested and potentially interested persons of the Submission. Procedures for the circulation of public notice shall include:

(A) Mailing notices of the request for approval of the Submission to designated 208 planning agencies, Federal and State fish, shellfish, and wildlife resource agencies; and to any other person or group who has requested individual notice, including those on appropriate mailing lists; and

(B) Publication of a notice of request for approval of the Submission in the largest daily newspaper within the jurisdiction(s) served by the POTW.

(ii) The public notice shall provide a period of not less than 30 days following the date of the public notice during which time interested persons may submit their written views on the Submission.

(iii) All written comments submitted during the 30 day comment period shall be retained by the Approval Authority and considered in the decision on whether or not to approve the Submission. The period for comment may be extended at the discretion of the Approval Authority; and

(2) Provide an opportunity for the applicant, any affected State, any interested State or Federal agency, person or group of persons to request a public hearing with respect to the Submission.

(i) This request for public hearing shall be filed within the 30 day (or extended) comment period described in paragraph (b)(1)(ii) of this section and shall indicate the interest of the person filing such request and the reasons why a hearing is warranted.

(ii) The Approval Authority shall hold a hearing if the POTW so requests. In addition, a hearing will be held if there is a significant public interest in issues relating to whether or not the Submission should be approved. Instances of doubt should be resolved in favor of holding the hearing.

(iii) Public notice of a hearing to consider a Submission and sufficient to inform interested parties of the nature of the hearing and the right to participate

shall be published in the same newspaper as the notice of the original request for approval of the Submission under paragraph (b)(1)(i)(B) of this section. In addition, notice of the hearing shall be sent to those persons requesting individual notice.

(3) Whenever the approval authority elects to defer review of a submission which authorizes the POTW to grant conditional revised discharge limits under § 403.7(b)(2) and 403.7(c), the Approval Authority shall publish public notice of its election in accordance with paragraph (b)(1) of this section.

(c) *Approval authority decision.* At the end of the 30 day (or extended) comment period and within the 90 day (or extended) period provided for in paragraph (a) of this section, the Approval Authority shall approve or deny the Submission based upon the evaluation in paragraph (a) of this section and taking into consideration comments submitted during the comment period and the record of the public hearing, if held. Where the Approval Authority makes a determination to deny the request, the Approval Authority shall so notify the POTW and each person who has requested individual notice. This notification shall include suggested modifications and the Approval Authority may allow the requestor additional time to bring the Submission into compliance with applicable requirements.

(d) *EPA objection to Director's decision.* No POTW pretreatment program or authorization to grant removal allowances shall be approved by the Director if following the 30 day (or extended) evaluation period provided for in paragraph (b)(1)(ii) of this section and any hearing held pursuant to paragraph (b)(2) of this section the Regional Administrator sets forth in writing objections to the approval of such Submission and the reasons for such objections. A copy of the Regional Administrator's objections shall be provided to the applicant, and each person who has requested individual notice. The Regional Administrator shall provide an opportunity for written comments and may convene a public hearing on his or her objections. Unless retracted, the Regional Administrator's objections shall constitute a final ruling to deny approval of a POTW pretreatment program or authorization to grant removal allowances 90 days after the date the objections are issued.

(e) *Notice of decision.* The Approval Authority shall notify those persons who submitted comments and participated in the public hearing, if held, of the

approval or disapproval of the Submission. In addition, the Approval Authority shall cause to be published a notice of approval or disapproval in the same newspapers as the original notice of request for approval of the Submission was published. The Approval Authority shall identify in any notice of POTW Pretreatment Program approval any authorization to modify categorical Pretreatment Standards which the POTW may make, in accordance with § 403.7, for removal of pollutants subject to Pretreatment Standards.

(f) *Public access to submission.* The Approval Authority shall ensure that the Submission and any comments upon such Submission are available to the public for inspection and copying.

§ 403.12 Reporting requirements for POTW's and industrial users.

(a) *Definition.* The term "Control Authority" as it is used in this section refers to: (1) The POTW if the POTW's Submission for its pretreatment program (§ 403.3(t)(1)) has been approved in accordance with the requirements of § 403.11; or (2) the Approval Authority if the Submission has not been approved.

(b) *Reporting requirement for industrial users upon effective date of categorical pretreatment standard—baseline report.* Within 180 days after the effective date of a categorical Pretreatment Standard, or 180 days after the final administrative decision made upon a category determination submission under § 403.6(a)(4), whichever is later, existing Industrial Users subject to such categorical Pretreatment Standards and currently discharging to or scheduled to discharge to a POTW shall be required to submit to the Control Authority a report which contains the information listed in paragraph (b)(1)–(7) of this section. Where reports containing this information already have been submitted to the Director or Regional Administrator in compliance with the requirements of 40 CFR 123.140(b), the Industrial user will not be required to submit this information again. New sources shall be required to submit to the Control Authority a report which contains the information listed in paragraphs (b)(1)–(5) of this section:

(1) *Identifying information.* The User shall submit the name and address of the facility, along with the name of the operator and owner;

(2) *Permits.* The User shall submit a list of any environmental control permits held by or for the facility;

(3) *Description of operations.* The User shall submit a brief description of the nature and volume of production.

and Standard Industrial Classification of the operation(s) carried out by such Industrial User. This description should include a schematic process diagram which indicates points of Discharge to the POTW from the regulated processes.

(4) *Flow measurement.* The User shall submit information showing the measured average daily and maximum daily flow, in gallons per day, to the POTW from each of the following:

- (i) regulated process streams; and
- (ii) other streams as necessary to allow use of the combined wastestream formula of § 403.8(e). (See paragraph (b)(5)(v) of this section.)

The Control Authority may allow for verifiable estimates of these flows where justified by cost or feasibility considerations.

(5) *Measurement of Pollutants.* (i) The user shall identify the Pretreatment Standards applicable to each regulated process;

(ii) In addition, the User shall submit the results of sampling and analysis identifying the nature and concentration (or mass, where required by the Standard or Control Authority) of regulated pollutants in the Discharge from each regulated process. Both daily maximum and average concentration (or mass, where required) shall be reported. The sample shall be representative of daily operations;

(iii) Where feasible, samples must be obtained through the flow-proportional composite sampling techniques specified in the applicable categorical Pretreatment Standard. Where composite sampling is not feasible, a grab sample is acceptable;

(iv) Where the flow of the stream being sampled is less than or equal to 950,000 liters/day (approximately 250,000 gpd), the User must take three samples within a two-week period. Where the flow of the stream being sampled is greater than 950,000 liters/day (approximately 250,000 gpd), the User must take six samples within a two-week period;

(v) Samples should be taken immediately downstream from pretreatment facilities if such exist or immediately downstream from the regulated process if no pretreatment exists. If other wastewaters are mixed with the regulated wastewater prior to pretreatment the User should measure the flows and concentrations necessary to allow use of the combined wastestream formula of § 403.8(e) in order to evaluate compliance with the Pretreatment Standards. Where an alternate concentration or mass limit has been calculated in accordance with § 403.8(e) this adjusted limit along with

supporting data shall be submitted to the Control Authority;

(vi) Sampling and analysis shall be performed in accordance with the techniques prescribed in 40 CFR Part 136 and amendments thereto. Where 40 CFR Part 136 does not contain sampling or analytical techniques for the pollutant in question, or where the Administrator determines that the Part 136 sampling and analytical techniques are inappropriate for the pollutant in question, sampling and analysis shall be performed by using validated analytical methods or any other applicable sampling and analytical procedures, including procedures suggested by the POTW or other parties, approved by the Administrator;

(vii) The Control Authority may allow the submission of a baseline report which utilizes only historical data so long as the data provides information sufficient to determine the need for industrial pretreatment measures;

(viii) The baseline report shall indicate the time, date and place, of sampling, and methods of analysis, and shall certify that such sampling and analysis is representative of normal work cycles and expected pollutant Discharges to the POTW;

(6) *Certification.* A statement, reviewed by an authorized representative of the Industrial User (as defined in subparagraph (k) of this section) and certified to by a qualified professional, indicating whether Pretreatment Standards are being met on a consistent basis, and, if not, whether additional operation and maintenance (O and M) and/or additional pretreatment is required for the Industrial User to meet the Pretreatment Standards and Requirements; and

(7) *Compliance Schedule.* If additional pretreatment and/or O and M will be required to meet the Pretreatment Standards; the shortest schedule by which the Industrial User will provide such additional pretreatment and/or O and M. The completion date in this schedule shall not be later than the compliance date established for the applicable Pretreatment Standard.

(i) Where the Industrial User's categorical Pretreatment Standard has been modified by a removal allowance (§ 403.7), the combined wastestream formula (§ 403.8(e)), and/or a Fundamentally Different Factors variance (§ 403.13) at the time the User submits the report required by paragraph (b) of this section, the information required by paragraphs (b)(6) and (7) of this section shall pertain to the modified limits.

(ii) If the categorical Pretreatment Standard is modified by a removal allowance (§ 403.7), the combined wastestream formula (§ 403.8(e)), and/or a Fundamentally Different Factors variance (§ 403.13) after the User submits the report required by paragraph (b) of this section, any necessary amendments to the information requested by paragraphs (b)(6) and (7) of this section shall be submitted by the User to the Control Authority within 60 days after the modified limit is approved.

(c) *Compliance Schedule for Meeting Categorical Pretreatment Standards.* The following conditions shall apply to the schedule required by paragraph (b)(7) of this section:

(1) The schedule shall contain increments of progress in the form of dates for the commencement and completion of major events leading to the construction and operation of additional pretreatment required for the Industrial User to meet the applicable categorical Pretreatment Standards (e.g. hiring an engineer, completing preliminary plans, completing final plans, executing contract for major components, commencing construction, completing construction, etc.).

(2) No increment referred to in paragraph (c)(1) of this section shall exceed 9 months.

(3) Not later than 14 days following each date in the schedule and the final date for compliance, the Industrial User shall submit a progress report to the Control Authority including, at a minimum, whether or not it complied with the increment of progress to be met on such date and, if not, the date on which it expects to comply with this increment of progress, the reason for delay, and the steps being taken by the Industrial User to return the construction to the schedule established. In no event shall more than 9 months elapse between such progress reports to the Control Authority.

(d) *Report on compliance with categorical pretreatment standard deadline.* Within 90 days following the date for final compliance with applicable categorical Pretreatment Standards or in the case of a New Source following commencement of the introduction of wastewater into the POTW, any Industrial User subject to Pretreatment Standards and Requirements shall submit to the Control Authority a report indicating the nature and concentration of all pollutants in the Discharge from the regulated process which are limited by Pretreatment Standards and Requirements and the average and maximum daily flow for these process

units in the Industrial User which are limited by such Pretreatment Standards and Requirements. The report shall state whether the applicable Pretreatment Standards or Requirements are being met on a consistent basis and, if not, what additional O and M and/or pretreatment is necessary to bring the Industrial User into compliance with the applicable Pretreatment Standards or Requirements. This statement shall be signed by an authorized representative of the Industrial User, as defined in paragraph (k) of this section, and certified to by a qualified professional.

(e) *Periodic reports on continued compliance.* (1) Any Industrial User subject to a categorical Pretreatment Standard, after the compliance date of such Pretreatment Standard, or, in the case of a New Source, after commencement of the discharge into the POTW, shall submit to the Control Authority during the months of June and December, unless required more frequently in the Pretreatment Standard or by the Control Authority or the Approval Authority, a report indicating the nature and concentration of pollutants in the effluent which are limited by such categorical Pretreatment Standards. In addition, this report shall include a record of measured or estimated average and maximum daily flows for the reporting period for the Discharge reported in paragraph (b)(4) of this section except that the Control Authority may require more detailed reporting of flows. At the discretion of the Control Authority and in consideration of such factors as local high or low flow rates, holidays, budget cycles, etc., the Control Authority may agree to alter the months during which the above reports are to be submitted.

(2) Where the Control Authority has imposed mass limitations on Industrial Users as provided for by § 403.6(d), the report required by paragraph (e)(1) of this section shall indicate the mass of pollutants regulated by Pretreatment Standards in the Discharge from the Industrial User.

(f) *Notice of slug loading.* The Industrial User shall notify the POTW immediately of any slug loading, as defined by § 403.5(b)(4), by the Industrial User.

(g) *Monitoring and analysis to demonstrate continued compliance.* The reports required in paragraphs (b)(5), (d), and (e) of this section shall contain the results of sampling and analysis of the Discharge, including the flow and the nature and concentration, or production and mass where requested by the Control Authority, of pollutants contained therein which are limited by the applicable Pretreatment Standards.

The frequency of monitoring shall be prescribed in the applicable Pretreatment Standard. All analyses shall be performed in accordance with procedures established by the Administrator pursuant to section 304(g) of the Act and contained in 40 CFR Part 136 and amendments thereto or with any other test procedures approved by the Administrator. Sampling shall be performed in accordance with the techniques approved by the Administrator. Where 40 CFR Part 136 does not include sampling or analytical techniques for the pollutants in question, or where the Administrator determines that the Part 136 sampling and analytical techniques are inappropriate for the pollutant in question, sampling and analyses shall be performed using validated analytical methods or any other sampling and analytical procedures, including procedures suggested by the POTW or other parties, approved by the Administrator.

(h) *Compliance schedule for POTW's.* The following conditions and reporting requirements shall apply to the compliance schedule for development of an approvable POTW Pretreatment Program required by § 403.8.

(1) The schedule shall contain increments of progress in the form of dates for the commencement and completion of major events leading to the development and implementation of a POTW Pretreatment Program (e.g., acquiring required authorities, developing funding mechanisms, acquiring equipment);

(2) No increment referred to in paragraph (h)(1) of this section shall exceed nine months;

(3) Not later than 14 days following each date in the schedule and the final date for compliance, the POTW shall submit a progress report to the Approval Authority including, as a minimum, whether or not it complied with the increment of progress to be met on such date and, if not, the date on which it expects to comply with this increment of progress, the reason for delay, and the steps taken by the POTW to return to the schedule established. In no event shall more than nine months elapse between such progress reports to the Approval Authority.

(i) *Initial POTW report on compliance with approved removal allowance.* A POTW which has received authorization to modify categorical Pretreatment Standards for pollutants removed by the POTW in accordance with the requirements of § 403.7 must submit to the Approval Authority within 60 days after the effective date of a Pretreatment Standard for which authorization to modify has been approved, a report

which contains the information required by §§ 403.7(d)(2), 403.7(d)(5) and 403.7(d)(6). A minimum of one sample per month during the reporting period is required.

(j) *Periodic reports by POTW to demonstrate continued compliance with removal allowance.* The reports referred to in paragraph (i) of this section will be submitted to the Approval Authority at 6-month intervals beginning with the submission of the initial report referred to in paragraph (i) of this section unless required more frequently by the Approval Authority.

(k) *Signatory requirements for industrial user reports.* The reports required by paragraphs (b), (d), and (e) of this section must be signed by an authorized representative of the Industrial User. An authorized representative may be:

(1) A principal executive officer of at least the level of vice president, if the Industrial User submitting the reports required by paragraphs (b), (d) and (e) of this section is a corporation.

(2) A general partner or proprietor if the Industrial User submitting the report is a partnership or sole proprietorship respectively.

(3) A duly authorized representative of the individual designated in subparagraph (1) or (2) of this paragraph if such representative is responsible for the overall operation of the facility from which the Indirect Discharge originates.

(l) *Signatory requirements for POTW reports.* Reports submitted to the Approval Authority by the POTW in accordance with paragraphs (h), (i) and (j) of this section must be signed by a principal executive officer, ranking elected official or other duly authorized employee if such employee is responsible for overall operation of the POTW.

(m) *Provisions governing fraud and false statements.* The reports required by paragraphs (b), (d), (e), (h), (i) and (j) of this section shall be subject to the provisions of 18 U.S.C. section 1001 relating to fraud and false statements and the provisions of section 309(c)(2) of the Act governing false statements, representations or certifications in reports required under the Act.

(n) *Record-keeping requirements.*

(1) Any Industrial User and POTW subject to the reporting requirements established in this section shall maintain records of all information resulting from any monitoring activities required by this section. Such records shall include for all samples:

(i) The date, exact place, method, and time of sampling and the names of the person or persons taking the samples;

(ii) The dates analyses were performed;

(iii) Who performed the analyses;

(iv) The analytical techniques/methods use; and

(v) The results of such analyses.

(2) Any Industrial User or POTW subject to the reporting requirements established in this section shall be required to retain for a minimum of 3 years any records of monitoring activities and results (whether or not such monitoring activities are required by this section) and shall make such records available for inspection and copying by the Director and the Regional Administrator (and POTW in the case of an Industrial User). This period of retention shall be extended during the course of any unresolved litigation regarding the Industrial User or POTW or when requested by the Director or the Regional Administrator.

(3) Any POTW to which reports are submitted by an Industrial User pursuant to paragraphs (b), (d), and (e) of this section shall retain such reports for a minimum of 3 years and shall make such reports available for inspection and copying by the Director and the Regional Administrator. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Industrial User or the operation of the POTW Pretreatment Program or when requested by the Director or the Regional Administrator.

§ 403.13 Variances from categorical pretreatment standards for fundamentally different factors.

(a) *Definition.* The term "Requester" means an Industrial User or a POTW or other interested person seeking a variance from the limits specified in a categorical Pretreatment Standard.

(b) *Purpose and scope.* In establishing categorical Pretreatment Standards for existing sources, the EPA will take into account all the information it can collect, develop and solicit regarding the factors relevant to pretreatment standards under section 307(b). In some cases, information which may affect these Pretreatment Standards will not be available or, for other reasons, will not be considered during their development. As a result, it may be necessary on a case-by-case basis to adjust the limits in categorical Pretreatment Standards, making them either more or less stringent, as they apply to a certain Industrial User within an industrial category or subcategory. This will only be done if data specific to that Industrial User indicates it presents factors fundamentally different from those considered by EPA in developing

the limit at issue. Any interested person believing that factors relating to an Industrial User are fundamentally different from the factors considered during development of a categorical Pretreatment Standard applicable to that User and further, that the existence of those factors justifies a different discharge limit from that specified in the applicable categorical Pretreatment Standard, may request a fundamentally different factors variance under this section or such a variance request may be initiated by the EPA.

(c) *Criteria.*—(1) *General criteria.* A request for a variance based upon fundamentally different factors shall be approved only if:

(i) There is an applicable categorical Pretreatment Standard which specifically controls the pollutant for which alternative limits have been requested; and

(ii) Factors relating to the discharge controlled by the categorical Pretreatment Standard are fundamentally different from the factors considered by EPA in establishing the Standards; and

(iii) The request for a variance is made in accordance with the procedural requirements in paragraphs (g) and (h) of this section.

(2) *Criteria applicable to less stringent limits.* A variance request for the establishment of limits less stringent than required by the Standard shall be approved only if:

(i) The alternative limit requested is no less stringent than justified by the fundamental difference;

(ii) The alternative limit will not result in a violation of prohibitive discharge standards prescribed by or established under § 403.5;

(iii) The alternative limit will not result in a non-water quality environmental impact (including energy requirements) fundamentally more adverse than the impact considered during development of the Pretreatment Standards; and

(iv) Compliance with the Standards (either by using the technologies upon which the Standards are based or by using other control alternatives) would result in either:

(A) A removal cost (adjusted for inflation) wholly out of proportion to the removal cost considered during development of the Standards; or

(B) A non-water quality environmental impact (including energy requirements) fundamentally more adverse than the impact considered during development of the Standards.

(3) *Criteria applicable to more stringent limits.* A variance request for the establishment of limits more

stringent than required by the Standards shall be approved only if:

(i) The alternative limit request is no more stringent than justified by the fundamental difference; and

(ii) Compliance with the alternative limit would not result in either:

(A) A removal cost (adjusted for inflation) wholly out of proportion to the removal cost considered during development of the Standards; or

(B) A non-water quality environmental impact (including energy requirements) fundamentally more adverse than the impact considered during development of the Standards.

