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MEMORANDUM
April 10, 1984

To: Carol Fleskes

Through: John Bernhardt

From: Art Johnson

Subject: Comments on the Reapplication for a 301(h) Marine Waiver by the City of Tacoma for the North End Wastewater Treatment Plant

John Bernhardt requested I review the Tacoma North End Wastewater Treatment Plant reapplication[1] for modification of secondary treatment requirements to: (1) determine if the applicant qualifies for a waiver based on receiving environment considerations, and (2) if the applicant qualifies, comment on the proposed monitoring program. The original application was reviewed and denied by EPA.

I do not believe the new information submitted by the applicant justifies reversing the original decision to deny. My judgment is based primarily on the following concerns:

1. The pulsed-bed filtration proposed as modified treatment for the plant's primary effluent is a technology currently under development and, as such, cannot be relied on to achieve a reduction in solids discharged to the receiving environment approaching secondary, as suggested by the applicant.

2. The discharge has the potential to interfere with a balanced indigenous population of marine life.

3. The plant discharges to an important and limited habitat for juvenile salmon in Commencement Bay.

4. The effluent is one of the major known sources of toxicants discharged to Commencement Bay.

5. The receiving environment is known to be stressed. The volume, character, and dispersion pathways of the discharge suggest it to be a contributor to this stress.

6. Bacteria, suspended solids, and toxicants discharged by the plant are incompatible with existing and proposed recreational use of the Ruston shoreline.

These and other concerns considered grounds for denying the reapplication are discussed below.

BACKGROUND

The initial application was originally submitted in 1979. Justification for the waiver was based on assessment of existing conditions in the treatment plant and receiving waters, as required by the application process. The applicant proposed an improved discharge involving addition of a diffuser to the existing marine outfall. A request for a variance on biochemical oxygen demand and suspended solids was also made. EPA denied the application based on a Technical Evaluation Report[2] (TER) prepared in June 1981 by Tetra Tech, Inc., an outside contractor, and staff review of the application and other data, references, and evidence. The decision to deny and a summary of supporting information were outlined in an EPA Technical Decision Document[3] dated October 18, 1982. This document listed the following reasons for denial:

1. "...the Task Force is unable to conclude whether the proposed discharge will comply with State water quality standards due to far-field dissolved oxygen demand."

2. "The proposed discharge...is expected to interfere with a balanced indigenous population of marine life and also interfere with recreational activities."

3. "The applicant has established a system for monitoring the impact of its discharge. This program contains deficiencies..."

4. "The proposed discharge would potentially impact other point and non-point sources."

5. "The applicant has proposed a program to enforce all applicable pretreatment requirements. This program contains deficiencies..."

6. "The applicant has proposed a schedule of activities intended to limit the entrance of toxic pollutants from non-industrial sources.... This schedule of activities contains deficiencies..."

After considering EPA's negative declaration, the City of Tacoma submitted an ammended application, as permitted under the federal 301(h) regulations. This application was notarized December 14, 1983. The section entitled "Basis for Application" states the reapplication is based on an improved discharge. The proposed improvements are the addition of a 20-port effluent diffuser (the original application specified a 10-port diffuser) to the existing outfall which has no diffuser, and filtration of the primary effluent to remove settleable suspended solids. Although not mentioned as a basis for reapplication, other concerns in EPA's decision document are addressed. Additional physical, chemical, and biological data are presented.

REVIEW OF FEDERAL 301(h) REGULATIONS

The recommendation to deny this application is based on the portion of section 301(h) of the Clean Water Act that provides the applicant must demonstrate "such modified requirements will not interfere with the attainment or maintenance of that water quality which ensures...the protection of a balanced indigenous population of shellfish, fish, and wildlife, and allows recreational activities in and on the water." Pertinent to this provision is the further stipulation that, "Following initial dilution, the partially diluted wastewater and particulates must be transported and dispersed so as not to adversely affect water use areas (including recreational and fishing areas) and areas of biological sensitivity."