(d) *Factors considered fundamentally different.* Factors which may be considered fundamentally different are:

(1) The nature or quality of pollutants contained in the raw waste load of the User's process wastewater;

(2) The volume of the User's process wastewater and effluent discharged;

(3) Non-water quality environmental impact of control and treatment of the User's raw waste load;

(4) Energy requirements of the application of control and treatment technology;

(5) Age, size, land availability, and configuration as they relate to the User's equipment or facilities; processes employed; process changes; and engineering aspects of the application of control technology;

(6) Cost of compliance with required control technology.

(e) *Factors which will not be considered fundamentally different.* A variance request or portion of such a request under this section may not be granted on any of the following grounds:

(1) The feasibility of installing the required waste treatment equipment within the time the Act allows;

(2) The assertion that the Standards cannot be achieved with the appropriate waste treatment facilities installed, if such assertion is not based on factors listed in paragraph (d) of this section;

(3) The User's ability to pay for the required waste treatment; or

(4) The impact of a Discharge on the quality of the POTW's receiving waters.

(f) *State or local law.* Nothing in this section shall be construed to impair the right of any state or locality under section 510 of the Act to impose more stringent limitations than required by Federal law.

(g) *Application deadline.*

(1) Requests for a variance and supporting information must be submitted in writing to the Director or to the Enforcement Division Director, as appropriate.

(2) In order to be considered, request for variances must be submitted within

180 days after the effective date of the categorical Pretreatment Standard unless the User has requested a categorical determination pursuant to § 403.8(a).

(3) Where the User has requested a categorical determination pursuant to § 403.8(a), the User may elect to await the results of the category determination before submitting a variance request under this section. Where the User so elects, he or she must submit the variance request within 30 days after a final decision has been made on the categorical determination pursuant to § 403.8(a)(4).

(h) *Contents of submission.* Written Submissions for variance request, whether made to the Enforcement Division Director or to the Director must include:

(1) The name and address of the person making the request;

(2) Identification of the interest of the Requester which is affected by the categorical Pretreatment Standard for which the variance is requested;

(3) Identification of the POTW currently receiving the waste from the Industrial User for which alternative discharge limits are requested;

(4) Identification of the categorical Pretreatment Standards which are applicable to the Industrial User;

(5) A list of each pollutant or pollutant parameter for which an alternative discharge limit is sought;

(6) The alternative discharge limits proposed by the Requester for each pollutant or pollutant parameter identified in item (5) of this paragraph;

(7) A description of the Industrial User's existing water pollution control facilities;

(8) A schematic flow representation of the Industrial User's water system including water supply, process wastewater systems, and points of Discharge; and

(9) A Statement of facts clearly establishing why the variance request should be approved, including detailed support data, documentation, and evidence necessary to fully evaluate the merits of the request, e.g., technical and economic data collected by the EPA and used in developing each pollutant discharge limit in the Pretreatment Standard.

(i) *Deficient requests.* The Enforcement Division Director or Director will only act on written requests for variances that contain all of the information required. Persons who have made incomplete Submissions will be notified by the Enforcement Division Director or Director that their requests are deficient and unless the time period is extended, will be given up to 30 days

to correct the deficiency. If the deficiency is not corrected within the time period allowed by the Enforcement Division Director or the Director, the request for a variance shall be denied.

(j) *Public notice.* Upon receipt of a complete request, the Director or Enforcement Division Director will provide notice of receipt, opportunity to review the submission, and opportunity to comment.

(1) The public notice shall be circulated in a manner designed to inform interested and potentially interested persons of the request. Procedures for the circulation of public notice shall include mailing notices to:

(i) The POTW into which the Industrial User requesting the variance discharges;

(ii) Adjoining States whose waters may be affected; and

(iii) Designated 208 planning agencies, Federal and State fish, shellfish and wildlife resource agencies; and to any other person or group who has requested individual notice, including those on appropriate mailing lists.

(2) The public notice shall provide for a period not less than 30 days following the date of the public notice during which time interested persons may review the request and submit their written views on the request.

(3) Following the comment period, the Director or Enforcement Division Director will make a determination on the request taking into consideration any comments received. Notice of this final decision shall be provided to the requestor (and the Industrial User for which the variance is requested if different), the POTW into which the Industrial User discharges and all persons who submitted comments on the request.

(k) *Review of requests by state.* (1) Where the Director finds that fundamentally different factors do not exist, he may deny the request and notify the requester (and Industrial User where they are not the same) and the POTW of the denial.

(2) Where the director finds that fundamentally different factors do exist, he shall forward the request, and a recommendation that the request be approved, to the Enforcement Division Director.

(1) *Review of requests by EPA.* (1) Where the Enforcement Division Director finds that fundamentally different factors do not exist, he shall deny the request for a variance and send a copy of his determination to the Director, to the POTW, and to the Requester (and to the Industrial User, where they are not the same).

(2) Where the Enforcement Division Director finds that fundamentally different factors do exist, and that a partial or full variance is justified, he will approve the variance. In approving the variance, the Enforcement Division Director will:

(i) Prepare recommended alternative discharge limits for the Industrial User either more or less stringent than those prescribed by the applicable categorical Pretreatment Standard to the extent warranted by the demonstrated fundamentally different factors;

(ii) Provide the following information in his written determination:

(A) the recommended alternative discharge limits for the Industrial User concerned;

(B) the rationale for the adjustment of the Pretreatment Standard (including the Enforcement Division Director's reasons for recommending that a fundamentally different factor variance be granted) and an explanation of how the Enforcement Division Director's recommended alternative discharge limits were derived;

(C) the supporting evidence submitted to the Enforcement Division Director; and

(D) other information considered by the Enforcement Division Director in developing the recommended alternative discharge limits;

(iii) Notify the Director and the POTW of his or her determination; and

(iv) Send the information described in paragraphs (1)(2) (i) and (ii) above to the Requestor (and to the Industrial User where they are not the same).

(m) *Request for hearing.* (1) Within 30 days following the date of receipt of notice of the Enforcement Division Director's decision on a variance request, the Requester or any other interested person may submit a petition to the Regional Administrator for a hearing to reconsider or contest the decision. If such a request is submitted by a person other than the Industrial User the person shall simultaneously serve a copy of the request on the Industrial User.

(2) If the Regional Administrator declines to hold a hearing and the Regional Administrator affirms the Enforcement Division Director's findings, the Requester may submit a petition for a hearing to the Administrator within 30 days of the Regional Administrator's decision.

§ 403.14 Confidentiality.

(a) *EPA authorities.* In accordance with 40 CFR Part 2, any information submitted to EPA pursuant to these regulations may be claimed as confidential by the submitter. Any such

claim must be asserted at the time of submission in the manner prescribed on the application form or instructions, or, in the case of other submissions, by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR Part 2 (Public Information):

(b) *Effluent data.* Information and data provided to the Control Authority pursuant to this part which is effluent data shall be available to the public without restriction.

(c) *State or POTW.* All other information which is submitted to the State or POTW shall be available to the public at least to the extent provided by 40 CFR § 2.302.

§ 403.15 Net/Gross calculation.

Categorical Pretreatment Standards may be adjusted to reflect the presence of pollutants in the Industrial Users' intake water in accordance with the provisions of paragraph (a)-(d) below:

(a) *Application deadline and contents.* Any Industrial User wishing to obtain a credit for intake pollutants must make application therefore within 60 days after the effective date of the applicable categorical Pretreatment Standard. Application shall be made to the appropriate Enforcement Division Director. Upon request of the Industrial User, the applicable Standard will be calculated on a "net" basis, i.e., adjusted to reflect credit for pollutants in the intake water, if the User demonstrates that:

(1) Its intake water is drawn from the same body of water into which the discharge from its publicly owned treatment works is made;

(2) The pollutants present in the intake water will not be entirely removed by the treatment system operated by the User;

(3) The pollutants in the intake water do not vary chemically or biologically from the pollutants limited by the applicable Standards; and

(4) The User does not significantly increase concentrations of pollutants in the intake water, even if the total amount of pollutants remains the same.

(b) *Criteria.* Standards adjusted under this paragraph shall be calculated on the basis of the amount of pollutants present after any treatment steps have been performed on the intake water by or for the Industrial User. Adjustments under this section shall be given only to the extent that pollutants in the intake

water which are limited by the Standard are not removed by the treatment technology employed by the User.

(c) *Notice.* The User shall notify the Regional Enforcement Officer if there are any significant changes in the quantity of the pollutants in the intake water or in the level of treatment provided.

(d) *EPA decision.* The Enforcement Division Director shall require the User to conduct additional monitoring (i.e., for flow and concentration of pollutants) as necessary to determine continued eligibility for and compliance with any adjustments. The Enforcement Division Director shall consider all timely applications for credits for intake pollutants plus any additional evidence that may have been submitted in response to the EPA's request. The Enforcement Division Director shall then make a written determination of the applicable credit(s), if any, state the reasons for its determination, state what additional monitoring is necessary, and send a copy of said determination to the applicant and the applicant's POTW. The decision of the Enforcement Division Director shall be final.

§ 403.16 Upset provision.

(a) *Definition.* For the purposes of this section, "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with categorical Pretreatment Standards because of factors beyond the reasonable control of the Industrial User. An Upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

(b) *Effect of an upset.* An Upset shall constitute an affirmative defense to an action brought for noncompliance with categorical Pretreatment Standards if the requirements of paragraph (c) are met.

(c) *Conditions necessary for a demonstration of upset.* An Industrial User who wishes to establish the affirmative defense of Upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An Upset occurred and the Industrial User can identify the specific cause(s) of the Upset;

(2) The facility was at the time being operated in a prudent and workman-like manner and in compliance with applicable operation and maintenance procedures;

(3) The Industrial User has submitted the following information to the POTW

and Control Authority within 24 hours of becoming aware of the Upset (if this information is provided orally, a written submission must be provided within five days):

(i) A description of the Indirect Discharge and cause of noncompliance;

(ii) The period of noncompliance, including exact dates and times or, if not corrected, the anticipated time the noncompliance is expected to continue;

(iii) Steps being taken and/or planned to reduce, eliminate and prevent recurrence of the noncompliance.

(d) *Burden of proof.* In any enforcement proceeding the Industrial User seeking to establish the occurrence of an Upset shall have the burden of proof.

(e) *Reviewability of agency consideration of claims of upset.* In the usual exercise of prosecutorial discretion, Agency enforcement personnel should review any claims that non-compliance was caused by an Upset. No determinations made in the course of the review constitute final Agency action subject to judicial review. Industrial Users will have the opportunity for a judicial determination on any claim of Upset only in an enforcement action brought for noncompliance with categorical Pretreatment Standards.

(f) *User responsibility in case of upset.* The Industrial User shall control production or all Discharges to the extent necessary to maintain compliance with categorical Pretreatment Standards upon reduction, loss, or failure of its treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost or fails.

Appendix A—United States Environmental Protection Agency

December 16, 1975.

Program Guidance Memorandum—61

Subject: Grants for Treatment and Control of Combined Sewer Overflows and Stormwater Discharges.

From: John T. Rhett, Deputy Assistant Administrator for Water Program Operations (WH-546).

To: Regional Administrators, Regions I-X.

This memorandum summarizes the Agency's policy on the use of construction grants for treatment and control of combined sewer overflows and stormwater discharges during wet-weather conditions. The purpose is to assure that projects are funded only when careful planning has demonstrated they are cost-effective.

I. Combined Sewer Overflows**A. Background**

The costs and benefits of control of various portions of pollution due to combined sewer overflows and by-passes vary greatly with the characteristics of the sewer and treatment system, the duration, intensity, frequency and areal extent of precipitation, the type and extent of development in the service area, and the characteristics, uses and water quality standards of the receiving waters. Decisions on grants for control of combined sewer overflows, therefore, must be made on a case-by-case basis after detailed planning at the local level.

Where detailed planning has been completed, treatment or control of pollution from wet-weather overflows and bypasses may be given priority for construction grant funds only after provision has been made for secondary treatment of dry-weather flows in the area. The detailed planning requirements and criteria for project approval follow.

B. Planning Requirements

Construction grants may be approved for control of pollution from combined sewer overflows only if planning for the project was thoroughly analyzed for the 20 year planning period:

1. Alternative control techniques which might be utilized to attain various levels of pollution control (related to alternative beneficial uses, if appropriate), including at least initial consideration of all the alternatives described in the section on "Combined Sewer and Stormwater Control in Alternative Waste Management Techniques and Best Practicable Waste Treatment" (Section C of Chapter III of the information proposed for comment in March 1974).
2. The costs of achieving the various levels of pollution control by each of the techniques appearing to be the most feasible and cost-effective after the preliminary analysis.
3. The benefits to the receiving waters of a range of levels of pollution control during wet-weather conditions. This analysis will normally be conducted as part of State water quality management planning, 208 areawide management planning, or other State, regional or local planning effort.
4. The costs and benefits of addition of advanced waste treatment processes to dry-weather flows in the area.

C. Criteria for Project Approval

The final alternative selected shall meet the following criteria:

1. The analysis required above has demonstrated that the level of pollution control provided will be necessary to protect a beneficial use of the receiving water even after technology based standards required by Section 301 of P.L. 92-500 are achieved by industrial point sources and at least secondary treatment is achieved for dry-weather municipal flows in the area.
2. Provision has already been made for funding of secondary treatment of dry-weather flows in the area.
3. The pollution control technique proposed for combined sewer overflow is a more cost-effective means of protecting the beneficial use of the receiving waters than other combined sewer pollution control techniques

and the addition of treatment higher than secondary treatment for dry-weather municipal flows in the area.

4. The marginal costs are not substantial compared to marginal benefits.

Marginal costs and benefits for each alternative may be displayed graphically to assist with determining a project's acceptability under this criterion. Dollar costs should be compared with quantified pollution reduction and water quality improvements. A descriptive narrative should also be included analyzing monetary, social and environmental costs compared to benefits, particularly the significance of the beneficial uses to be protected by the project.

II. Stormwater Discharges

Approaches for reducing pollution from separate stormwater discharges are now in the early stages of development and evaluation. We anticipate, however, that in many cases the benefits obtained by construction of treatment works for this purpose will be small compared with the costs, and other techniques of control and prevention will be more cost-effective. The policy of the Agency is, therefore, that construction grants shall not be used for construction of treatment works to control pollution from separate discharges of stormwater except under unusual conditions where the project clearly has been demonstrated to meet the planning requirements and criteria described above for combined sewer overflows.

III. Multi-purpose Projects

Projects with multiple purposes, such as flood control and recreation in addition to pollution control, may be eligible for an amount not to exceed the cost of the most cost-effective single purpose pollution abatement system. Normally the Separable Costs-Remaining Benefits (SCRB) method should be used to allocate costs between pollution control and other purposes, although in unusual cases another method may be appropriate. For such cost allocation, the cost of the least cost pollution abatement alternative may be used as a substitute measure of the benefits for that purpose. The method is described in "Proposed Practices for Economic Analysis of River Basin Projects," GPO, Washington, D.C., 1958, and "Efficiency in Government through Systems Analysis," by Roland N. McKean, John Wiley & Sons, Inc., 1958.

Enlargement of or otherwise adding to combined sewer conveyance systems is one means of reducing or eliminating flooding caused by wet-weather conditions. These additions may be designed so as to produce some benefits in terms of reduced discharge of pollutants to surrounding waterways. The pollution control benefits of such flood control measures, however, are likely to be small compared with the costs, and the measures therefore would normally be ineligible for funding under the construction grants program.

All multi-purpose projects where less than 100% of the costs are eligible for construction grants under this policy shall contain a special grant condition precluding EPA funding of non-pollution control elements.

This condition should, as a minimum, contain a provision similar to the following:

"The grantee explicitly acknowledges and agrees that costs are allowable only to the extent they are incurred for the water pollution control elements of this project."

Additional special conditions should be included as appropriate to assure that the grantee clearly understands which elements of the project are eligible for construction grants under Public Law 92-500.

Appendix B—65 Toxic Pollutants

Acenaphthene
Acrolein
Acrylonitrile
Aldrin/Dieldrin
Antimony and compounds¹
Arsenic and compounds
Asbestos
Benzene
Benzidine
Beryllium and compounds
Cadmium and compounds
Carbon tetrachloride
Chlordane (technical mixture and metabolites)
Chlorinated benzenes (other than dichlorobenzenes)
Chlorinated ethanes (including 1,2-dichloroethane, 1,1,1-trichloroethane, and hexachloroethane)
Chloroalkyl ethers (chloromethyl, chloroethyl, and mixed ethers)
Chlorinated naphthalene
Chlorinated phenols (other than those listed elsewhere; includes trichlorophenols and chlorinated cresols)
Chloroform
2-chlorophenol
Chromium and compounds
Copper and compounds
Cyanides
DDT and metabolites
Dichlorobenzenes (1,2-, 1,3-, and 1,4-dichlorobenzenes)
Dichlorobenzidine
Dichloroethylenes (1,1- and 1,2-dichloroethylene)
2,4-dichlorophenol
Dichloropropane and dichloropropene
2,4-dimethylphenol
Dinitrotoluene
Diphenylhydrazine
Endosulfan and metabolites
Endrin and metabolites
Ethylbenzene
Fluoroanthene
Haloethers (other than those listed elsewhere; includes chlorophenylphenyl ethers, bromophenylphenyl ether, bis(dichloroisopropyl) ether, bis(chloroethoxy) methane and polychlorinated diphenyl ethers)
Halomethanes (other than those listed elsewhere; includes methylene chloromethyl-chloride, methylbromide, bromoform, dichlorobromomethane, trichlorofluoromethane, dichlorodifluoromethane)
Heptachlor and metabolites
Hexachlorobutadiene

¹ As used throughout this Appendix B the term "compounds" shall include organic and inorganic compounds.

Hexachlorocyclohexane (all isomers)
 Hexachlorocyclopentadiene
 Isophorone
 Lead and compounds
 Mercury and compounds
 Naphthalene
 Nickel and compounds
 Nitrobenzene
 Nitrophenols (Including 2,4-dinitrophenol, dinitroresol)
 Nitrosamines
 Pentachlorophenol
 Phenol
 Phthalate esters
 Polychlorinated biphenyls (PCBs)
 Polynuclear aromatic hydrocarbons (including benzantracenes, benzopyrenes, benzofluoranthene, chrysenes, dibenzanthracenes, and indenopyrenes)
 Selenium and compounds
 Silver and compounds
 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
 Tetrachloroethylene
 Thallium and compounds
 Toluene
 Toxaphene
 Trichloroethylene
 Vinyl chloride
 Zinc and compounds

Appendix C—34 Industrial Categories

Adhesives and Sealants
 Aluminum Forming
 Auto and Other Laundries
 Battery Manufacturing
 Coal Mining
 Coil Coating
 Copper Forming
 Electrical and Electronic Components
 Electroplating
 Explosives Manufacturing
 Foundries
 Gum and Wood Chemicals
 Inorganic Chemicals Manufacturing
 Iron and Steel Manufacturing
 Leather Tanning and Finishing
 Mechanical Products Manufacturing
 Nonferrous Metals Manufacturing
 Ore Mining
 Organic Chemicals Manufacturing
 Paint and Ink Formulation
 Pesticides
 Petroleum Refining
 Pharmaceutical Preparations
 Photographic Equipment and Supplies
 Plastics Processing
 Plastic and Synthetic Materials Manufacturing
 Porcelain Enameling
 Printing and Publishing
 Pulp and Paper Mills
 Rubber Processing
 Soap and Detergent Manufacturing
 Steam Electric Power Plants
 Textile Mills
 Timber Products Processing

Appendix D—Selected Industrial Subcategories Exempted From Regulation Pursuant of Paragraph 8 of the NRDC v. Costle Consent Decree

The following industrial subcategories have been excluded from further rulemaking pursuant to paragraph 8 of the *Natural Resources Defense Council v. Costle Consent*

Decree for one or more of the following reasons: (1) the pollutants of concern are not detectable in the effluent from the industrial user (paragraph 8(a)(iii)); (2) the pollutants of concern are present only in trace amounts and are neither causing nor likely to cause toxic effects (paragraph 8(a)(iii)); (3) the pollutants of concern are present in amounts too small to be effectively reduced by technologies known to the Administrator (paragraph 8(a)(iii)); or (4) the wastestream contains only pollutants which are compatible with the POTW (paragraph 8(b)(i)). In some instances, different rationale were given for exclusion under paragraph 8. However, EPA has reviewed these subcategories and has determined that exclusion could have occurred due to one of the four reasons listed above.

This list includes all subcategories that have been excluded for the above-listed reasons as of [date of publication in the Federal Register]. This list will be updated periodically for the convenience of the reader.

Auto and Other Laundries Industry

- Carpet Cleaners
- Coin Operated Laundries
- Diaper Services
- Dry Cleaners
- Power Laundries

Battery Manufacturing Industry

- Carbon Zinc Air Cell Batteries
- Lithium Batteries
- Magnesium Carbon Batteries
- Magnesium Cell Batteries
- Miniature Alkaline Batteries
- Nickel Zinc Batteries

Electrical and Electronic Components

- Carbon and Graphite Products
- Fixed Capacitors
- Fluorescent Lamps
- Incandescent Lamps
- Magnetic Coatings
- Mica Paper

Electroplating

- Alkaline Cleaning
- Bright Dipping
- Chemical Machining
- Galvanizing
- Immersion Plating
- Iridite Dipping
- Pickling

Explosives Industry

- Military Explosive Manufacturing

Foundries Industry

- Nickel Casting
- Tin Casting
- Titanium Casting

Gum and Wood Chemicals

- Char and Charcoal Briquets
- Gum Resin, Turpentine and Essential Oils

Iron and Steel Industry

- Basic Oxygen Furnace (Semiwet)
- Beehive Coke Process
- Electric Arc Furnace (Semiwet)

Inorganic Chemicals Manufacturing Industry

- Aluminum Sulfate

- Ammonium Chloride
- Ammonium Hydroxide
- Barium Carbonate
- Borax
- Boric Acid
- Bromine
- Calcium Carbide
- Calcium Carbonate
- Calcium Chloride
- Calcium Hydroxide
- Calcium Oxide
- Carbon Dioxide
- Carbon Monoxide
- Chromic Acid
- Cuprous Oxide
- Ferric Chloride
- Ferrous Sulfate
- Fluorine
- Hydrogen
- Hydrochloric Acid
- Hydrogen Peroxide
- Iodine
- Lead Monoxide
- Lithium Carbonate
- Manganese Sulfate
- Nitric Acid

- Oxygen and Nitrogen
- Potassium Chloride
- Potassium Dichromate
- Potassium Iodide
- Potassium Metal
- Potassium Permanganate
- Potassium Sulfate
- Sodium Bicarbonate
- Sodium Carbonate
- Sodium Chloride
- Sodium Fluoride
- Sodium Hydrosulfide
- Sodium Metal
- Sodium Silicate
- Sodium Sulfite
- Sodium Thiosulfate
- Stannic Oxide
- Sulfur Dioxide
- Sulfuric Acid
- Zinc Oxide
- Zinc Sulfate

Leather Industries

- Gloves
- Luggage
- Shoes and Related Footwear
- Personal Goods

Non Ferrous Metals Industry

- Primary Arsenic
- Primary Antimony
- Secondary Babbitt
- Primary Barium
- Secondary Beryllium
- Primary Bismuth
- Primary Boron
- Secondary Boron
- Bauxite
- Secondary Cadmium
- Primary Calcium
- Primary Cesium
- Primary Chromium
- Primary Cobalt
- Secondary Cobalt
- Secondary Columbium
- Primary Gallium
- Primary Germanium
- Primary Gold
- Secondary Precious Metals
- Primary Hafnium

- Primary and Secondary Indium
- Primary Lithium
- Primary Manganese
- Primary Magnesium
- Secondary Magnesium
- Primary Mercury
- Secondary Mercury
- Primary Molybdenum
- Secondary Molybdenum
- Primary Nickel
- Secondary Nickel
- Secondary Plutonium
- Primary Potassium
- Primary Rare Earths
- Primary Rhenium
- Secondary Rhenium
- Primary Rubidium
- Primary Platinum Group
- Primary Silicon
- Primary Sodium
- Secondary Tantalum
- Primary Tin
- Secondary Tin
- Primary Titanium
- Secondary Titanium
- Secondary Tungsten
- Primary Uranium
- Secondary Uranium
- Secondary Zinc
- Primary Zirconium

Paint and Ink Industry

- Solvent Base Process
- Solvent Wash Process

Paving and Roofing Industry

- Asphalt Concrete
- Asphalt Emulsion
- Linoleum
- Printed Asphalt Felt
- Roofing

Pulp, Paper, Paperboard, and Converted Paper Industry

- Converted Paper Industry

Rubber Processing Industry

- Latex-Dipped, Latex-Extruded, and Latex Molded Goods
- Latex Foam
- Small-sized General Molded, Extruded and Fabricated Rubber Plants
- Medium-sized General Molded, Extruded and Fabricated Rubber Plants
- Large-sized General Molded, Extruded and Fabricated Rubber Plants
- Synthetic Crumb Rubber Production—Emulsion Polymerization
- Synthetic Crumb Rubber Production—Solution Polymerization
- Synthetic Latex Rubber Production
- Tire & Inner Tube Production

Textile Industry

- Apparel Manufacturing
- Cordage and Twine
- Low Water Use Processing (Greige Mills)
- Padding and Upholstery Filling

Timber Products Processing

- Barking Process
- Finishing Processes
- Hardboard—Dry Process
- Log Washing
- Particleboard
- Planing Mills
- Sawmills

- Veneer
- Wet Storage
- Wood Preserving (Inorganics) Process

PART 125—CRITERIA AND STANDARDS FOR THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Subpart D—Criteria and Standards for Determining Fundamentally Different Factors Under Sections 301(b)(1)(A), 301(b)(2)(A) and (E) AND 307(b) OF THE ACT

2. 40 CFR Part 125 subpart D is amended by deleting "and 307(b)" from the title of the subpart.

3. 40 CFR § 125.30 is amended to read as follows:

§ 125.30 Purpose and scope.

(a) This subpart establishes the criteria and standards to be used in determining whether effluent limitations alternative to those required by promulgated EPA effluent limitations guidelines under sections 301 and 304 of the Act (hereinafter referred to as "national limits") should be imposed on a discharger because factors relating to the discharger's facilities, equipment, processes or other factors related to the discharger are fundamentally different from the factors considered by EPA in development of the national limits. This subpart applies to all national limits promulgated under sections 301 and 304 of the Act, except for those contained in 40 CFR Part 423 (steam electric generating point source category).

(b) In establishing national limits, EPA takes into account all the information it can collect, develop and solicit regarding the factors listed in sections 304(b) and 304(g) of the Act.

(FR Doc. 81-1221 Filed 1-27-81; 8:45 am)
BILLING CODE 6560-33-M

APPENDIX C: POTWs With Pretreatment Programs

REVISED 9/30/85

CALIFORNIA

69 Programs > 5 MGD

100 PROGRAMS REQUIRED
100 @ PROGRAMS

NPDES NO.	AUTHORITY NAME	FACILITY NAME	CITY NAME	DISCHARGE FLOW (MGD)	INDUSTRIAL FLOW (MGD)	PROGRAM APP	STATUS MO/YR
*CA0038091	BENICIA, CITY OF	BENICIA WWTF	BENICIA	3.00	neg.	@	8/81
*CA0055531	BURBANK, CITY OF	BURBANK WWTF	BURBANK	9.00+	1.05	@	7/82
*CA0053597	CAMARILLO S.D.	CAMARILLO WWTF	CAMARILLO	6.75+	0.15	@	3/83
*CA0038628	CENTRAL MARIN S.A.	CENTRAL MARIN	SAN RAFAEL	10.00+	neg.	@	6/83
*CA0037648	CENTRAL CONTRA COSTA	CENTRAL CONTRA COSTA	MARTINEZ	35.00+	0.79	@	9/82
*CA0105279	CHINO BASIN MMN WD	CHINO BASIN REG TP#1	ONTARIO	24.50+	3.58	@	5/83
*CA	CHINO CITY		CHINO			@	5/83
*CA0037940	CONTRA COSTA COUNTY	7-A	W. PITTSBURG	9.50+	0.41	@	7/82
*CA0110604	CO SAN DIST OF ORAN	OCSO STP NO 2	FOUNTAIN VAL.	227.00+	31.80	@	1/84
*CA	CUCAMONGA WT. DIST.		CUCAMONGA			@	5/83
*CA0022756	CRESCENT CITY	CRESCENT CITY WWTF	CRESCENT CITY	1.96	0.04	@	7/82
*CA0079049	DAVIS, CITY OF	DAVIS WWTF	DAVIS	5.00	0.00	@	3/83
*CA0037613	DUBLIN-SAN RAMON SD	DUBLIN-SAN RAMON WWT	PLEASANTON	9.00+	0.02	@	6/83
*CA	EASTERN MUNICIPAL W	HEMET-SAN JACINTO WW	SAN JACINTO	3.50		@	8/83
*CA0037702	EAST BAY MUD	EAST BAY MUD WWTF	OAKLAND	128.00+	10.00	@	6/83
*CA0079171	EAST YOLO COMM SERV	WEST SACRAMENTO WWTF	W. SACRAMENTO	8.00+	0.65	@	5/83
*CA0107981	ESCONDIDO, CITY OF	HALE AVENUE WWTF	ESCONDIDO	16.50+	0.81	@	3/83
*CA0107395	ENCINA JT SEWERAGE	ENCINA JOINT POWERS	CARLSBAD	13.75+	0.83	@	7/83
*CA0023418	EUREKA	HILL STREET WWTF	EUREKA	1.09	0.00	@	1/83
*CA0038377	FAIRFIELD-SUISUN SD	FAIRFIELD SUISUN WWT	FAIRFIELD	15.58+	2.08	@	8/82
*CA	FONTANA, CITY OF		FONTANA			@	5/83
*CA	FRESNO, CITY OF	FRESNO WWTF	FRESNO	37.90+	2.30	@	6/83
*CA	GILROY, CITY OF	GILROY WWTF	GILROY	0.09		@	9/83
*CA0048160	GOLETA SANITARY DIS	GOLETA WWTF	GOLETA	10.50+	0.04	@	7/83
*CA0037656	HAYWARD, CITY OF	HAYWARD WWTF	HAYWARD	21.50+	8.00	@	8/81
*CA0105970	IRVINE RANCH WATER	MICHAELSON WWTF	IRVINE	4.00	0.00	@	3/83
*CA	JURUPA CO. SAN.		RIVERSIDE			@	5/83
*CA0109991	LA CITY PUB WRKS	HYPERION WWTF	LOS ANGELES	352.30+	32.00	@	6/83
CA0053953	LA CITY PUB WRKS	L.A. GLENDALE WWJP	LOS ANGELES	20.00	2.00		
CA0053856	LA CITY PUB WRKS	TERMINAL ISLAND WWTF	SAN PEDRO	30.00	8.00		
*CA0053813	LA COUNTY S.D.	JWPCP	CARSON	385.00+	96.25	@	3/85
*CA0056014	LAS VIRGENES MUNWD	TAPIA WWTF	CALABASAS	8.00+	0.30	@	6/82

CALIFORNIA (Continued)

NPDES NO.	AUTHORITY NAME	FACILITY NAME	CITY NAME	DISCHARGE FLOW (MGD)	INDUSTRIAL FLOW (MGD)	PROGRAM APP	STATUS MO/YR
*CA0038008	LIVERMORE, CITY OF	LIVERMORE WWTF	LIVERMORE	6.25+	0.55	@	8/83
*CA0079243	LODI CITY OF	WHITE SLOUGH WWTF	LODI	5.80+	0.86	@	3/83
*CA0048127	LOMPOC, CITY OF	LOMPOC WWTF	LOMPOC	5.00	0.08	@	7/83
*CA	MADERA, CITY OF	MADERA STP	MADERA		0.03	@	9/83
*CA0079219	MERCED, CITY OF	MERCED STP	MERCED	9.20+	0.43	@	3/83
*CA0079103	MODESTO, CITY OF	MODESTO WWTF	MODESTO	45.00+	10.00	@	3/83
*CA0048551	MONTEREY REGIONAL MONTCLAIR	MONTEREY REG. WWTF	PACIFIC GROVE	16.30+	2.80	@	5/83
*CA0037575	NAPA S.D.	NAPA SANIT. DIST WWT	MONTCLAIR			@	5/83
*CA0079472	NAPASANIT. DIST WWT	NAPA SANIT. DIST WWT	NAPA	15.40+	0.30	@	5/83
*CA0037737	NEWMAN, CITY OF	NEWMAN WWTF	NEWMAN	0.85	0.00	@	4/83
	N. SAN MATEO CO SAN	DALY CITY WWTF	DALY CITY	5.40+	0.05	@	6/83
*CA0037958	NOVATO S.D.	NOVATO WWTF (MAIN)	NOVATO	4.53	neg.	@	9/82
*CA0053961	OAK VIEW	OAK VIEW WWTF	VENTURA	3.00	0.20	@	5/83
*CA0107433	OCEANSIDE, CITY OF	LA SALINA WWTF	OCEANSIDE	15.10+	0.32	@	12/82
*CA0039591	ORO-LOMA SAN DIST	ORO LOMA WWTF	SAN LORENZO	20.00+	0.80	@	8/82
*CA0037834	PALO ALTO, CITY OF	PALO ALTO WWTF	PALO ALTO	35.00+	6.00	@	7/82
*CA0037810	PETALUMA, CITY OF	PETALUMA WWTF	PETALUMA	2.64	0.60	@	6/83
*CA0079731	REDDING, CITY OF	REDDING REG WWTF	REDDING	8.80+	0.00	@	2/83
*CA0105759	REDLANDS, CITY OF	REDLANDS WWTF	REDLANDS	6.00+	0.00	@	5/83
*CA0105295	RIALTO, CITY OF	RIALTO WWTF	RIALTO	6.00+	0.20	@	1/83
*CA0037729	RICHMOND MUNICIPAL	RICHMOND WWTF	RICHMOND	16.00+	1.00	@	4/82
*CA0105350	RIVERSIDE, CITY OF	RIVERSIDE CITY WWTF	RIVERSIDE	21.75+	3.00	@	5/83
CA	RIVERBANK, CITY OF	RIVERBANK WWTF	RIVERBANK	7.60	7.00		
*CA0079502	ROSEVILLE, CITY OF	ROSEVILLE WWTF	ROSEVILLE	11.50+	0.25	@	1/84
*CA	RUBIDUX COMM. SD		RUBIDUX			@	5/83
*CA0079111	SACRAMENTO REG CSD	SACTO REG WWTF	SACRAMENTO	150.00+	11.50	@	1/83
*CA0048101	SALINAS, CITY OF	SALINAS IND WWTF	SALINAS	6.00+	2.71	@	5/83
*CA0105392	SAN BERNARDINO, CITY	SAN BERNARDINO WWTF	SAN BERNARDINO	28.00+	1.50	@	8/83
*CA0053651	SAN BUENA VENTURA	VENTURA WWTF	VENTURA	14.00+	0.25	@	6/82
*CA0107409	SAN DIEGO, CITY OF	PT LOMA WWTF	SAN DIEGO	116.89+	8.40	@	6/82
*CA0107999	SAN DIEGO, COUNTY	SAN ELIJO JP REG SEW	SAN DIEGO	3.70	0.00	@	6/82
*CA0038610	SAN FRANCISCO, CITY	N. POINT & SOUTHEAST	SAN FRANCISCO	85.00+	neg.	@	1/83

NPDES NO.	AUTHORITY NAME	FACILITY NAME	CITY NAME	DISCHARGE FLOW (MGD)	INDUSTRIAL FLOW (MGD)	PROGRAM STATUS	
						APP	MO/YR
*CA0037842	SAN JOSE, CITY OF	SAN JOSE/SANTA CLARA	SAN JOSE	160.00+	40.00	@	1/83
*CA0037745	SAN LEANDRO, CITY	SAN LEANDRO WWTF	SAN LEANDRO	11.00+	3.10	@	4/82
*CA0049224	SAN LUIS OBISPO	SAN LUIS OBISPO WWTF	SAN LUIS OBISPO	5.10+	0.50	@	5/83
*CA0037541	SAN MATEO, CITY OF	SAN MATEO WWTF	SAN MATEO	13.60+	0.00	@	9/83
*CA0048143	SANTA BARBARA, CITY	SANTA BARBARA WWTF	SANTA BARBARA	11.00+	0.19	@	3/83
*CA0048194	SANTA CRUZ, CITY OF	SANTA CRUZ WWTF	SANTA CRUZ	21.00+	1.20	@	10/83
*CA0048275	SANTA MARIA, CITY	PUBLIC AIRPORT WWTF	SANTA MARIA	2.90	1.50	@	7/83
*CA0022764	SANTA ROSA	LAGUNA WWTF	SANTA ROSA	15.00+	0.75	@	6/83
A	SELMA-KINGS.-FLOWER		KINGSBURG			@	6/83
*CA0037711	SO. MARIN SA	SO.MARIN WWTF	MILL VALLEY	2.90	0.00	@	6/83
*CA0055221	SIMI VALLEY COUNTY	SIMI VALLEY WWTF	SIMI VALLEY	9.10+	0.38	@	6/82
*CA0107417	SO EAST REG REC AUT	SERRA REG WWTF	DANA POINT	17.80+	0.03	@	2/83
*CA0038130	SO SAN FRAN DPT PUB	SO SF-SAN BRUNO WWTF	SO.SAN FRAN.	13.00+	1.70	@	2/83
*CA0102709	SOUTH TAHOE PUD	SOUTH TAHOE WWTF	SO.LAKE TAHOE	7.00+	0.00	@	6/82
*CA0079138	STOCKTON DEPT OF PU	STOCKTON REG. WWTF	STOCKTON	67.00+	8.00	@	6/82
*CA0037621	SUNNYVALE, CITY OF	SUNNYVALE WWTF	SUNNYVALE	21.38+	10.30	@	6/82
*CA0078948	TURLOCK, CITY OF	TURLOCK WWTF	TURLOCK	12.75+	8.10	@	9/82
*CA0079154	TRACY, CITY OF	TRACY WWTF	TRACY	5.50+	1.60	@	3/83
*CA0056294	THOUSAND OAKS DPT	HILL CANYON WWTF	CAMARILLO	10.00+	0.20	@	6/82
*CA0037591	UNION SANITARY DIST	ALVARADO #3 WWTF	UNION CITY	4.50	0.61	@	9/81
*CA	UPLAND, CITY OF		UPLAND			@	5/83
*CA0077691	VACAVILLE DEPT OF P	EASTERLY WWTF	ELMIRA	10.00+	0.33	@	3/83
*A0037699	VALLEJO SAN & FC DI	VSTED WWTF & RECL	VALLEJO	12.50+	0.20	@	7/82
*CA	VENTURA RCSD		FILLMORE	+		@	6/82
CA0054097	OXNARD, CITY OF	OXNARD WWTF	OXNARD	22.50	2.55		
*CA0079189	VISALIA, CITY OF	VISALIA WWTF	VISALIA	7.70+	1.57	@	5/83
*CA0048216	WATSONVILLE, CITY	WATSONVILLE WWTF	WATSONVILLE	13.40+	3.00	@	5/83
*CA0037974	WEST CONTRA COSTA	WCCSD WWTF	SAN PABLO	12.50+	0.65	@	4/82
*CA0077950	WOODLAND, CITY OF	WOODLAND WWTF	WOODLAND	4.00		@	8/83
*CA0079260	YUBA CITY, CITY OF	YUBA CITY WWTF	YUBA CITY	7.00+	1.60	@	7/82
*CA0107611	ALISO WAT MANAGEMNT	AWNA COASTAL WWTF	SOUTH LAGUNA	2.50	0.00	@	2/83
*CA	BAKERSFIELD, CITY	BAKERSFIELD WWTF #2	BAKERSFIELD	15.00+	0.77	@	9/85
*CA0037788	BURLINGAME, CITY OF	BURLINGAME WWTF	BURLINGAME	5.50+	0.50	@	1/84

CALIFORNIA (Continued)

NPDES NO.	AUTHORITY NAME	FACILITY NAME	CITY NAME	DISCHARGE FLOW (MGD)	INDUSTRIAL FLOW (MGD)	PROGRAM STATUS APP MO/YR
*CA0105236	COLTON, CITY OF	COLTON WWTF	COLTON	5.40+	0.70	@ 6/85
*CA0105848	CORONA, CITY OF	CORONA WWTF	CORONA	5.50+	0.43	@ 3/85
*CA0037532	MILLBRAE, CITY OF	MILLBRAE WWTF	MILLBRAE	3.00	0.05	@ 1/84
*CA	SAN BERNARDINO CO.					@ 9/85
*CA0038369	SOUTH BAYSIDE SYS A	S BAYSIDE WWTF	REDWOOD CITY	26.00+	2.70	@ 6/85
*CA	ONTARIO, CITY OF		ONTARIO			@ 7/83
*CA0059021	VENTURA R.C.S.D.	FILLMORE WWTF	FILLMORE	1.33	0.00	@ 9/83
DELETIONS:						
*CA	BACKSVILLE					
*CA0104426	EL CENTRO, CITY OF	EL CENTRO WWTF	EL CENTRO	5.00		
*CA0078905	REDDING, CITY OF	ENTERPRISES WWTF	REDDING	1.00		
*CA	MOUNT VERNON CO. SA	MOUNT VERNON WWTF				
*CA	VENECIA					
*CA	CLARK CO.					
*CA	SAN FRAN AIRPORT					
*CA	PORTERVILLE, CITY OF		PORTERVILLE			

APPENDIX D: Trihalomethane Formation

APPENDIX D. TRIHALOMETHANE FORMATION

General

Trihalomethanes (THMs) are compounds characterized by a methane structure with three hydrogen atoms replaced by halogen atoms. For instance, chloroform (trichloromethane) has the structural formula CHCl_3 . Of the 16 PTOCs of interest, three are classified as THMs; chloroform, bromodichloromethane, and chlorodibromomethane.