The balanced indigenous population (BIP) to be protected is defined as an ecological community which:

1. "Exhibits characteristics similar to those of nearby, healthy communities existing under comparable but unpolluted environmental conditions, or

2. May reasonably be expected to become re-established in the polluted water body segment from adjacent waters if sources of pollution were removed."

   A BIP must exist:

   A. "Immediately beyond the zone of initial dilution of the applicant's modified discharge; and

   B. in all areas beyond the zone of initial dilution where marine life is actually or potentially affected by the applicant's modified discharge."

   Additionally:

   C. "The discharge must not result in the accumulation of toxic pollutants or pesticides at levels which exert adverse effects on the biota within the initial zone of dilution."

The definition of "stressed waters" also applies to this waiver application. Stressed waters are "those receiving environments in which an applicant can demonstrate, to the satisfaction of the administration, that the absence of a balanced indigenous population is caused solely by human perturbations other than the applicant's discharge." Where the receiving environment is considered stressed, the applicant may not:

1. "Contribute to, increase or perpetuate such stressed conditions;

2. Contribute to further degradations of the biota or water quality if the level of human perturbation increases, and

3. Retard the recovery of biota or water quality if the level of human perturbation from other sources decreases."

REVIEW COMMENTS ON THE APPLICATION

Effluent Filtration. The applicant proposes to improve the Tacoma North End discharge through reduced suspended solids emissions--accomplished by filtration --and increased effluent dilution--accomplished by addition of a diffuser.

The applicant "expects" a removal efficiency of 50 percent for suspended solids in primary effluent based on pilot-scale tests done elsewhere and claims the proposed filtered discharge would approximate primary plus secondary treatment (80 percent versus 85 percent solids removal). They further claim "conservative" removal efficiencies of 70 percent for particles likely to be deposited in Commencement Bay (i.e., those with settling velocities of 0.1 cm/sec or greater).

Filtration of primary effuent is a developing technology not routinely applicable to treatment plants of North End's size. Pilot-scale testing is proposed by North End. West Point recently found a wide range of solids removal (11 to 66 percent) in a pilot-scale study[4]. They do not propose to employ filtration in their treatment.

Postulated high removal efficiencies, resulting estimates of low solids loads to Commencement Bay, and low rates of deposition on the seabed cannot be accepted as fact in weighing the merits of a waiver application*. Therefore, potential impacts that would result from the existing North End discharge (with dilution improved by a diffuser) were given consideration in reviewing this waiver.

*Jerry Anderson[5] has outlined WDOE concerns over use of unproven technologies in waiver applications.

Initial Dilution. The applicant used MERGE to calculate critical initial dilutions of between 112 and 154 for a range of flow rates. The TER used a more conservative model, PLUME, and calculated that initial dilution ranged from 12 to 54 for the original diffuser design during critical seasons; during minimum stratification the range was 151 to 219. Improved diffuser design as proposed in the reapplication (20 3-inch ports versus 10 6-inch ports), MERGE's capability of accounting for the influence of currents, and the applicant's selection of shallow density gradients in the receiving waters appear to be the principal reasons for these differences in dilution.

The density gradients selected by the applicant can be faulted. Density gradient is a major factor in plume dilution. Profiles selected as representative of critical seasons in the TER had gradients of 1.87 to 13.88 sigma-t units. The applicant, maintaining that only four-significant-figure-accurate salinity and temperature data can be used to compute dilution, employs a profile with a gradient of only 1.05 sigma-t units to achieve 112 to 154 critical dilutions.

The importance of density gradient profile selection for initial dilution calculations is demonstrated by results from MERGE ran for different profiles. This work was done for WDOE by Lys Hornsby, Tetra Tech, using data I provided from Appendix C of the application on diffuser/effluent parameters (page 1) and current speeds (page 3). Three density profiles were compared. The first was the profile selected by the applicant to predict critical initial dilutions (Appendix C, page 3, profile for 0300-9/14/83). The other two profiles were those recommended in the TER for critical seasons (pages 38-39, profiles b and d). A dry-weather flow of 6 MGD was used. Higher flows would give lower dilutions.