Under the appropriate conditions, the chlorination of wastewater can lead to the formation of THMs. In this section, the important factors which affect the formation of THMs are described, along with possible precursors, and formation and reaction mechanisms. Although a comprehensive review of THM formation is beyond the scope of this study, references are noted so that the reader may pursue additional information on the subject.

Factors Affecting THM Formation

Several factors can influence the relative magnitude of THM formation. These can be classified into three groups; (1) general wastewater characteristics, (2) specific biological and chemical characteristics of the wastewater, and (3) characteristics of the chlorination system. A brief review of the factors associated with each group is presented in the following subsections.

General wastewater characteristics

The two general wastewater conditions which can influence THM formation are pH and temperature. From a practical standpoint, the wastewater pH should have a very small impact on haloform reactions. This is due to the typically narrow pH range of most wastewaters. Dore et. al. (1982) found that the THM yield peaked at much higher pH values than are usually observed in municipal wastewater. However, the peak

was found to be a function of the halogen compound used and the precursors present.

Changes in the temperature of the wastewater affect the reaction rate of THM formation and competing reactions. As with pH, a typically narrow wastewater temperature range leads to the conclusion that temperature does not significantly influence THM formation.

Specific biological and chemical characteristics of the wastewater

Competing halogens, ammonia, precursor compounds, and chemical and biological agents which lead to the formation of precursors, can all affect the quantity of individual THMs which are formed as a result of the chlorination of wastewater. The effects of competing halogens and ammonia will be discussed here. Precursors and precursor formation are addressed later.

Three halogens which may be present in wastewater are chlorine, bromine, and iodine, with iodine considered to be present in insignificant amounts relative to chlorine and bromine. Chlorine and bromine can react to form hypochlorous and hypobromous acid, respectively, which when exposed to the appropriate precursors lead to the formation of chlorinated and brominated THMs (Dore et al., 1982). In general, hypochlorous acid is considered to be more reactive with THM precursors than is hypobromous acid (Dore et al., 1982). However, brominated species have been found to be significant, even at high chlorine doses (Amy et al., 1984).

The presence of ammonia in wastewater plays an important role in the formation of trihalomethanes. Naturally occurring or added ammonia reacts with available chlorine to form chloramines, thus exerting a free chlorine demand and reducing the ultimate trihalomethane levels. It is generally believed that chloramines do not react to form THMs (Amy et al., 1984). However, Riznychok et. al. (1983) has suggested that chloramines are part of the total combined available chlorine which can react to form THMs. In either case, the presence of ammonia appears to reduce, but not totally eliminate THM production. The lack of complete

inhibition suggests that the reactivity of some precursors may be very high (Dore et al., 1982). It has been observed that complete elimination of THMs in chlorinated water containing humic substances is rare (Amy et al., 1984). Furthermore, greater quantities of THMS were formed during the chlorination of nitrified (ammonia reduced) effluent than during the chlorination in non-nitrified wastewater effluent (Chow and Roberts, 1981).

The significant effect of ammonia on THM formation suggests the importance of the degree of nitrification and the point of chlorine application. For instance, a sewage treatment plant that discharges to a sensitive receiving water may be required to meet stringent ammonia discharge standards. A high degree of nitrification before chlorination favors the formation of THMs. The opposite would be true for wastewaters with high ammonia concentrations and sewage treatment plants not designed for ammonia removal.

Characteristics of the chlorination system

Three important characteristics of the chlorination system are the chlorine dose, reaction time, and the location of chlorine addition.

The formation of trihalomethanes has been shown to be proportional to the chlorine dose, or amount of chlorine added to the wastewater per unit time (Dore et al., 1982; Amy et al., 1984). For a better understanding of the effect that the chlorine dose has on the THM yield, breakpoint chlorination and chlorine breakpoint curves should be considered. A thorough review of breakpoint chlorination is beyond the scope of this work.

The reaction time during which trihalomethanes can form after chlorine addition is important, but not well understood for wastewater streams. The reaction time is dependent upon the wastewater flowrate and the residence time in the chlorine contact and effluent outfall systems. The use and location of dechlorination systems are also important factors. Chloroform, bromodichloromethane, and chlorodibromomethane have all been shown to increase with increases in the reaction

time (Cooper et. al., 1983). Dechlorination tends to reduce, but not completely eliminate THM yields, even after a very short reaction time of 2 minutes (Helz et al., 1985). This suggests that the chemical processes involved in the production of THMs occur rapidly after chlorine addition.

The location of chlorine addition can seriously impact the relative significance of THM formation. Where disinfection is necessary, final effluent is typically chlorinated. However, some facilities require chlorination of the influent to control odors, and some require chlorinated odor control on the influent, as well as disinfection by chlorination of the effluent, stream. If the influent stream is chlorinated, several mechanisms can affect the THM yield. For instance, without influent dechlorination the increased reaction time and precursor concentration tend to favor an increase in the THM yield, while a higher ammonia concentration in the influent stream favors a reduction in the yield. In addition, the precursor concentration may actually be lower in the influent stream as precursors may form during biological treatment later in the treatment process.

Precursors

Although it would be desirable to be able to correlate the formation of trihalomethanes with a common organic parameter such as BOD or COD, such correlations are not possible, as the formation of THMs is closely related to the chemical structure of the precursor compounds (Dore et al., 1982; Takehisa et al., 1985). The most commonly noted THM precursors are humic substances (Amy et al., 1984). Takehisa et al. (1985) observed that both humic acid and fulvic acid in natural water were precursors leading to the formation of THMs in drinking water.

Aquatic algae and their metabolic products can produce precursors of THMs, but the precursor molecules have not been identified conclusively (Itoh et al., 1985). Acetoacetic acid, known to be an intermediate of fatty acid catabolism, is typically produced by sewage bacteria during the biodegradation of organic materials (Itoh et al., 1985). In

addition, the chlorination of a solution containing acetoacetic acid led to a chloroform yield of 55.5% on a molar basis, and it was suggested that between 51 - 87% of the total chloroform yield of a wastewater was explained by reactions involving acetoacetic acid (Itoh et al., 1985).

Dore et. al. (1982) studied a number of potential precursors and the chloroform yield when waters containing those precursors were spiked with a known amount of chlorine. Potentially significant precursors were noted to be those compounds bearing acetyl groups, and those compounds susceptible to forming acetyl groups by oxidation. The precursors that were studied had a wide range of molar percent yields of chloroform, ranging from 0.15% for acetone, to 91.5% for resorcinol. Additional precursors and their molar percent yields included phenol (0.4%), pyruvic acid (1%), acetophenone (1.2%), phloroglucinol (55%), and acetyl acetone (91%).

Reaction Mechanisms

The reactions of greatest concern are the THM formation reaction and the chloramine formation reaction. The reaction between hypochlorous acid and ammonia to form chloramines has a reaction rate on the order of $1.0 \times 10^6 \text{ L/mol-s}$. Such a high rate would tend to indicate a low amount of THM formation when ammonia is present during chlorination. However, THMs have been observed to form even under such conditions. Cooper et al. (1983) suggested that such results can be explained by a multi-step process for THM formation. The first step is believed to be relatively fast with respect to the hypochlorous acid / ammonia reaction. Slower formation reactions follow for a period of 24 hours or more after chlorination. Amy et al. (1984) also observed an initial THM formation rate that is competitive with the formation of chloramines. It was suggested that following the initial step the THM formation mechanism is slow, but it acts in parallel with the chloramine formation mechanism. The THM formation peak has been noted to occur approximately 15 minutes after the initial chlorine contact (Riznychok et al., 1983). The overall time frame for formation has been observed to be on the order of days (Kavanaugh et al., 1980).

Emissions of Trihalomethanes Following Chlorination

Volatile emissions of THMs following chlorination can be significantly affected by the location of chlorination, as well as effluent outfall characteristics. For instance, if the wastewater is chlorinated as influent, THMs have ample opportunity to volatilize throughout the entire treatment process. If the effluent is chlorinated at the sewage treatment plant and then conveyed to an ultimate receiving water, the characteristics of the effluent outfall line (e.g., open, enclosed, vented, length, etc.) can affect emissions during outfall. The nature of the receiving system is also very important. While volatilization may not occur at the sewage treatment plant or in the outfall line, if the effluent is discharged to a surface receiving water the THMs are likely to volatilize downstream.

Summary

Trihalomethanes form during the chlorination of municipal wastewater. However, studies to date have focussed upon drinking water chlorination, and an understanding of THM formation during wastewater treatment is incomplete. The most important factors that affect THM formation are the presence of competing halogens, ammonia that competes for available chlorine, and organic precursors. The chlorine dose, reaction time, and the location of chlorine addition are also factors that affect THM formation. The most important precursors appear to be humic substances that bear acetyl groups. The reaction between such precursors and hypochlorous acid is able to compete with the formation of chloramines for a short period of time following the initial chlorine contact. Thus, even in the presence of ammonia, some degree of THM formation is expected to occur. Finally, the importance of the generated chloroform with respect to airborne emissions is believed to be dependent upon the location of chlorine addition and the effluent outfall characteristics.

APPENDIX E: WEST Code

```

C PROGRAM WEST (WORST-CASE EMISSIONS DURING SEWAGE TREATMENT)
C
C DEVELOPED BY: RICHARD L. CORSI
C UNIVERSITY OF CALIFORNIA AT DAVIS
C DECEMBER 1986
C
C PROGRAM WEST UTILIZES AVERAGE FLOW AND CONCENTRATION DATA THAT
C ARE STORED IN EXTERNAL FILE COUNTY.DAT. THESE DATA ARE THEN USED
C TO COMPUTE AVERAGE EMISSION RATES FROM INDIVIDUAL WASTEWATER
C TREATMENT PLANTS. EMISSIONS FROM INDIVIDUAL PLANTS ARE OUTPUT TO
C EXTERNAL FILE EMSTP.PRT. COUNTY-BY-COUNTY EMISSIONS ARE OUTPUT
C TO EXTERNAL FILE CSUM.PRT.
C
C REAL PR(16),SUMS(16),SUMC(16),C(16),CFLO(58),TOTF(58),PFLOW(58)
C 1,EOUT(16),SR(16),SLUMC(16),SLUMS(16)
C
C OPEN(UNIT=3,FILE='CSUM.PRT',STATUS='NEW')
C OPEN(UNIT=5,FILE='COUNTY.DAT',STATUS='OLD')
C OPEN(UNIT=6,FILE='EMSTP.PRT',STATUS='NEW')
C
C THROUGHOUT ANALYSIS, THE FOLLOWING SUBSCRIPTS ARE USED:
C
C 1 ACRYLONITRILE
C 2 BENZENE
C 3 BROMODICHLOROMETHANE
C 4 CARBON TETRACHLORIDE
C 5 CHLOROBENZENE
C 6 CHLOROFORM
C 7 DIBROMOCHLOROBENZENE
C 8 1,1 DICHLOROETHYLENE
C 9 ETHYLBENZENE
C 10 1,2 DICHLOROETHANE
C 11 METHYLENE CHLORIDE
C 12 PERCHLOROETHYLENE
C 13 TOLUENE
C 14 1,1,1 TRICHLOROETHANE
C 15 TRICHLOROETHYLENE
C 16 VINYL CHLORIDE
C
C ASSIGN THE FRACTIONAL REMOVAL EFFICIENCIES
C
C PR(1)=0.90
C PR(2)=0.72
C PR(3)=0.90
C PR(4)=0.95
C PR(5)=0.87
C PR(6)=0.90
C PR(7)=0.90
C PR(8)=0.77
C PR(9)=0.84
C PR(10)=0.97
C PR(11)=0.65
C PR(12)=0.79
C PR(13)=0.89
C PR(14)=0.79
C PR(15)=0.83
C PR(16)=1.0
C
C ASSIGN THE SLUDGE ADSORPTION FACTORS
C
C SR(1)=0.0
C SR(2)=0.01
C SR(3)=0.0
C SR(4)=0.043
C SR(5)=0.051
C SR(6)=0.0067
C SR(7)=0.0
C SR(8)=0.0
C SR(9)=0.043
C SR(10)=0.011

```

```

SR(11)=0.0799
SR(12)=0.0414
SR(13)=0.0974
SR(14)=0.0067
SR(15)=0.0408
SR(16)=0.0126
C
C READ NUMBER OF COUNTIES IN DATABASE COUNTY.DAT (NC)
C
READ(5,*)NC
C
C INITIALIZE THE STATEWIDE EMISSIONS AND SLUDGE TOTALS
C
DO 9 MM=1,16,1
  SUMS(MM)=0.0
  SLUMS(MM)=0.0
9 CONTINUE
SUMD=0.0
SUMF=0.0
C
C LOOP THROUGH THE COUNTIES
C I=COUNTY NUMBER (1=ALAMEDA ..... 58=YUBA)
C
DO 10 I=1,NC,1
C
C ICTY = COUNTY NUMBER; NP = NUMBER OF PLANTS IN COUNTY ICTY
C
  READ(5,*)ICTY,NP
C
C INITIALIZE THE EMISSIONS AND SLUDGE TOTALS FOR COUNTY I
C
  DO 11 MM=1,16,1
    SUMC(MM)=0.0
    SLUMC(MM)=0.0
11 CONTINUE
C
C INITIALIZE THE TOTAL FLOW (TOTF) FOR COUNTY I, AND FLOW
C (CFLO) ACCOUNTED FOR BY MWTPS WITH CONCENTRATION DATA
C
  TOTF(I)=0.0
  CFLO(I)=0.0
C
C LOOP THROUGH ALL NP PLANTS IN COUNTY I
C
  DO 20 J=1,NP,1
    SPLANT=0.0
    READ(5,1000)
C
C IFLAG INDICATES THE DEGREE OF AVAILABLE DATA
C
  READ(5,1050)IFLAG
C
C READ FLOW DATA AND ASSIGN THE MOST APPROPRIATE FLOWRATE
C
  AF IS THE TOTAL FLOW LISTED IN THE NEEDS DATA BASE;
  AIND IS THE INDUSTRIAL FLOW; ACT IS AN UPDATED FLOWRATE IF SUCH
  A VALUE IS AVAILABLE. ALL FLOWS ARE READ AS MGD.
C
  READ(5,1100)AF,AIND,ACT
C
C SELECT APPROPRIATE FLOWRATE
C
  IF(ACT .EQ. 0.0)THEN
    FLOW=AF
  ELSE
    FLOW=ACT
  END IF
C
C COMPLETE SUMMATION OF FLOWS IN COUNTY I
C
  TOTF(I)=TOTF(I)+FLOW
  SUMF=SUMF+FLOW

```

```

C CODE (IUP) TO INDICATE IF THE DATA IN COUNTY.DAT IS UPDATED
C
    IF(ACT .GT. 0.0)THEN
        IUP=1
    ELSE
        IUP=0
    END IF

C
C DEFINE THE FRACTION INDUSTRIAL FLOW (R)
C
    R=AIND/FLOW

C
C ANALYSIS FOR STPS WITH KNOWN INFLUENT AND EFFLUENT DATA
C
    IF(IFLAG .EQ. 1 .OR. IFLAG .EQ. 3)THEN
        CFLO(I)=CFLO(I)+FLOW
        SUMD=SUMD+FLOW

C
C LOOP THROUGH EACH OF THE 16 PTOCS
C
    DO 30 M=1,16,1
        READ(5,1200)CI,CE,ICODE
        SLOUT=SR(M)*FLOW*CI*1.52E-3
        IF(ICODE .EQ. 5)THEN
            IF(CE .GT. CI)THEN
                IF(M .EQ. 3 .OR. M .EQ. 6 .OR. M .EQ. 7)THEN
                    D=CI*PR(M)
                ELSE
                    D=0.0
                END IF
            ELSE
                D=CI-CE
            END IF
        ELSE IF(ICODE .EQ. 2)THEN
            D=CI
        ELSE
            D=0.0
        END IF

C
C CALCULATE THE EMISSION RATE (EOUT) IN TONS/YEAR
C
        EOUT(M)=D*FLOW*1.52E-3
        SPLANT=SPLANT+EOUT(M)
        SUMC(M)=SUMC(M)+EOUT(M)
        SUMS(M)=SUMS(M)+EOUT(M)
        SLUMC(M)=SLUMC(M)+SLOUT
        SLUMS(M)=SLUMS(M)+SLOUT
30    CONTINUE
        WRITE(6,1300)ICTY,J,SPLANT,(EOUT(LM),LM=2,16,1)

C
C ANALYSIS FOR STPS WITH KNOWN INFLUENT DATA
C
        ELSE IF(IFLAG .EQ. 2)THEN
            CFLO(I)=CFLO(I)+FLOW
            SUMD=SUMD+FLOW
            DO 40 M=1,16,1
                READ(5,1400)CI,ICODE
                SLOUT=SR(M)*FLOW*CI*1.52E-3
                IF(ICODE .EQ. 5)THEN
                    D=PR(M)*CI
                ELSE
                    D=0.0
                END IF
                EOUT(M)=D*FLOW*1.52E-3
                SPLANT=SPLANT+EOUT(M)
                SUMC(M)=SUMC(M)+EOUT(M)
                SUMS(M)=SUMS(M)+EOUT(M)
                SLUMC(M)=SLUMC(M)+SLOUT
                SLUMS(M)=SLUMS(M)+SLOUT
40    CONTINUE
        WRITE(6,1300)ICTY,J,SPLANT,(EOUT(LM),LM=2,16,1)