The following results were obtained:

Density Profile Used in MERGE	Critical Initial Dilution	Trapping Depth
gradient = 1.05 (Applicant)	154	11.7 meters
gradient = 1.87 (TER)	100	14.9 meters
gradient = 13.88 (TER)	87	15.8 meters

It is apparent that during some critical seasons the proposed diffuser may achieve considerably lower dilution and deeper trapping depths than claimed by the applicant.

As noted in the TER and EPA decision document, a potential also exists for a small reduction in expected dilution at this outfall site due to reintrainment caused by oscillation of longshore ebb and flood currents back and forth over the outfall.

Dispersion of Wastewater and Solids. Trapping depths greater than 15 meters (measured from the surface) were calculated by the applicant to occur only 15 percent of the time. As shown above, use of slight-to-moderate density gradients only (0.79 to 3.83 sigma-t units in this case) overestimates the heights to which the plume will rise.

Based on current meter and drogue studies, the applicant characterizes currents in this part of Commencement Bay as having net transport out of the bay at depths above 15 meters and into the bay below 15 meters. Their trapping depth calculations allow them to conclude that 85 percent of the effluent would leave the bay to the northwest and 15 percent would be transported into the industrial portion of the inner bay.

An out-at-the-surface/in-at-depth circulation pattern for Commencement Bay has been confirmed by a number of investigators[6,7,8]. The applicant's contention that 85 percent of the effluent leaves the bay in the surface layers is optimistic because of their biased use of density profiles.

As shown by the applicant, both surface and bottom waters move into the bay during flood. Wind effects were not considered by the applicant, but are known to strongly influence the movement of surface waters in Commencement Bay[7,9]. North winds would be expected to move effluent toward shore. The nearest shoreline is 213 meters[2] not 400 meters as shown in the application. The applicant's calculation of 1.5 hours' travel time to this shore is, therefore, an overestimate, as is their far-field dilution here of 225. As shown above, use of overly optimistic critical initial dilution factors further underestimates the applicant's potential impact to nearshore areas.

The set of ebb and flood results in the area of highest solids deposition being a narrow band parallel to shore. The applicant depicts the maximum deposition zone as extending in approximately equal direction either side of the outfall. The fact that bottom currents in this part of Commencement Bay are sufficient to re-suspend bottom sediments[8], coupled with net deepwater transport into the bay, suggests settleable solids would move into rather than out of the bay.

Using data from pilot-scale studies on filtration efficiency for particulates of varying sizes, the applicant predicts final solids removal for the filtered discharge "virtually equal to secondary treatment" (80 percent versus 85 percent). A maximum solids deposition rate of only 4.0 $g/m^2/year$ is calculated. Tetra Tech calculations where solids removal is not adjusted by the use of these predictions, give maximum deposition rates of 110 $g/m^2/year$.

Compliance With Fecal Coliform Standards. The applicant states that results of August 1983 shoreline samples at Old Town dock southeast of the outfall (site A), 1/2 mile northwest of the outfall (site B), and at Owens Beach, Point Defiance Park (site C) demonstrate compliance with the Washington State fecal coliform criteria for Class A and AA waters. Sites A and B appear to be equally far removed from the outfall. Since A clearly exceeds the standard and B approaches the standard, the applicant's contention of compliance is questionable. The data show bacteria problems exist here.

The North End discharge, although usually within NPDES permit limits, is a major source of bacteria to these waters. A report cited by the applicant as showing bacterial densities increased, not with closer proximity to the treatment plant but with closer proximity to the Puyallup River was based on data collected prior to improved disinfection through increased contact time at the Tacoma Central STP. WDOE routine monitoring data on fecal coliforms off the mouth of the Puyallup have shown a concomittant improvement.

Biological Impact

The applicant cites benthic invertebrate data from Malins[10] and a survey of their own as evidence of a balanced indigenous population immediately beyond the zone of initial dilution as well as farther removed areas potentially impacted by the discharge. While Infaunal Trophic Indices calculated by Malins are in the normal range, it should be pointed out that his samples were composites of grabs from a range of depths (40, 110, 150 feet--none of which coincide with the outfall) and therefore covered a variety of habitats affording opportunity to collect an increased number of species. It should also be noted that no organisms were found at this site during the winter.

The results of the benthic invertebrate surveys done for the waiver are interpreted as showing no difference between the control and outfall sites. This conclusion appears warranted from the standpoints of calculated trophic structure and diversity indices, but biomass was about twice as high at outfall stations than control stations which suggests enrichment, as noted by the applicant. The location of the applicant's control stations are not clearly shown.

Applicant statements in this section characterizing the habitat from which these samples were drawn as being among the least contaminated of Puget Sound areas sampled by Malins are misleading as shown by other data on these sediments discussed later.

The applicant's phytoplankton studies do not meet the stated objective of determining if the present or proposed discharges are or will affect the community balance and health because the station chosen to reflect the impact of the discharge is 800 meters offshore of the outfall and not in the path of the effluent plume.

The applicant's assessment of impacts to fishes is limited to what are probably accurate statements that demersal and pelagic species, including salmon, are unlikely to spend more than brief periods in the zone of initial dilution. This overlooks the fact that the Ruston shoreline forms an important nursery for juvenile salmon. Biologists for the Puyallup Tribe have found juveniles throughout the Ruston Way area with catches of chinook juveniles being comparatively large[11]. Due to extensive industrial/commercial development of the Tacoma tideflats, the Ruston shoreline should be considered a habitat of limited distribution for Puyallup River outmigrants in Commencement Bay.

Toxicants

The priority pollutant data provided by the applicant for the North End effluent and WDOE/EPA data[12] on the effluent and other Commencement Bay discharges were reviewed to put the treatment plant contribution in perspective. The following pollutants have been detected one or more times in the effluent (8 samples):

chloroform[2]
dichlorobromomethane[2]
chlorodibromomethane[2]
tetrachloroethylene[2]
methylene chloride
hexachlorobutadiene[2]
bis(2-chloroisopropyl) ether
bis(2-chloroethoxy) methane
a + b BHC[1,2,3]
gamma BHC[1,2,3]
N-nitrosodimethylamine[1]
N-nitrosodipropylamine
cyanide[1]
ethylbenzene
toluene
naphthalene
fluoranthene

acenaphthene
anthracene
benzo(b)fluoranthene[2,3]
benzo(k)fluoranthene[2,3]
dibenzo(a,h)anthracene[2,3]
chrysene[2,3]
fluorene[2,3]
phenanthrene
pyrene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
hexachlorobenzene[2,3]
bis(2-ethylhexyl) phthalate
butylbenzyl phthalate
di-n-octyl phthalate

diethyl phthalate
2,6-dinitrotoluene
azobenzene[2] (from diphenylhydrazine
phenol
pentachlorophenol
4-chloro-3-methyl phenol
arsenic[2,3]
copper
chromium[1]
cadmium[1,2]
selenium
lead[1,2]
mercury[1,2]
nickel[1,2]
zinc[1]
silver[1]

[1]Measured at concentrations above EPA criteria for protection of marine life.
[2]Measured at concentrations above EPA criteria for protection of human health (toxicity or 10^{-7} carcinogenic risk) from ingestion of seafood.
[3]Measured at concentrations which exceed health criteria after critical initial dilution of 112.

NOTE: EPA criteria from CFR vol. 45. No. 23, November 28, 1980.

Forty-nine toxicants have been detected. Of these, 11 were present at concentrations exceeding EPA criteria for marine life; 19 exceeded EPA human health criteria (toxicity or 10^{-7} carcinogenic risk) for consumption of seafood from the receiving environment. After dilution (lowest critical initial diultion calculated by the applicant - 112), 9 of the organic compounds still exceeded EPA health criteria.