```

```

C      ANALYSIS FOR STPS WITH KNOWN INFLUENT DATA
C
      ELSE IF(IFLAG .EQ. 2)THEN
        CFLO(I)=CFLO(I)+FLOW
        SUMD=SUMD+FLOW
        DO 40 M=1,16,1
          READ(5,1400)CI,ICODE
          SLOUT=SR(M)*FLOW*CI*1.52E-3
          IF(ICODE .EQ. 5)THEN
            D=PR(M)*CI
          ELSE
            D=0.0
          END IF
          EOUT(M)=D*FLOW*1.52E-3
          SPLANT=SPLANT+EOUT(M)
          SUMC(M)=SUMC(M)+EOUT(M)
          SUMS(M)=SUMS(M)+EOUT(M)
          SLUMC(M)=SLUMC(M)+SLOUT
          SLUMS(M)=SLUMS(M)+SLOUT
40      CONTINUE
        WRITE(6,1300)ICTY,J,SPLANT,(EOUT(LM),LM=2,16,1)
C
C      ENTER THE EXTRAPOLATION SEGMENT
C
      ELSE
C
C      EXTRAPOLATE CONCENTRATIONS TO THOSE STPS WITH NO INDUSTRIAL FLOW
C
        IF(R .EQ. 0.0)THEN
          C(1)=0.0
          C(2)=0.60
          C(3)=0.13
          C(4)=0.0
          C(5)=0.0
          C(6)=11.2
          C(7)=0.17
          C(8)=0.0
          C(9)=0.32
          C(10)=0.30
          C(11)=6.93
          C(12)=4.25
          C(13)=4.35
          C(14)=2.13
          C(15)=1.42
          C(16)=0.0
        ELSE
C
C      EXTRAPOLATE CONCENTRATIONS TO STPS IN THE INLAND VALLEY
C
          IF(ICTY .EQ. 4 .OR. ICTY .EQ. 6 .OR. ICTY .EQ. 10 .OR.
1          ICTY .EQ. 11 .OR. ICTY .EQ. 13 .OR. ICTY .EQ. 15 .OR.
1          ICTY .EQ. 16 .OR. ICTY .EQ. 20 .OR. ICTY .EQ. 24 .OR.
1          ICTY .EQ. 34 .OR. ICTY .EQ. 39 .OR. ICTY .EQ. 45 .OR.
1          ICTY .EQ. 45 .OR. ICTY .EQ. 50 .OR. ICTY .EQ. 51 .OR.
1          ICTY .EQ. 52 .OR. ICTY .EQ. 54 .OR. ICTY .EQ. 57 .OR.
1          ICTY .EQ. 58)THEN
            C(1)=0.0
            C(2)=0.08*R
            C(3)=0.0
            C(4)=0.0
            C(5)=0.71*R
            C(6)=28.47*R
            C(7)=0.0
            C(8)=3.06*R
            C(9)=8.91*R
            C(10)=0.0
            C(11)=30.06*R
            C(12)=104.18*R
            C(13)=84.61*R
            C(14)=22.38*R
            C(15)=157.7*R
            C(16)=0.0
          
```



```

C      EXTRAPOLATE CONCENTRATIONS TO STPS IN CONTRA COSTA AND SOLANO
C      COUNTIES
C
      ELSE IF(ICTY .EQ. 7 .OR. ICTY .EQ. 48)THEN
        C(1)=0.0
        C(2)=23.3*R
        C(3)=0.0
        C(4)=0.0
        C(5)=0.0
        C(6)=548.6*R
        C(7)=0.0
        C(8)=0.0
        C(9)=30.74*R
        C(10)=7.69*R
        C(11)=555.3*R
        C(12)=254.2*R
        C(13)=161.7*R
        C(14)=34.97*R
        C(15)=64.65*R
        C(16)=0.0
C
C      EXTRAPOLATE CONCENTRATIONS TO STPS IN ALAMEDA AND SANTA CLARA
C      COUNTIES
C
      ELSE IF(ICTY .EQ. 1 .OR. ICTY .EQ. 43)THEN
        C(1)=0.0
        C(2)=21.2*R
        C(3)=1.6*R
        C(4)=16.82*R
        C(5)=0.0
        C(6)=65.03*R
        C(7)=0.93*R
        C(8)=11.71*R
        C(9)=9.55*R
        C(10)=0.0
        C(11)=174.45*R
        C(12)=168.89*R
        C(13)=182.59*R
        C(14)=88.71*R
        C(15)=27.68*R
        C(16)=0.0
C
C      EXTRAPOLATE CONCENTRATIONS TO STPS IN SAN MATEO AND SF COUNTIES
C
      ELSE IF(ICTY .EQ. 38 .OR. ICTY .EQ. 41)THEN
        C(1)=0.0
        C(2)=9.9*R
        C(3)=1.94*R
        C(4)=0.0
        C(5)=81.18*R
        C(6)=178.8*R
        C(7)=0.0
        C(8)=54.93*R
        C(9)=51.78*R
        C(10)=120.94*R
        C(11)=102.88*R
        C(12)=273.27*R
        C(13)=200.31*R
        C(14)=116.49*R
        C(15)=111.29*R
        C(16)=0.0
C
C      EXTRAPOLATE CONCENTRATIONS TO STPS IN LA AND ORANGE COUNTIES
C
      ELSE IF(ICTY .EQ. 19 .OR. ICTY .EQ. 30)THEN
        C(1)=0.0
        C(2)=124.57*R
        C(3)=2.43*R
        C(4)=1.52*R
        C(5)=0.66*R
        C(6)=161.63*R
        C(7)=0.62*R

```

```

C(8)=7.38*R
C(9)=115.2*R
C(10)=22.29*R
C(11)=589.1*R
C(12)=395.89*R
C(13)=589.6*R
C(14)=442.4*R
C(15)=60.86*R
C(16)=12.87*R
C
C
C      EXTRAPOLATE CONCENTRATIONS TO STPS IN VENTURA COUNTY
C
      ELSE IF(ICTY .EQ. 56)THEN
        C(1)=0.0
        C(2)=73.2*R
        C(3)=33.6*R
        C(4)=0.0
        C(5)=0.0
        C(6)=113.19*R
        C(7)=15.4*R
        C(8)=38.5*R
        C(9)=14.0*R
        C(10)=0.0
        C(11)=0.0
        C(12)=230.3*R
        C(13)=51.8*R
        C(14)=228.2*R
        C(15)=10.5*R
        C(16)=0.0
C
C
C      EXTRAPOLATE CONCENTRATIONS TO STPS IN RIVERSIDE, SAN BERNARDINO,
C      AND SAN DIEGO COUNTIES
C
      ELSE IF(ICTY .EQ. 33 .OR. ICTY .EQ. 36 .OR. ICTY
1      .EQ. 37)THEN
        C(1)=0.0
        C(2)=45.61*R
        C(3)=12.47*R
        C(4)=0.0
        C(5)=0.0
        C(6)=69.71*R
        C(7)=0.0
        C(8)=0.36*R
        C(9)=97.98*R
        C(10)=0.0
        C(11)=176.35*R
        C(12)=64.67*R
        C(13)=367.10*R
        C(14)=47.09*R
        C(15)=2.93*R
        C(16)=0.0
C
C
C      EXTRAPOLATE CONCENTRATIONS TO THOSE COUNTIES NOT LISTED ABOVE
C
      ELSE
        C(1)=0.0
        C(2)=0.60
        C(3)=0.13
        C(4)=0.0
        C(5)=0.0
        C(6)=11.2
        C(7)=0.17
        C(8)=0.0
        C(9)=0.32
        C(10)=0.3
        C(11)=6.93
        C(12)=4.25
        C(13)=4.35
        C(14)=2.13
        C(15)=1.42
        C(16)=0.00
      END IF

```

```

C
C ESTIMATE THE EMISSION RATE (EOUT).. (TONS/YEAR) FOR THE STPS
C WITHOUT KNOWN INFLUENT OR INFLUENT/EFFLUENT DATA
C
      END IF
      DO 50 M=1,16,1
        SLOUT=C(M)*FLOW*SR(M)*1.52E-3
        D=C(M)*PR(M)
        EOUT(M)=D*FLOW*1.52E-3
        SPLANT=SPLANT+EOUT(M)
        SUMC(M)=SUMC(M)+EOUT(M)
        SUMS(M)=SUMS(M)+EOUT(M)
        SLUMC(M)=SLUMC(M)+SLOUT
        SLUMS(M)=SLUMS(M)+SLOUT
50      CONTINUE
      WRITE(6,1300)ICTY,J,SPLANT,(EOUT(LM),LM=2,16,1)
      END IF
      CONTINUE
C
C COMPUTE THE TOTAL EMISSIONS FOR EACH PTOC IN COUNTY I
C
      SUM=0.0
      SLUD=0.0
      DO 60 L=1,16,1
        SUM=SUM+SUMC(L)
        SLUD=SLUD+SLUMC(L)
60      CONTINUE
C
C COUNTY OUTPUT: TOTAL EMISSIONS (SUM), SPECIATED EMISSIONS (SUMC),
C TOTAL REMOVAL IN SLUDGE (SLUD), SPECIATED REMOVAL IN SLUDGE,
C SLUMC
C
      WRITE(3,1500)I,SUM,(SUMC(LM),LM=2,16,1),
1      SLUD,(SLUMC(LM),LM=2,16,1)
10     CONTINUE
C
C OUTPUT STATEWIDE LOSSES IN SLUDGE STREAMS (SPECIATED = SLUMS;
C TOTAL = SSLUG), AND EMISSIONS (SUMS).
C
      SSLUG=0.0
      DO 70 M=1,16,1
        SSLUG=SSLUG+SLUMS(M)
70      CONTINUE
      WRITE(3,1600)SSLUG,(SLUMS(LM),LM=2,16,1)
      WRITE(3,1700)(SUMS(M),M=1,16,1)
C
C FORMAT GROUPING
C
1000  FORMAT(1X)
1050  FORMAT(I2)
1100  FORMAT(1X,F9.2,11X,F9.2,21X,F9.2,/)
1200  FORMAT(11X,F9.2,21X,F9.2,11X,I10)
1300  FORMAT(2(1X,I2),16(1X,F6.2))
1400  FORMAT(11X,F9.2,41X,I10)
1500  FORMAT(1X,I2,16(1X,F6.2),/,3X,16(1X,F6.2))
1600  FORMAT(/,3X,16(1X,F6.2))
1700  FORMAT(5(/),16(1X,F6.2))
      END

```

APPENDIX F: Data Base Structure

APPENDIX F: DATA BASE STRUCTURE

In this appendix, descriptions of four data files, submitted to the staff of the CARB for future analyses relative to MWTPs, are provided. Three of the four files (TTRAIN, POTW, and SLUDGE) are related by MWTP facility numbers to establish a "linked" data base structure. Those three files contain records associated with individual MWTPs in California. File COUNTY contains information regarding emissions of PTOCs and PTOC removals in sludge streams throughout individual counties. Descriptions of the data records and data fields are provided below for each file. Equivalent FORTRAN field formats are listed for each data field.

POTW

File POTW contains information related to the location, flow characteristics, and estimated emissions from every MWTP identified in this study. All emissions estimates are reported in tons/year to two decimal places. Those listed as 0.00 should be assumed to be less than 10 lb/year. The most recent annual average flowrates were used whenever possible (i.e., for most of the MWTPs identified in Table 13 of this report). Otherwise, average dry weather flowrates from the NEEDS data base were used. Latitude and longitude coordinates were also extracted from the NEEDS data base, although coordinates for a small number of the facilities were not available. Most of the location coordinates correspond to the site of effluent discharge, which in some cases may be several miles from the actual treatment facility. The record for each MWTP has the following two-line structure.

```
SNME  CNUM  SNUM  FNUM  LA  LO  TF  IF  TEM  P2  P3  .....  P6
P7  P8  P9  .....  P16
```

SNME	Name of facility	columns	1-25	A25
CNUM	County number		28-29	I2
SNUM	Plant number in county CNUM		32-33	I2
FNUM	Facility ID number		36-43	I8
LA	Latitude (degrees.minutes.seconds)		46-52	F7.4

L0	Longitude(" "	55-62	F8.4
TF	Total flow (MGD)	65-70	F6.2
IF	Industrial flow (MGD)	73-77	F5.2
TEM	Total PTOC emissions	80-85	F6.2
P2	Benzene emissions	88-93	F6.2
P3	Bromodichloromethane emissions	96-101	
P4	Carbon tetrachloride emissions	104-109	
P5	Chlorobenzene emissions	112-117	
P6	Chloroform emissions	120-125	
P7	Dibromochloromethane emissions	1-6	
P8	1,1 Dichloroethylene emissions	9-14	
P9	Ethylbenzene emissions	17-22	
P10	1,2 Dichloroethane emissions	25-30	
P11	Methylene chloride emissions	33-38	
P12	Perchloroethylene emissions	41-46	F6.2
P13	Toluene emissions	49-54	
P14	1,1,1 Trichloroethane emissions	57-62	
P15	Trichloroethylene emissions	65-70	
P16	Vinyl chloride emissions	73-78	

TTRAIN

File TTRAIN contains information regarding specific treatment processes at individual MWTPs. Twenty-eight treatment processes were chosen for entry into the data base. A 1 was entered in the record field if the MWTP utilizes the indicated process. Otherwise, a 0 was entered in the process data field. It should be noted that the treatment train data was extracted from the NEEDS data base which was observed to be outdated for some of the MWTPs. For major MWTPs, such as the eight that were visited for this study (Appendix G), revisions were made to the data base using more recent data. In addition, TTRAIN only indicates whether or not a process exists at a specific MWTP, and not where that process is located with respect to other processes in the treatment train. We have found that the use of TTRAIN with commercially available data base software can be valuable for readily identifying MWTPs in

California that utilize specific treatment processes (e.g., pure-oxygen activated sludge, multi-media filtration, etc.). The record for each MWTP consists of one row of data as indicated below.

FNUM	PR1	PR2	PR3	PR27	PR28
FNUM	Facility ID number			Columns 1-8	I8
PR1	Bar screening			11	I1
PR2	Grit or scum removal			14	I1
PR3	Comminution			17	I1
PR4	Flow equalization			20	I1
PR5	Pre-aeration			23	I1
PR6	Primary clarification			26	I1
PR7	Non-aerated ponds			29	I1
PR8	Aerated lagoons			32	I1
PR9	Trickling filters			35	I1
PR10	Attached growth processes			38	I1
PR11	Conventional activated sludge			41	I1
PR12	Pure-oxygen activated sludge			44	I1
PR13	Oxidation ditch			47	I1
PR14	Other suspended growth processes			50	I1
PR15	Land treatment			53	I1
PR16	Secondary clarification			56	I1
PR17	Sand filtration			59	I1
PR18	Mixed media filtration			62	I1
PR19	Pressure filtration			65	I1
PR20	Rock filtration			68	I1
PR21	Other filtration			71	I1
PR22	Activated carbon treatment			74	I1
PR23	Neutralization			77	I1
PR24	Breakpoint chlorination			80	I1
PR25	Ammonia stripping			83	I1
PR26	Dechlorination			86	I1
PR27	Post-aeration			89	I1
PR28	Chlorination			92	I1

SLUDGE

File SLUDGE contains information associated with sludge treatment and disposal operations at individual MWTPs. Identification of an existing process is completed by the code described in TTRAIN (0 = does not utilize; 1 = does utilize). The sludge treatment and disposal characteristics were extracted from the NEEDS data base and are subject to the uncertainties noted previously for POTW and TTRAIN. The record for each MWTP consists of one row as indicated below.

FNUM ST1 ST2 ST9 SD1 SD2 SD3 SD4 SD5

FNUM	Facility ID number	Columns 1-8	I8
ST1	Aerobic digestion	11	I1
ST2	Anaerobic digestion	14	I1
ST3	Composting	17	I1
ST4	Purifax treatment	20	I1
ST5	Air drying	23	I1
ST6	Sludge lagoons	26	I1
ST7	Mechanical dewatering	29	I1
ST8	Air flotation thickening	32	I1
ST9	Incineration	35	I1
SD1	Landfill/trenching	38	I1
SD2	Land spreading	41	I1
SD3	Ocean disposal	44	I1
SD4	Sludge distribution or marketing	47	I1
SD5	Other sludge disposal mechanisms	50	I1

COUNTY

File COUNTY contains information regarding estimates of total and speciated PTOC emissions for each county in California. Estimated PTOC removals in sludge streams are also provided for each county. Emissions and quantities removed in sludge are recorded in tons/year to two decimal places. Values listed as 0.00 should be taken to be less than 10 lb/year. The record for each county has the following two-line structure.

CNUM	CNME	TEC	E2	E3	E14	E15
E16	TS	S2	S3		S15	S16

CNUM	County number	Columns	1-2	I2
CNME	County name		5-19	A15
TEC	Total PTOC emissions		22-27	F6.2
E2	Benzene emissions		30-35	"
E3	Bromodichloromethane emissions		38-43	"
E4	Carbon tetrachloride emissions		46-51	F6.2
E5	Chlorobenzene emissions		54-59	"
E6	Chloroform emissions		62-67	"
E7	Dibromochloromethane emissions		70-75	"
E8	1,1 Dichloroethylene emissions		78-83	"
E9	Ethylbenzene emissions		86-91	"
E10	1,2 Dichloroethane emissions		94-99	"
E11	Methylene chloride emissions		102-107	"
E12	Perchloroethylene emissions		110-115	"
E13	Toluene emissions		118-123	"
E14	1,1,1 Trichloroethane emissions		126-131	"
E15	Trichloroethylene emissions		1-6	"
E16	Vinyl chloride emissions		9-14	"
TS	Total PTOC removal in sludge		17-21	F5.2
S2	Benzene removal		24-28	"
S3	Bromodichloromethane removal		31-35	"
S4	Carbon tetrachloride removal		38-42	"
S5	Chlorobenzene removal		45-49	"
S6	Chloroform removal		52-56	"
S7	Dibromochloromethane removal		59-63	"
S8	1,1 Dichloroethylene		66-70	"
S9	Ethylbenzene removal		73-77	"
S10	1,2 Dichloroethane removal		80-84	"
S11	Methylene chloride removal		87-91	"
S12	Perchloroethylene removal		94-98	"
S13	Toluene removal		101-105	"
S14	1,1,1 Trichloroethane removal		108-112	"
S15	Trichloroethylene removal		115-119	"
S16	Vinyl chloride removal		122-126	"

APPENDIX G: WASTEWATER TREATMENT PLANT VISITS

Eight municipal wastewater treatment plants (MWTPs) were visited. The MWTPs were selected on the basis of a number of factors: representative of a wide geographic cross-section of California, location in an air basin where photochemical air pollution was of concern, proximity to population centers, MWTP size, the amount of industrial flow, and characteristics of industries that discharged to the MWTP. The eight plants accounted for greater than 42% of the total dry-weather wastewater treated in California. A review of the visit to each MWTP and the general characteristics of each MWTP are provided in this section. Where available, past liquid and gas-phase sampling efforts are summarized. Finally, recommendations are made regarding future sampling efforts.

Sacramento Regional Wastewater Treatment Plant (July 16, 1986)

The Sacramento Regional Wastewater Treatment Plant (SRWTP) was the largest sewage treatment plant (STP) in the Central Valley and the fifth largest STP, with respect to influent flow, in the state of California. The SRWTP was subjected to an average seasonal dry weather flow of 136 MGD, and an average wet weather flow of 142 MGD. The plant served an estimated 750,000 residents, as well as various commercial and industrial users. The principal industrial users were two canneries which discharged as much as 10 MGD during canning season.

Major treatment processes at the SRWTP included primary treatment, followed by pure-oxygen activated sludge treatment, chlorination, out-fall, dechlorination, and discharge to the Sacramento River. Primary treatment involved influent screening, aerated grit removal, and primary sedimentation using 12 sedimentation tanks. All of the primary treatment processes were fully enclosed. Secondary treatment included eight pure-oxygen activated sludge aeration basins, followed by 16 secondary sedimentation tanks. The latter were not enclosed. Sixty to seventy

tons of sludge were generated each day. Secondary sludge was thickened by flotation before being mixed with primary sludge. The mixture was treated for approximately three weeks in anaerobic digesters. The sludge was then stored in solids storage basin ponds before being disposed of on-site by subsurface injection.

Liquid-phase samples were drawn from the influent and the effluent streams on a quarterly basis. Pre-chlorination and post-chlorination samples were completed on a less frequent basis. Influent and effluent samples were drawn by using a single "grab" sample, with the effluent sample time lagged by the estimated amount of time it would take a "plug" of water to pass through the entire treatment process. Past sampling indicated consistently higher chloroform concentrations in the effluent as compared to the influent. The formation of brominated THMs appeared to be insignificant. Sludge was not analyzed for the presence of PTOCs.

The efforts to reduce odors by enclosing most of the treatment processes, treatment of process off-gases, and the nature of industrial users, are believed to have led to lower PTOC emissions from the SRWTP relative to conventional treatment plants of comparable size.

Very few processes were noted as potential sources of PTOC emissions. Minor emissions might have occurred from the soil at the sludge disposal site. However, subsurface injection as well as a (retainer) wall, which acted to reduce air flow over the soil surface, should have reduced those emissions. In addition, the fraction of PTOCs partitioned to sludge was expected to be low, and those PTOCs in the sludge were likely to volatilize and be flared or degraded during anaerobic digestion. Another source of emissions might have been hot sludge foam which escaped from the floating roof digesters and became exposed to the atmosphere. However, this accounted for only a small fraction of the sludge, and the total exposed surface area was small. Some emissions may have occurred from uncovered secondary clarifiers, but the PTOC concentrations at that stage of the treatment process were probably very low. Emissions of trihalomethanes from the Sacramento River could have occurred following effluent chlorination and discharge.

A major source of PTOC emissions at the SRWTP was expected to be an odor removal tower (ORT) through which off-gases from primary and secondary treatment were vented to the atmosphere through an induced draft fan. The ventilation system would be suitable for sampling. Other sources of PTOC emissions could have been pressure-relief valves on each of the nine digester tanks. Each tank was equipped with up to four valves. Digester gases can contain significant concentrations of vinyl chloride. Past gas-phase sampling tests of digester gases have indicated significant concentrations of toluene, dichloroethylene, trichloroethylene, and perchloroethylene, in digester gases (California Air Resources Board, 1985). Both the ORT and out-gassing pressure-relief valves would be conducive to emissions sampling. In addition, large vacant fields surrounding the treatment plant would allow for upwind and downwind sampling if necessary.

Bakersfield Wastewater Treatment Plant #2 (August 4, 1986)

The Bakersfield WWTP #2 (BWTP2) was managed by the city of Bakersfield. It treated an annual average wastewater flow of 14.3 MGD. The BWTP2 served a population of approximately 130,000 residents, as well as 350 commercial and industrial users that accounted for 5% of the wastewater that was treated. The plant had not treated petroleum refinery wastewater.

The treatment train for the BWTP2 was relatively simple. Influent passed through bar screens and a comminutor, followed by an aerated grit chamber, and two 110 ft. diameter primary clarifiers in parallel. Secondary treatment included two aerated waste lagoon systems in parallel. Each lagoon system was composed of two lagoons. Secondary effluent was pumped to storage reservoirs. Stored effluent was ultimately used for restricted agricultural purposes. The effluent was not chlorinated. Primary and secondary sludge both underwent anaerobic digestion before being spread upon 150,000 sq. ft. of sludge drying beds located on-site. Between one and two equivalent dry tons of sludge were treated each day.

The most significant sources of PTOC emissions at the BWTF2 were expected to be the two aerated processes, grit removal and waste lagoons. Primary clarification, digester gas relief, and stripping from sludge drying beds could have also been emissions sources. Previous sampling for priority pollutants at the BWTP2 indicated that ethylbenzene accumulated to significant concentrations in sludge. None of the other 16 PTOCs were detected in sludge samples. The last sample analysis for volatile priority pollutants was completed in 1983. At that time chloroform, ethylbenzene, methylene chloride, perchloroethylene, and toluene were all detected. However, all of those compounds occurred at relatively low concentrations ($<7 \mu\text{g/l}$). Because PTOC emissions were expected to be very low from the BWTP2, ambient or process sampling there would probably not be of great practical benefit.

Joint Water Pollution Control Plant (August 6, 1986)

The Joint Water Pollution Control Plant (JWPCP) was managed by the County Sanitation District of Los Angeles County (CSDLAC). With an annual average flow of 365 MGD, it treated the second largest flow of wastewater in the state of California. Approximately 15% of the total flow was discharged by industrial users, which included several oil refineries and metal finishing plants. The area that it served was densely populated, with greater than 3,000,000 domestic users. In addition to the sludge generated at the plant, the JWPCP treated sludge from several other CSDLAC MWTPs. The amount of sludge treated and disposed of averaged approximately 380 tons/day.

Approximately 33% of the incoming wastewater was subjected only to primary treatment. Primary treatment at the JWPCP consisted of eight bar screens, six covered grit chambers in parallel, and fifty-two covered primary clarifiers. The grit chambers were aerated. The wastewater that underwent only primary treatment was also subjected to aeration using three traveling water screens before being discharged to the Pacific Ocean. Off-gases generated during primary treatment were vented through caustic scrubbers, activated carbon filters, or both.

The remainder (67%) of the incoming wastewater was subjected to both primary and secondary treatment. The primary effluent was treated using a pure-oxygen activated sludge system. Secondary sludge was removed using up to fifty-two secondary clarifiers in parallel. The secondary wastewater transport channel was aerated for particle suspension. Off-gases from the channel were treated by wet scrubbing. Final effluent was chlorinated only when disinfection was found to be necessary. The final effluent was discharged to the Pacific Ocean.

Secondary sludge was thickened by using up to four dissolved air flotation (DAF) tanks. Off-gases were treated using a two-stage blower with an activated carbon filter. Primary sludge and thickened secondary sludge were treated using anaerobic digestion. Approximately 7,000,000 SCF/day of digester was burned in engines for power generation, with a portion having been intermittently flared. Following digestion, the sludge was dewatered using low speed scroll or basket centrifuges. Dewatered sludge cake was transported by conveyor belts to twelve 550 ton capacity storage silos. Air in the enclosure above the silos was scrubbed using activated carbon before being vented to the atmosphere. Approximately 67% of the sludge was trucked to landfills for ultimate disposal. The remainder was composted on-site for commercial use as a soil amendment. The composting area consisted of approximately 540 windrows which covered twenty-five acres. Each windrow averaged 825 feet in length, and had a capacity of 525 wet tons of sludge. For the purpose of mixing and aeration, windrows were turned daily using a mobile composter. By 1988, a large fraction of the dewatered sludge was scheduled to be used for combustion to produce additional electricity for the plant.

Although many of the processes at the JWPCP were covered, and off-gases were typically scrubbed for odor control, many potential emission sources existed. Sources of emissions could have included aerated wastewater transport channels, fugitive emissions from the activated sludge system, leaking digesters, out-gassing pressure-relief valves on digesters, off-gases vented from scrubbers, and emissions from sludge composting operations.

Previous gas-phase sampling for some PTOCs was completed by the staff of the CSDLAC, and indicated that, compared to other processes that were analyzed, the aerated primary effluent channel was a significant source of PTOC emissions. The sum total of emissions for 23 VOCs, including twelve PTOCs, was estimated to be approximately 150 lb/day from all of the processes analyzed. Those processes included several off-gas scrubbers, the aerated primary effluent channel, and the activated sludge aeration basins.

Past analyses of digester gases indicated high concentrations of VOCs. However, no emissions estimates were made for PTOCs escaping from the digesters. Because of the large amount of digester gas that was produced at the JWPCP, it may be beneficial to complete an analysis of digester gas components. A study of the amount of digester gas lost by leakage and out-gassing pressure-relief valves would also be valuable.

Estimates of emissions from sludge compost piles had not been completed. The process of sludge aeration by turning might have been a source of volatile emissions. However, the amount of PTOCs partitioned to sludge and remaining at that stage of treatment was not expected to be significant. Future sampling efforts during sludge aeration would lead to a better understanding of the significance of sludge composting as a PTOC emission source.

Liquid-phase sampling of the JWPCP influent has indicated high concentrations ($> 100 \mu\text{g/l}$) of benzene, methylene chloride, and toluene. Chloroform, 1,1 dichloroethylene, ethylbenzene, perchloroethylene, 1,1,1 trichloroethane, trichloroethylene, and vinyl chloride have also been detected.

Because of its size, location, and readily measurable concentrations of PTOCs, the JWPCP should be considered for future sampling. Unfortunately, ambient sampling will be complicated by background sources which are common in the industrialized region surrounding the JWPCP. Grit chambers, digesters, aerated conveyance channels, and aeration basins are sources that should be considered for

future emissions sampling. An opportunity also exists for determining the efficiency of odor scrubbers and activated carbon filters.

Hyperion Treatment Plant (August 7, 1986)

The Hyperion Treatment Plant (HTP) was managed by the Department of Public Works of the City of Los Angeles, treated more municipal wastewater (> 400 MGD) than any MWTP in California. The population served exceeded three million people, and included a large number of industrial users. Approximately twelve percent of the incoming wastewater was attributed to industrial users. Those users were varied in nature. However, they included several large industries (e.g., metal finishers, electroplaters, and oil refineries) which possibly discharged significant amounts of PTOCs to the HTP.

Two sets of headworks were used to treat the influent streams conveyed by four main sewers. Only two of the five grit chambers that followed the headworks were aerated. Following grit removal, wastewater was passed through twelve clarifiers in parallel. Of the 400 MGD of wastewater received by the HTP, seventy-five percent was discharged to the Pacific Ocean after undergoing only primary treatment. The primary effluent which underwent secondary treatment was passed through sixteen rectangular, uncovered, biological reactors in parallel. Tapered coarse bubble aeration was employed. The secondary effluent was passed through 20 uncovered sedimentation tanks in parallel. The final effluent, primary and secondary, was discharged five miles offshore into the Pacific Ocean. Final effluent was chlorinated only in the event that a the effluent was discharged through a one mile outfall.

Secondary sludge was thickened prior to anaerobic digestion. A total of eighteen floating roof digesters were used. Digester gas was stored in tanks, flared, and intermittently vented for pressure-relief. Ultimately, approximately 250 tons/day of dry sludge was being discharged, primarily through a seven mile offshore outfall. The remainder was trucked to landfills.

In comparison to other MWTPs in California, emissions from the HTP were expected to be significant because of relatively high PTOC concentrations in the influent stream, and the application of uncovered, aerated processes. For instance, during six sampling periods during the first quarter of 1986, the average toluene concentration in the influent stream was 152 µg/l. The most significant source of emissions was expected to be from the aerated biological reactors in the activated sludge system. Other potentially significant emissions sources included the main sewer vents, aerated grit chambers, an aerated channel used to convey primary effluent to biological reactors, and the venting of digester gas.

Liquid-phase sampling of primary clarifier influent and effluent had been completed by the staff of the HTP. However, interferences caused a general increase in PTOC concentrations across the clarifier. Thus, emissions from primary clarifiers could not be estimated. Additional sampling of clarifiers would be appropriate. Sampling at the aerated grit chambers and transport channels would be valuable in order to assess the significance of those processes as PTOC emission sources. The floating roof digesters should be investigated as a source of emissions. An analysis of digester gas and gas-phase sampling at digester tank roof edges would be desirable to complete such an analysis. Finally, ambient sampling at the HTP would be appropriate, particularly at the eastern border of the plant. Onshore airflow could cause residents to the east of the HTP to be exposed to PTOCs emitted from the HTP.

The HTP was scheduled for modification to a pure-oxygen treatment plant by 1993. Four 130 MGD pure-oxygen systems were to be implemented by that time. The additional aeration could lead to increased PTOC emissions. However, covered pure-oxygen treatment systems are believed to be less conducive to volatile emissions than are conventional activated sludge systems which utilize higher gas-to-liquid volume ratios for aeration. The modification affords the opportunity to complete gas and liquid-phase sampling of aeration basins before and after the conversion to a pure-oxygen plant. This could lead to a better under-

standing of the relative efficiencies of pure-oxygen and conventional activated sludge systems at stripping PTOCs to the atmosphere.

A system to dehydrate and incinerate the sludge was to be employed by 1987. This would completely eliminate the need for offshore discharge of the sludge. The effects of such a modification on PTOC emissions is not well understood.

Fresno Regional Wastewater Treatment Plant No. 1 (August 8, 1986)

The Fresno Regional Wastewater Treatment Plant No. 1 (FRWTP1) was managed by the Department of Public Works of the city of Fresno. It was the second largest MWTP, with respect to influent flowrate, in the interior valley region of California. The plant was located approximately six miles west of Fresno. The FRWTP1 treated an annual average flow of 42 MGD, and up to 8 MGD of effluent from the Fresno Regional Wastewater Treatment Plant No. 2 which was located approximately one mile south of the FRWTP1. In addition to having served a residential population of greater than 300,000, approximately six percent of the wastewater treated by the FRWTP1 was attributed to commercial and industrial users. Those users included electroplaters, industrial cleaners, hospitals, and independent and educational laboratories.

The FRWTP1 employed treatment up to the secondary level. Pre-chlorination was practiced at the headworks to control odors. After passing through bar screens, the wastewater was treated using up to four primary clarifiers in parallel. Primary effluent was conveyed via non-aerated channels to four activated sludge aeration basins. The basins were aerated using four coarse bubble donut diffusers per basin. Secondary effluent flowed to four final clarifiers before being pumped to a series of percolation ponds.

Primary sludge was thickened by utilizing two uncovered primary thickeners which were operated in either gravity or air flotation mode. Secondary sludge was simply being returned to the plant's headworks.

The blended sludge was stabilized using four anaerobic digesters, two of which were of the floating roof type. The staff of the FRWTP1 noted that sludge foam appeared infrequently on digester roofs. Sludge resided in the digesters for 25 to 30 days, before being placed in on-site drying beds. Digester gas was used to fire burners which produced heat necessary for the anaerobic digestion process. The gas was also compressed and used for mixing the sludge in the digesters. Some gas was flared in waste-gas burners, and the remainder was used for power generation. Approximately 250,000 cubic feet of digester gas was being produced each day.

No gas-phase sampling had been completed at the FRWTP1. However, based upon liquid-phase PTOC concentrations in the plant influent, PTOC emissions were expected to be low. The major sources of emissions were expected to be the four activated sludge aeration basins, as well as the headworks, where odors were the most pronounced. Other PTOC emission sources included the primary sludge thickeners in flotation mode, floating roof digesters, percolation ponds, and sludge drying beds.

Because of the relatively low expected PTOC emissions, gas-phase sampling at the FRWTP1 is not recommended. However, the chlorination of influent wastewater does afford the opportunity to study the formation of trihalomethanes as a result of pre-chlorination. Such THMs have ample time to volatilize as they travel through the treatment system. The aeration basins were scheduled to be modified to fine bubble systems by 1987, and secondary sludge thickeners similar to the primary sludge thickeners were to be employed. Both of the modifications would tend to increase volatilization. However, even with the expected increase in emissions, the overall PTOC emissions would probably remain low with respect to treatment plants of comparable size.

Sunnyvale Water Pollution Control Plant (August 13, 1986)

The Sunnyvale Water Pollution Control Plant (SWPCP) was managed by the City of Sunnyvale's Department of Public Works. The SWPCP employed

specific secondary and advanced treatment processes which the other seven MWTPs that were chosen for review did not employ. Furthermore, the SWPCP was characterized by an active sampling, analysis, and enforcement program, which stemmed from strict restrictions regarding the discharge of wastewater effluent into the southern end of San Francisco Bay. The SWPCP was located at the southern shore of the San Francisco Bay. It served the city of Sunnyvale, a small residential area in Cupertino, and a portion of the Moffett field naval air base. These areas accounted for a service population of greater than 100,000, and an average annual flow of approximately 20 MGD. In 1985, 69 industrial users discharged to the plant. These included several electroplaters and metal finishers, in addition to 28 electrical and electronic manufacturers. Commercial and industrial users contributed approximately 50% of the wastewater treated by the SWPCP.

The treatment train at the SWPCP included primary, secondary, and advanced treatment. Influent passed through bar screens located within an enclosed structure which was vented in order to reduce worker exposure to airborne emissions. The wastewater was then pumped to ten aerated, uncovered grit chambers, up to 10 in parallel. Primary clarification followed grit removal. Primary effluent then flowed to two oxidation ponds in parallel. All transport channels were covered and non-aerated. The two oxidation ponds covered 540 acres. They were no longer being aerated on a regular basis. However, surface aeration could be employed whenever necessary to raise dissolved oxygen levels in the ponds. Plans existed to convert the ponds to shallower, high-rate, channel ponds. Wastewater residence time in the ponds averaged 35 to 40 days before being pumped to trickling filters, one to three operated in parallel. The trickling filters were used to reduce ammonia concentrations in order to meet discharge requirements. The trickling filters were 35 feet deep, 92 feet in diameter, and they employed a corrugated aluminum packing material which presented a large surface area for biological growth. Trickling filter effluent, which included algae from the oxidation ponds, was then treated to remove the algae by employing a maximum of four air flotation tanks (AFTs). One to three AFTs were operated in parallel. Effluent from the AFTs flowed through

eight dual-media filters in parallel before being chlorinated in contact chambers with a chlorine dose rate of 2000-6000 lb/day. The chlorine contact time, before dechlorination using sulfur dioxide, ranged from 30 to 60 minutes. Final effluent was discharged to a slough where it flowed into the San Francisco Bay.

All primary sludge and 15% of the thickened algae removed in the AFTs was treated using four floating roof digesters. The remainder of the thickened algae was returned to the oxidation ponds. Digested sludge was placed in two drying beds which covered approximately 2.5 acres.

Liquid-phase sampling in 1985 indicated periods of relatively high concentrations ($> 20 \mu\text{g/l}$) of chloroform, methylene chloride, perchloroethylene, and toluene in the plant's influent stream. Composite influent and effluent samples also suggested that a significant amount of chloroform was being produced as a result of chlorination. This could be significant for the SWPCP, since final effluent was discharged to an uncovered slough which provided an opportunity for THM volatilization. In addition, a significant reduction in ammonia concentration by advanced treatment prior to chlorination reduced the competition among halogens and ammonia for available chlorine, which probably favored increased halogenation of organics.

Additional PTOC emissions could have occurred from the venting of the bar screen room, grit chambers, oxidation ponds, digester gas releases, trickling filters, and air flotation tanks. The latter two were expected to be insignificant, as PTOC concentrations were probably low at the advanced stage of treatment. The aeration of grit chambers could have lead to significant emissions of PTOCs. The termination of oxidation pond aeration should have reduced PTOC emissions during secondary treatment. However, the large surface area of the ponds is conducive to volatilization. Finally, as noted for the other plants that were visited, emissions from floating roof digesters were possible.

Because of the size of the SWPCP, extensive ambient sampling within

the plant's boundaries is not recommended. In addition, other nearby sources, including a landfill which bordered the SWPCP, would make it difficult to separate background concentrations from those attributed to the SWPCP. The most valuable future studies at the SWPCP would be upwind/downwind measurements of the chlorine contact chambers, and the slough which conveys effluent to the San Francisco Bay. Particular attention should be paid to concentrations of chloroform.