With respect to the organics, more compounds have been detected in the North End effluent than in any of the approximately 50 Commencement Bay discharges (primarily storm runoff and industrial and municipal discharges on which WDOE and EPA have data[12]. This is partly a function of large sample size at the North End facility. On the other hand, the poor detection limits employed for many of the North End samples (5-10 ug/L) underestimates the number of compounds present. A number of the North End compounds (chloroalkyl ethers and nitrosamines, for example) have not been detected in other discharges to the bay. Large effluent flow relative to most other discharges makes the North End discharge a major loader of toxicants to Commencement Bay.

Stressed Waters

The applicant acknowledges that evidence of diseased fish and chemical contaminants in sediment indicate that Commencement Bay "might have stressed waters", but that these problems are associated with the industrial waterways. Citing their evidence of a BIP for benthic macroinvertebrates, the applicant contends that portions of the bay in the vicinity of the North End outfall cannot be considered stressed. With regard to contaminants of concern in Commencement Bay, the applicant states that contaminants that have been documented to accumulate in biota are "generally not present or are in low concentrations, in the outfall effluent."

Evidence of stress in the receiving environment for the North End discharge includes:

1. A NOAA review[9] of data on contaminants in Puget Sound which found that "excess concentrations of all metals in sediment were observed all along the southern shore...(sources) include combined sewer overflows and storm drains, a sewage treatment plant discharge and...discharges from the ASARCO copper smelter."

2. An EPA study[13] showing the highest levels of metals in Commencement Bay fishes occur here.

3. An EPA sediment survey[14] in Commencement Bay outside the industrial waterways in which organic priority pollutant analyses showed stations along the south shore of Commencement Bay (#36 - #40 between ASARCO and Old Tacoma) had the highest concentrations of PCB-1254, napthalene,

anthracene/phenanthrene, and pyrene. (Detection limits for the applicant's survey of selected organics in sediment at these sites were too high to produce useful data, but did show very high polynuclear aromatic hydrocarbons (PNAs) at one station.)

4. EPA amphipod bioassays[15] on Commencement Bay sediment outside the waterways showed low survival at only two sites--one of which was the intertidal zone immediately inshore of the North End outfall.

As a result of the above type of information, the Tacoma-Pierce County Health Department's advisory against consuming a daily diet of seafood from Commencement Bay also extends out along the south shore of the bay to Point Defiance.

Contrary to applicant statements, a number of constituents identified in the North End effluent (metals, PNAs, hexachlorobutadiene, and phthalates, for example) are chemicals of concern in Commencement Bay sediment or biota. Further evidence of the potential for this effluent to contribute to existing stresses is provided by results of EPA oyster larvae bioassays[16] which showed 96 percent mortality and 100 percent abnormality were caused by 48-hour exposure to 20 percent concentrations of this effluent.

Finally, with regard to the applicant's determination of a BIP in the vicinity of the outfall ,it should be noted that the 301(h) regulations state a BIP must exist "in all areas beyond the zone of initial dilution where marine life is actually or potentially affected by the applicant's modified discharge." A BIP does not exist in inner Commencement Bay[10] which, because of the transport pathways for the North End effluent, as discussed earlier, is potentially affected by the discharge.

Recreation

As noted by the applicant, water contact sports (swimming, diving, water skiing) fishing and shellfishing "could be impacted" by the discharge. The applicant further states that the City of Tacoma has designated the Ruston-Point Defiance area for development of a mixture of water-oriented and water-related commercial and public development.

Because of industrial development in the inner bay and lack of access to the north shore, the Ruston-Point Definance shoreline is the main beach area available to the public. It has been calculated[17] that over 95 percent of the sport catch in Commencement Bay comes from the southwest side of the bay.

The Department of Fisheries has constructed a major new fishing pier and artificial reef within 500 yards of the outfall. The west boundary of the subtidal land leased for these fisheries enhancement projects is less than

150 yards from the North End outfall and extends out to a depth of approximately 80 feet. This is very close to the zone of initial dilution. The City of Tacoma has plans to place a diving reef at the west end of this parcel[18].

It seems clear that continued discharge of North End primary effluent is incompatible with existing and planned recreational activities in this part of Commencement Bay.

AJ:cp

cc: Norm Glenn & Staff
Joan Thomas
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