San Jose - Santa Clara Water Pollution Control Plant (8-13-1986)

The San Jose-Santa Clara Water Pollution Control Plant (SJSCWP) was managed by the City of San Jose Department of Water Pollution Control. At an average annual flowrate of approximately 110 MGD, the SJSCWP was the sixth largest MWTP, with respect to flow, in California. It was the largest in the San Francisco Bay region. In addition to serving a residential population of 1.1 million, the SJSCWP treated wastewater from a diverse cross-section of commercial and industrial users that accounted for greater than 30% (based upon the NEEDS data base) of the total wastewater discharged to the plant. Industrial users included electroplaters, metal finishers, and several circuit board manufacturers.

The SJSCWP employed a relatively high degree of treatment. Influent screening was composed of above-ground bar screens followed by finer screens. Wastewater was then passed through two non-aerated grit chambers in parallel, before passing through a maximum of 24 rectangular, primary clarifiers in parallel. Primary effluent was conveyed in an aerated open channel to an average of eight four-stage, coarse bubble, activated sludge treatment units operated in parallel. A maximum of sixteen aeration basins were available for biological treatment. Secondary effluent was clarified before being conveyed to an average of 12 on-line, aerated (coarse bubble) nitrification basins. The average aeration rates in the secondary and advanced aeration basins were 160,000 SCF per minute and 120,000 SCF per minute, respectively. Following nitrification, the wastewater was filtered using a multi-media

filtration system before being chlorinated, dechlorinated using sulfur dioxide, and discharged to the San Francisco Bay. The chlorine contact time was approximately one hour before dechlorination. Available chlorine was exposed to organics in the wastewater in addition to a small amount of ammonia added to the wastewater stream after nitrification but before multi-media filtration.

Primary sludge and thickened secondary sludge was mixed in 16 floating roof anaerobic digesters. The sludge residence time in the digesters was approximately 30 days. Sludge from the digesters was stored for several years in lagoons which cover 400 acres at the SJSCWP. Approximately 85 dry tons/day of sludge were dried in on-site drying beds before being disposed of to sludge piles. An average of 1.5 million cubic feet/day of digester gas was being produced, nearly all of which was used to run engines in order to generate power for the plant. In turn, engine cooling water was used to heat sludge in the digesters.

Liquid-phase sampling of the influent stream from 1984 to 1986 indicated high average concentrations of several PTOCs. For instance, during six 24-hour composite samples drawn during the noted period, the average concentrations for methylene chloride, perchloroethylene, and toluene were 104.0, 48.0, and 159.0 $\mu\text{g/l}$, respectively. Aside from chloroform (10.7 $\mu\text{g/l}$), 1,1,1 trichloroethane (4.0 $\mu\text{g/l}$), and trichloroethylene (11.0 $\mu\text{g/l}$), all other PTOCs were reported to be below detection limit in the influent stream. However, the detection of bromodichloromethane, and a high average concentration of chloroform in the effluent stream suggested the formation of THMs as a result of chlorination. Finally, influent samples were reportedly drawn after grit removal. Thus, some PTOC volatilization could have occurred prior to sampling.

The emissions of PTOCs were most likely from aerated processes such as the primary effluent channel, and activated sludge and nitrification aeration basins. The latter might not be a significant source, since if volatilization occurred it probably occurred to a great extent in the activated sludge basins. Additional emissions could have occurred as

digester gases escaped from the floating roof digesters, and THMs volatilized following chlorination. If gas-phase sampling is to be completed in the future, it is recommended that emissions from the aerated channel, aerated activated sludge basins, chlorine contact chambers, and digester roofs be investigated.

East Bay Municipal Utility District WWTF (August 19, 1986)

The East Bay Municipal Utility District WWTF (EBMUD) was managed by the East Bay Municipal Utility District. It was located on the Northwest boundary of Oakland, near the eastern edge of the San Francisco Bay Bridge. It served the cities of Alameda, Berkeley, Emeryville, Oakland, Piedmont, El Cerrito, Kensington, and a small area of Richmond. In total, 567,000 residential customers, and over 20,000 business and industrial users, discharged an annual average flow of approximately eighty million gallons of wastewater per day. Industrial users contributed approximately 10% of the total flow. As of 1985, 91 of those users were subject to the EPA's categorical standards for industries. Included in the list, with the number of facilities indicated in parentheses, were industries involved with electroplating (35), metal molding and casting (19), metal finishing (14), pharmaceuticals (7), and iron and steel (5).

The EBMUD operated a secondary treatment facility. The influent was pre-chlorinated as an odor control measure. Five bar screens were operated in parallel inside of a covered facility. Air from the facility was vented through a chlorine spray scrubber before being discharged to the atmosphere. After screening, wastewater was pumped to up to five gravity-flow grit tanks in parallel. The wastewater flowed over a weir at the end of each tank. During storms, up to eight aerated grit tanks could be employed as needed. From the grit tanks, the wastewater was clarified using a maximum of sixteen primary clarifiers in parallel. Primary effluent was conveyed in an aerated, covered channel, where it fed into a pure-oxygen activated sludge system. The activated sludge reactors were covered, and involved eight four-stage trains which

utilized submerged turbine mixer/spargers for oxygen transfer. The mixed liquor recycle channel was aerated for particle suspension. Twelve final clarifiers were used to collect secondary sludge. Secondary effluent was chlorinated and later dechlorinated using sulfur dioxide. The effluent outfall was composed of a 1.75 mile long partially-open channel followed by a 1.1 mile long conveyance line leading to a discharge at the bottom of San Francisco Bay. A 700 foot length of diffuser was employed.

An average of 1850 dry tons of sludge was disposed of each month. Approximately 75% of the sludge was trucked to landfills, and 25% was mixed with woodchips and composted for commercial use. Primary sludge was pumped directly to anaerobic digesters. Secondary sludge was thickened by centrifuge before being mixed with primary sludge in the digesters. Ten high-rate, floating roof digesters were being used, each with an eight day sludge residence time. Digested sludge was dewatered by centrifuge and vacuum filters before being disposed of to landfills or to the on-site composting area. The 1.2-1.4 million cubic feet per day of digester gas was burned in three large engines which supplied up to 50% of the facility's power requirements. Waste heat was utilized to heat digesters, sludge conveyance pipes, and buildings at the plant.

The EBMUD maintained a well-equipped laboratory which allowed for relatively extensive priority pollutant analyses for samples drawn from the influent, effluent and sludge streams. Liquid-phase influent sampling completed from 1984 to 1986 indicated relatively high average concentrations of several PTOCs, including benzene, chloroform, methylene chloride, perchloroethylene, and toluene. In addition, average chloroform concentrations in the effluent stream were approximately equal to those in the influent stream. Bromodichloromethane was also infrequently detected in the effluent stream, and never detected in the influent stream. Finally, sampling for PTOCs in dewatered sludge indicated some accumulation of ethylbenzene and toluene.

Previous gas-phase sampling of activated sludge off-gases and the air above the mixed-liquor recycle channel were completed by the staff

of the EBMUD. However, all of the PTOCs were observed to be below detection limit.

A number of processes could have contributed to PTOC emissions from the EBMUD WWTF. Those included the large weirs on the gravity grit chambers, vented activated sludge off-gases, the aerated mixed-liquor recycle channel, floating roof digesters, and sludge composting. Emissions from grit tank weirs could be addressed using either gas sampling above the weir or pre-weir and post-weir liquid-phase sampling. Additional gas-phase sampling is needed to verify the previous results regarding emissions from the aerated recycle channel and activated sludge basins.

Recommendations for Future Sampling

It is recommended that extensive future sampling be completed at the JWPCP, to investigate the difference between estimated uncontrolled emissions and measured controlled emissions, and to study the relative stripping efficiencies of control devices at removing PTOCs from off-gas streams. A complete study would include liquid-phase sampling for PTOCs in the JWPCP's influent and effluent streams, as well as in the influent and effluent streams of several processes; bar screens, grit chambers, primary clarifiers, and pure-oxygen activated sludge reactors. Wastewater flowrates should either be measured or obtained from plant records. During the same time period that liquid-phase samples are drawn, gas-phase PTOC concentrations and off-gas flowrates should be measured in the air spaces above individual processes, as well as at the exit vents of caustic scrubbers and activated carbon filters. It would also be desirable to account for wastewater residence times in each process stream. Aerated channels, sludge composting operations, and pure-oxygen activated sludge reactors should also be investigated as emissions sources.

In the remainder of this appendix, recommendations are made for studying emissions from individual treatment processes that are most conducive to both volatile emissions and sampling.

Primary Treatment: Because PTOC concentrations are generally the highest as they enter treatment facilities, bar screens, grit chambers, and primary clarifiers require further attention as potential sources of PTOC emissions. As noted above, simultaneous liquid and gas-phase measurements of concentrations and flowrates would be desirable. The Sunnyvale WWTF and the East Bay MUD WWTF both utilize bar screens enclosed in buildings. Each would provide suitable sampling conditions. The East Bay MUD WWTF also employs grit chamber effluent weirs which should be considered for sampling, as the weirs are characterized by several feet of free-falling water, a condition conducive to volatilization. The JWPCP utilizes covered primary clarifiers and enclosed, aerated grit chambers which should be further studied as PTOC emissions sources. Because grit chambers at the San Jose-Santa Clara WPCP and the East Headworks at the Hyperion Treatment Plant (HTP) are not aerated, and because PTOC mass loadings into those two facilities have been relatively high, PTOC concentrations in the primary clarifiers of those two systems may be high enough to cause significant volatile emissions. It is recommended that they be considered for future sampling.

Aerated Transport Channels: Aerated primary transport channels may be significant sources of PTOC emissions. In addition to the JWPCP, other MWTPs that utilize aerated transport channels include the HTP, the San Jose-Santa Clara WPCP, and the East Bay MUD WWTF. The Aerated channels at the JWPCP and the East Bay MUD WWTF are covered and more conducive to off-gas sampling than are the channels at the other two plants.

Biological Reactors: Conventional and pure-oxygen activated sludge (AS) systems should be considered for future sampling of PTOCs in both the liquid and gas phases. Of the eight plants that were visited, the Sacramento Regional WWTF, the East Bay MUD WWTF, and the JWPCP employ pure-oxygen AS systems. That latter differs from the former two in that it utilizes surface, rather than submerged, oxygenation. Both types of oxygenation should be studied in order to gain a better understanding of their PTOC stripping efficiencies. Because the East Bay MUD WWTF has been subjected to higher PTOC loadings than has the Sacramento Regional WWTF, it may be preferable for comparison with the JWPCP's pure-oxygen

AS system. In addition, the HTP will be converted to a pure-oxygen AS plant in the future. Thus, it affords the opportunity to complete sampling of PTOC emissions from both conventional and pure-oxygen AS systems at the same facility. The San Jose-Santa Clara WPCP also utilizes conventional AS treatment.

Chlorination Systems: To study the emissions of chloroform following chlorination, influent and effluent streams, and the air upwind, above, and downwind of chlorine contact chambers should be sampled. Of the eight MWTPs that were visited, the four that appeared to generate the greatest amount of chloroform were the Sacramento Regional WWTF, the East Bay MUD WWTF, the San Jose-Santa Clara WWTF, and the Sunnyvale WWTF. The latter two may be the most conducive to volatile emissions, as both the chlorine contact chambers and the effluent outfall systems are open to the atmosphere.

Digesters: A great deal of uncertainty exists regarding emissions from digesters. However, high concentrations of some PTOCs have been observed in digester gases. Component analyses of digester gases, and gas-phase sampling at the openings of floating roof digesters and pressure-relief valves could lead to a better understanding of the importance of digesters as PTOC emissions sources. Based upon the amount of digester gas produced, PTOC mass loadings, and the type of digesters utilized, digesters at the JWPCP, the HTP, and the San Jose-Santa Clara WPCP are recommended for future sampling.

Ambient Sampling: As noted in Section B of this report, the HTP is recommended for ambient sampling, particularly at the eastern border of the plant. During periods of onshore breezes, simultaneous measurements to the west of the plant would be desirable to distinguish concentrations attributed to the HTP from background PTOC levels.

Other Plants to Consider: Only eight MWTPs were visited as part of this study. Uncontrolled emissions estimates indicated that three other MWTPs that were not visited may be significant sources of PTOC emissions. Those plants are the Terminal Island Treatment Plant, the

Palo Alto WWTF, and the OCSD WWTF #2. It is recommended that those facilities be visited and studied to indicate whether or not future sampling is warranted.

APPENDIX H: TEST (A Refined Emissions Model)

Modeling the Emissions of Volatile and
Potentially Toxic Organic Compounds From
Municipal Wastewater Treatment Plants

Richard L. Corsi
Daniel P.Y. Chang
Edward D. Schroeder
Qingzeng Qiu

Department of Civil Engineering
University of California at Davis
Davis, California 95616

INTRODUCTION

Occurrences of potentially toxic organic compounds (PTOCs) in the influent streams of municipal wastewater treatment plants (MWTPs) are of concern for several reasons. Such compounds may contaminate sludge, interfere with biological treatment processes, endanger the health of treatment plant employees, and cause adverse effects to sensitive effluent receiving waters. Because of their affinity for the gaseous phase, volatile PTOCs (VTOCs) have been the focus of recent studies regarding emissions from MWTPs.¹⁻³ Volatile PTOCs that are frequently detected in the influent streams of MWTPs include benzene, chloroform, ethylbenzene, methylene chloride, perchloroethylene, toluene, 1,1,1-trichloroethane, and trichloroethylene.

Because of the cost and experimental difficulties associated with VTOC emissions measurements, the application of semi-empirical mass transport models is an attractive and valuable method to study the emissions associated with wastewater treatment. Models can be used to estimate emissions from entire treatment trains or from individual treatment processes. The resulting emissions estimates can then be used for emissions inventories, as input into transport models, or to analyze the effects of treatment modifications on the fate of organic contaminants.

This paper discusses methods used to model the distribution of VTOCs in MWTPs. The development of a user-oriented model to predict VTOC emissions throughout entire treatment trains is then described. Individual treatment processes and the competition among removal mechanisms are emphasized.

TRANSPORT AND REMOVAL OF VTOCS DURING WASTEWATER TREATMENT

The primary transport and removal mechanisms for organic contaminants in wastewater are volatilization, adsorption and removal in sludge streams, biodegradation, and pass-through to receiving waters. In addition, formation of organic contaminants can occur during wastewater treatment. To provide readers unfamiliar with wastewater treatment some background regarding the systems to be modeled, each of the removal and formation mechanisms is briefly described below.

Volatilization

Several treatment processes have characteristics that are conducive to the volatilization of VTOCs. For instance, high concentrations of contaminants are first exposed to the atmosphere at uncovered primary treatment processes such as bar screens and grit removal tanks. While the hydraulic residence times in such processes are low, the bars and racks on screening systems induce turbulence at the surface of the wastewater. Furthermore, grit tanks are often aerated, thus increasing the potential for stripping to the atmosphere. Residence times in primary clarifiers are generally much longer than those in screening systems or grit tanks. The large open clarifier surfaces and flow over clarifier weirs can lead to VTOC emissions.⁴

Secondary treatment processes such as trickling filters and activated sludge systems present additional opportunities for volatilization. In trickling filters, wastewater is contacted with biological organisms adhering to rock or plastic media. To promote efficient biodegradation of organic contaminants, large surface areas are exposed to reduce mass transfer resistance. In order to supply the aerobic organisms with oxygen, air is either actively blown or allowed to rise through the filter media by drafts induced by natural temperature gradients. Activated sludge systems and aerated waste lagoons also promote volatilization because both are aerated or oxygenated and have relatively long residence times.

Other treatment processes where volatilization can occur include aerated conveyance channels, rotating biological contactors, overland flow systems, and equalization basins.

Removal in Sludge Streams

Organic compounds can adsorb to suspended solids and biomass with subsequent removal in primary and secondary clarifiers. A previous study indicated that adsorption and removal of VTOCs in primary sludge streams is significantly greater than removal in waste activated sludge streams.⁵ This may be due to higher concentrations during primary treatment, as well as efficient stripping as a result of aeration in secondary systems. The adsorption of individual organic compounds to solids found in wastewater is not well understood. However, octanol/water partition coefficients have been used to rank VTOCs according to their relative affinity for adsorption.⁵ It was concluded from analysis of raw mass flow data that removal in sludge streams typically accounts for less than five percent of the total removal of VTOCs throughout an entire treatment train.⁶

Biodegradation

Biochemical oxidation of organic contaminants occurs at secondary and advanced treatment processes such as trickling filters, waste lagoons, activated sludge systems, oxidation ponds, rotating biological contactors, overland flow systems, and wetland systems. However, little is known regarding the bio-oxidation efficiency of VTOCs during municipal wastewater treatment. Laboratory research has indicated that several VTOCs (i.e., benzene, chlorobenzene, ethylbenzene, and toluene) can be efficiently bio-oxidized under the appropriate conditions.^{7,8} However, such research is typically completed using high contaminant concentrations (> 10 mg/l) and steady-state contaminant feeds, conditions which are necessary to maintain acclimated microbial populations. Volatile PTOC concentrations in municipal wastewaters rarely exceed 0.1 mg/l, and slug discharges are common. MWTPs are not believed to meet the conditions that are necessary for acclimation, and thus efficient bio-oxidation of VTOCs is not expected to occur. Some degradation in unacclimated systems is expected to occur as a result of cometabolism by bacteria that utilize other organic material as their carbon source.⁹ For most of the VTOCs the average percent degraded in

unacclimated secondary treatment facilities has been reported to be between 0.0 and 20%, as opposed to values as high as 74%, for benzene, in acclimated systems.¹⁰

Formation

Pre-chlorination for odor control and post-chlorination for disinfection can lead to the formation of trihalomethanes (THMs) such as bromodichloromethane, dibromochloromethane, and chloroform. The ratio of average THM mass loadings in effluent streams to the mass loadings in influent streams is typically greater than 1.0 for those MWTPs that post-chlorinate, and much less than 1.0 in those MWTPs that do not post-chlorinate.^{6,11} The factors that affect the formation of THMs during municipal wastewater treatment are complex, not well understood, and were not treated in the present modeling effort.

Pass-Through

The VTOCs that enter a MWTP or that form during the treatment process, and that are not removed by one of the removal mechanisms described above, are passed through the treatment system and discharged in the effluent stream. An analysis of data compiled from previous studies indicated that the average percent pass-through (100% - percent removed) for VTOCs is typically less than 20%.⁶ The fate of VTOCs following pass-through is not well documented. No attempt was made to model VTOCs which passed through a MWTP.

VTOC DISTRIBUTION MODELS

The simplest predictive distribution models (PDMs) are based upon the assumption of steady-state conditions. While such conditions are typically not satisfied at MWTPs, steady-state PDMs can be valuable in order to assess the effects of treatment plant modifications on the fate of VTOCs. Furthermore, existing data are insufficient to establish concentration distributions as input into more complex transient models. The following analysis is based upon the assumption of steady-state conditions. Models are presented for continuous flow stirred-tank reactors (CFSTRs), plug-flow reactors (PFRs), and trickling filters. A brief discussion of approaches to estimating model parameters is then given.

CFSTRs

The concentration "C" of a VTOC in a CFSTR is assumed to be equal to the effluent concentration. This simplifies the distribution model, particularly for the case when a portion of the treated flow is recycled. For a CFSTR the steady-state effluent concentration, "C_e", is estimated by

$$C_e = C_i / \{1.0 + r(k_v + k_b + k_s)\}, \quad (1)$$

where C_i is the influent concentration, r is the hydraulic residence

time (volume of process/wastewater flowrate), and k_v , k_b , and k_s are the rate constants for removal by volatilization, biodegradation, and adsorption to sludge, respectively. The CFSTR model can be used to estimate VTOC losses from well-mixed systems, which can include aerated lagoons and aeration basins.

PFRs

Plug-flow reactors are characterized by ideal mixing in the lateral direction and no mixing in the longitudinal direction. A simplified method for modeling transport in PFRs is to treat the PFR as a series of successive CFSTRs. The effluent concentration from the PFR can then be calculated as

$$C_e = C_i / \{1.0 + (r/n)(k_v + k_b + k_s)\}^n \quad (2)$$

where C_i , r , k_v , k_b , and k_s are as defined previously, and n is the number of CFSTRs used to model the PFR. Equation 2 can be used to estimate VTOC losses from grit removal tanks, clarifiers, aeration basins, conveyance channels, and other systems with negligible mixing in the longitudinal direction. When effluent from a PFR is recycled, an iterative procedure is required to solve the equation because the concentration is not uniform throughout the reactor.

Trickling Filter Models

For this study, a model for the removal of VTOCs in trickling filters was assumed to have a form similar to models which are used to predict reductions in biochemical oxygen demand (BOD). A simplified exponential model is

$$C_e = C_i \exp\{-(k_v + k_b + k_s)[pAh/(Q + pQ)]\}, \quad (3)$$

where p is the porosity of the filter media, A is the cross-sectional area of the filter, h is the depth of the filter, Q is the wastewater flowrate, and all other variables are as described previously. For systems with recycle, Equation 3 must be modified using an "effective" influent concentration C_i' such that

$$C_i' = (C_i + bC_e)/(1 + b), \quad (4)$$

where b is the fraction of the incoming flow recycled from the effluent to the influent stream (recycle ratio). An iterative solution algorithm is then required.

Estimating k_v

Values for k_v are typically estimated by calculating the mass transfer coefficient for oxygen (reaeration rate), " k_o ", and then applying the relationship

$$k_v = a'k_o, \quad (5)$$

where a' is the transfer rate proportionality coefficient. The basis for a constant k_v/k_o is found in the classical two-film, penetration, or surface renewal theories of mass transfer across an air-water interface.¹² The two latter theories describe highly agitated conditions better than the former. Two-film theory is commonly used for less-agitated conditions. Taking the ratio of the theoretical fluxes for two high-volatility compounds (e.g., a VTOC and oxygen) causes the dependence of wastewater parameters such as temperature and viscosity to cancel, leaving only the physical properties (i.e., diffusion coefficient) of the two compounds. For two-film theory a' is equal to the ratio of the VTOC to oxygen diffusion coefficients. For penetration and surface renewal theories, a' is equal to the square root of the ratio of the VTOC to oxygen diffusion coefficients. Experiments have verified that the values of a' , estimated using the above theories, typically lie between 0.55 and 0.65 for most of the VTOCs.^{12,13}

Empirical methods have been proposed to estimate values of k_o , and an extensive review of those methods has been completed.¹⁴ Most of the methods were developed for natural systems such as ponds, streams, and rivers. However, they have been used successfully to model mass transfer in wastewater treatment systems.⁴ For surface aerated systems the value of k_o is commonly taken to be the area-weighted average of mass transfer rates for non-agitated and agitated regions. The non-agitated regions can be treated as natural systems as noted above. To estimate mass transfer coefficients in the agitated regions, empirical models have been developed. Those models typically require knowledge of aerator characteristics, such as power rating, efficiency, and oxygen transfer rate, that are often available from the manufacturer of the aerator.

For bubble aeration, k_v is dependent upon the degree of saturation of rising air bubbles. A method has been developed to estimate the product of the hydraulic residence time and k_v for use in Equation 1.¹³ Model requirements include the ratio of the gas to liquid flowrates, the dimensionless Henry's law coefficient, and the type of bubbles (i.e., coarse, medium, or fine).

For those systems that are characterized by radial flow (RF), PFR models can be used along with mass transfer coefficients obtained by integrating k_v or k_o equations in the radial direction. Such models have been used for radial flow clarifiers.

Estimating k_b

Bio-oxidation rates for VTOCs have not been extensively reported.^{15,16} The bio-oxidation rates that have been reported for VTOCs are believed to overestimate the removals caused by biodegradation. The reason for overestimation is because the rates are commonly based upon laboratory experiments completed under conditions required to maintain biological acclimation to the VTOCs. Large uncertainties are associated with the extrapolation of those values to field conditions.

Estimating k_s

Few models exist to estimate adsorption to solids and biomass. Empirical models have been developed to estimate the partitioning of VTOCs between the wastewater and activated sludge.^{4,17} However, the models are limited because they do not allow for time variations, or they are based upon laboratory studies that suppressed other removal mechanisms.

INTEGRATED EMISSIONS MODEL

General

An integrated emissions model (TEST; Toxic Emissions during Sewage Treatment) was developed in order to estimate VTOC emissions from entire wastewater treatment systems. The individual process models described in the previous section, in addition to several less commonly used models, were incorporated into the TEST model. The TEST model is user-oriented, and flexible in its ability to model user-specified treatment configurations. An option flow diagram for the TEST model is shown Figure 1. Initial input requirements include the choice of VTOCs to be modeled. Following the initial input segment, treatment processes are selected in sequence until the entire treatment train is modeled. Processes can be specified to be in series or in parallel. The effluent concentrations from individual processes are used as influent concentrations in the nearest downstream processes. The process options are described below.

The grit chamber option is used to estimate emissions from either aerated or non-aerated grit removal tanks. In either case, plug flow is assumed and modeled using a series of successive CFSTRs. Volatilization is assumed to be the only removal mechanism.

The clarifier option allows for either plug or radial flow to be modeled. Emissions from either primary or secondary clarifiers can be estimated. The user may choose to enter adsorption rate constants if they are available.

An option to estimate emissions from conveyance channels is also included. Emissions from aerated channels can be modeled. Regardless of the degree of aeration, plug flow is assumed and modeled using successive CFSTRs.

The trickling filter submodel is based upon Equation 3. In addition to the physical specifications of the trickling filter, the user must input a volatilization rate for each VTOC based upon a range specified on the model menu. Bio-oxidation and adsorption rates may be input interactively. The trickling filter option also allows for recycle of the effluent flow. If recycle is used, an iterative procedure is required with the user having to prescribe an initial estimate for the effluent concentration of each VTOC.

The activated sludge model allows several user options. The system can be modeled as a CFSTR or a PFR. Surface or bubble aeration can be prescribed. For bubble aeration, coarse, medium, or fine bubble diffuser systems can be analyzed. Uniform and tapered aeration options are available. Bio-oxidation and adsorption rates are entered by the user. If a PFR with recycle is modeled, an iterative solution is required.

Other treatment processes can be "constructed" during the model execution by specifying the appropriate reactor models and requirements for aeration.

Following the analysis of one process, the user then specifies the next process to be analyzed. Once all of the processes in the treatment train have been analyzed, process specifications, concentrations, removal efficiencies, and emissions for the selected VTOCs at each individual treatment process are output.

Example Application

To exemplify the use of the TEST model, an example application is provided. A simplified treatment configuration was chosen as depicted in Figure 2. The treatment processes that were involved included an aerated grit tank, followed by two rectangular clarifiers (sedimentation basins) in parallel, three CFSTR activated sludge aeration basins in parallel, and three secondary clarifiers in parallel. Specifications for each process are also listed in Figure 2. Benzene and vinyl chloride were analyzed using an influent concentration of 100 $\mu\text{g/l}$ for each. Bio-oxidation rates of 0.005 hours^{-1} were selected for the activated sludge systems. Adsorption was assumed to be insignificant. An influent flowrate of $2.2 \text{ m}^3/\text{sec}$ (50 million gallons per day) was assumed.

The predicted emission rates and removal efficiencies are provided for each individual process in Figure 2. For both benzene and vinyl chloride, most of the total removal occurred in the activated sludge aeration basins. The percent removal was significantly greater for vinyl chloride, which has a much higher Henry's law constant than benzene. For each VTOC, greater than 99% of the total removal in the aeration basins was attributed to volatilization which clearly dominated bio-oxidation as the primary removal mechanism. Removal in each of the clarifiers was relatively insignificant. Removals in the aerated grit chambers were greater than removals in the clarifiers. However, because the aeration rates and hydraulic residence times in grit chambers are typically very low, emissions from those devices appear to be much lower than emissions from activated sludge aeration basins. The overall removal efficiencies for benzene and vinyl chloride were 32% and 75%, respectively. Emissions throughout the entire treatment train amounted to 6.1 kg/day for benzene and 14.1 kg/day for vinyl chloride.

SUMMARY

A model (TEST) has been developed to predict the distribution of organic contaminants during municipal wastewater treatment. The model was exercised in an example application which exemplified the significance of aerated secondary treatment processes as emissions sources. For VTOCs, the primary removal mechanism appears to be volatilization. Further validation will be required, but even at this stage TEST can be used to predict emissions of VTOCs throughout entire treatment systems. Moreover, the relative importance of specific treatment processes can be studied and the effects of process modifications as emission control measures can be assessed. The model has been delivered to the California Air Resources Board for further evaluation.

ACKNOWLEDGEMENTS

This study was supported by the California Air Resources Board (CARB) under contract #A5-127-32. The authors would like to thank the staff of the CARB, particularly Mr. Joseph Pantalone, for their assistance. Ms. Barbara Nichols and Ms. Virginia Roy were of great assistance in preparing the final manuscript.

DISCLAIMER

"The statements and conclusions in this paper are those of the contractor and not necessarily those of the California Air Resources Board. The mention of commercial products, their source or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

REFERENCES

1. California Air Resources Board, Source Tests for Vinyl Chloride and Other VOCs at Sewage Treatment Plants, memorandum to D.C. Simeroth, P. Ouchida and K. Jones, 1985.
2. V.S. Dunovant, C.S. Clark, S.S. Que Hee, V.S. Hertzberg, and J.G. Trapp, "Volatile organics in the wastewater and airspaces of three wastewater treatment plants," Journal of the Water Pollution Control Federation, 58(9): 886 (1986).
3. P.A. Lurker, C.S. Clark and V.J. Elia, "Atmospheric release of chlorinated organic compounds from the activated sludge process," Journal of the Water Pollution Control Federation, 54(12): 1566 (1982).
4. C.C. Allen, D.A. Green, J.B. White and J.B. Coburn, Preliminary Assessment of Air Emissions From Aerated Waste Treatment Systems at Hazardous Waste Treatment Storage and Disposal Facilities, U.S. Environmental Protection Agency, Hazardous Waste Engineering Research Laboratory, Office of Research and Development, Cincinnati, Ohio, 1986.
5. G. Dixon and B. Bremen, Technical Background and Estimation Methods for Assessing Air Releases from Sewage Treatment Plants, Versar, Inc., memorandum to F. Reinhardt, 1984.
6. D.P.Y. Chang, E.D. Schroeder and R.L. Corsi, Emissions of Volatile and Potentially Toxic Organic Compounds From Wastewater Treatment and Collection Systems, Draft Report Submitted to the California Air Resources Board, 1987.
7. D.F. Kincannon, E.L. Stover, V. Nichols and D. Medley, "Removal mechanisms for toxic priority pollutants," Journal of the Water Pollution Control Federation, 55(2): 157 (1983).
8. C.T. Lawson and S.A. Siegrist, "Removal mechanisms for selected priority pollutants in activated sludge systems," Proceedings of the ASCE Environmental Engineering Division Specialty Conference, 1981 National Conference on Environmental Engineering, F.M. Saunders, Ed.: 356 (1981).
9. C.J. Kim and W.J. Maier, "Acclimation and biodegradation of chlorinated organic compounds in the presence of alternate substrates," Journal of the Water Pollution Control Federation, 58(2): 157 (1986).
10. U.S. Environmental Protection Agency, Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works, EPA/530-SW-86-004, U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, D.C., 1986.

11. U.S. Environmental Protection Agency, Fate of Priority Pollutants in Publicly Owned Treatment Works, vol. 1, EPA 440/1-82/303, U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, D.C., 1982.
12. J.H. Smith, D.C. Bomberger, Jr. and D.L. Haynes, "Prediction of the volatilization rates of high-volatility chemicals from natural water bodies," Environmental Science and Technology, 14(11): 1332 (1980).
13. P.V. Roberts, C. Munz, P. Dandliker and C. Matter-Muller, Volatilization of Organic Pollutants in Wastewater-Model Studies, EPA-600/52-84-047, U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory, Cincinnati, Ohio, 1984.
14. R.G. Thomas, Volatilization from Water, Chapter 15 in Handbook of Chemical Property Estimation Methods, W.J. Lyman et al., Ed., McGraw-Hill Book Co., New York, 1982.
15. J.W. Patterson and P.S. Kodukala, "Biodegradation of hazardous organic pollutants," Chemical Engineering Progress, 77(4): 48 (1981).
16. W.J. Weber, B.E. Jones and L.E. Katz, "Fate of toxic organic compounds in activated sludge and integrated PAC systems," Water Sci. Tech., 19: 471 (1987).
17. J.W. Blackburn, W.L. Troxler, K.N. Truong, R.P. Zink, S.C. Meckstroth, J.R. Florance, A. Groen, G.S. Sayler, R.W. Beck, R.A. Minear, A. Breen and O. Yagi, Organic Chemical Fate Prediction in Activated Sludge Treatment Processes, EPA/600/52-85/102, U.S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, 1985.

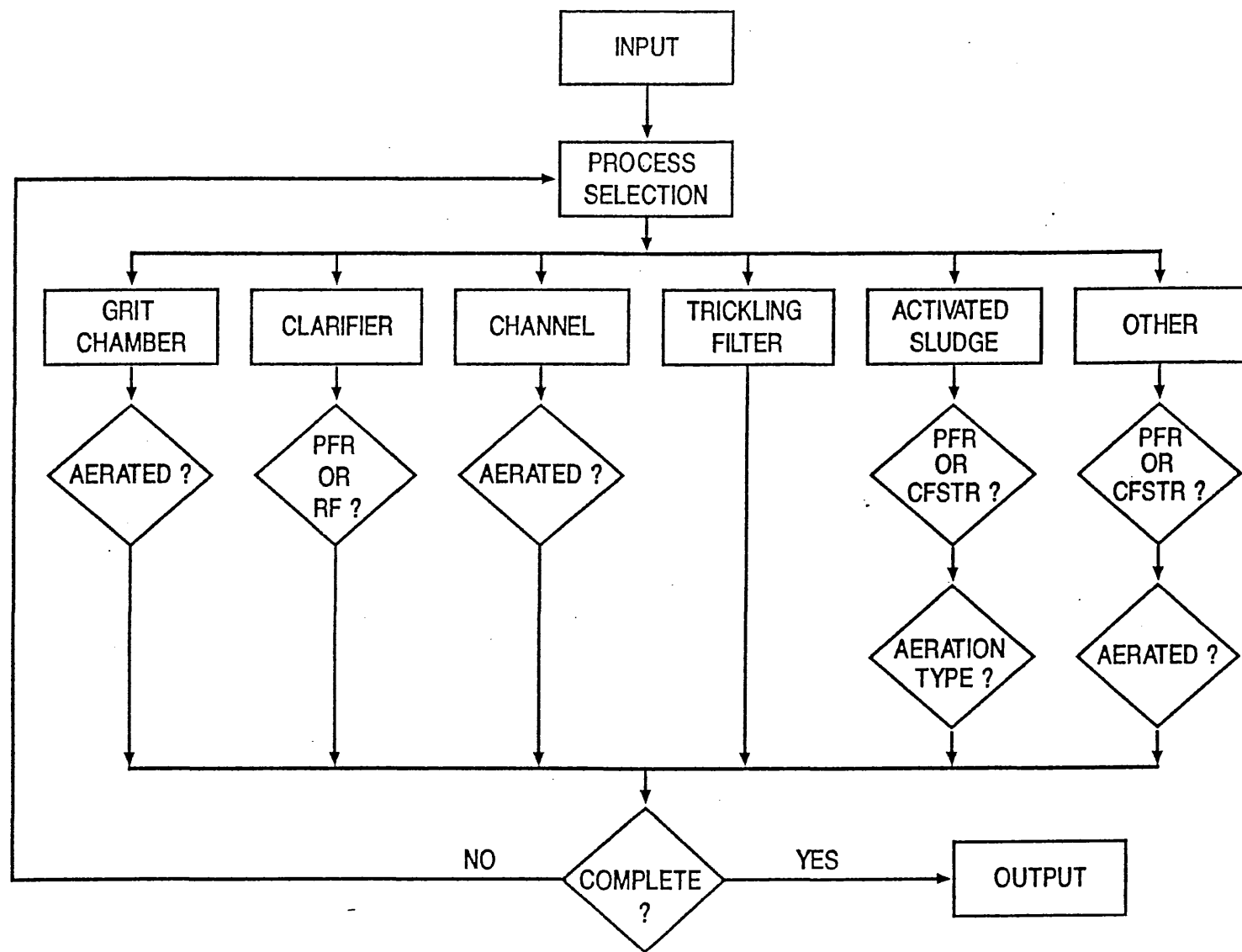
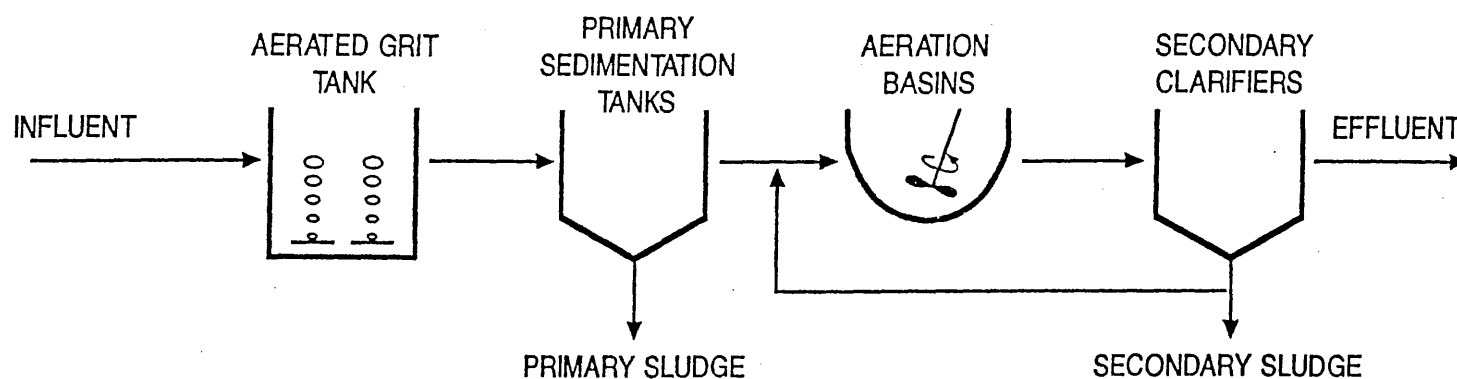


FIGURE 1. OPTION FLOW DIAGRAM FOR THE TEST MODEL



INFLUENT	GRIT TANK	PRIMARY SED. TANKS	AERATION BASINS	SECONDARY CLARIFIERS
Flow: 2.2 m ³ /sec	Depth: 3.5 m	Rectangular	CFSTR	Rectangular
Benzene: 100 µg/l	Width: 8.0 m	Two in parallel	Three in parallel	Three in parallel
Vinyl chloride: 100 µg/l	Length: 25.0 m	Depth: 4.0 m	Volume: 7000 m ³	Depth: 4.0 m
	Aeration: 0.08 m ³ /sec	Width: 14.0 m	Aeration: 1.4 m ³ /s	Width: 14.0 m
	HRT: 0.09 hours	Length: 80.0 m	HRT: 2.66 hours	Length: 80.0 m
		HRT: 1.14 hours		HRT: 1.71 hours
	E (kg/day) % REM	E (kg/day) % REM	E (kg/day) % REM	E (kg/day) % REM
Benzene	0.2 0.9	0.01 0.04	5.9 31.0	0.01 0.04
Vinyl chloride	.6 3.3	0.01 0.04	13.5 73.9	0.00 0.04

FIGURE 2. EXAMPLE APPLICATION USING THE TEST MODEL. HRT = HYDRAULIC RESIDENCE TIME, E = EMISSION RATE (KG/DAY), AND % REM = PERCENT OF EACH VTOC REMOVED ACROSS THE PROCESS