

January 26, 2009

Testimony by Hans Krock regarding the recent EPA ruling on the City and County of Honolulu request for waivers of the secondary treatment requirement for the Sand Island and Honouliuli treatment plants.

My name is Hans Krock - I am an Emeritus Professor of Ocean and Resources Engineering at UH Manoa. (However, UH Manoa is not responsible for anything I write or say.) I am a part of a voluntary (unpaid) scientific and professional advisory group to the C & C of Honolulu regarding the validity of the request of waivers and the response by EPA.

Relevant aspects of my background are:

- A Ph.D. in Environmental Engineering with minors in Chemistry and Chemical Engineering from University of California, Berkeley. I developed very sensitive bioassay techniques to measure both toxicity and biostimulation in the natural environment.
- Research on primary, secondary, and tertiary treatment processes including sludge treatment and the effect of salinity.
- Extensive measurements in Hawaiian waters of water quality parameters and the effects of both primary and secondary discharges.
- Extensive measurements and evaluation of mixing and transport in embayments and open coastal waters, including Eulerian and Lagrangian plume dynamics.
- The establishment of kinetic constants describing the phytoplankton growth rate

response to the addition of nutrients to real world tropical Pacific waters.

- Measurement and evaluation of the internal wave field in Hawaiian waters and its effect on horizontal currents and on density profile dynamics.
- Measurements of water quality parameters above and below the thermocline in Hawaiian waters.
- Measurement and evaluation of gas exchange dynamics into and out of seawater with emphasis on carbon dioxide including its effect on pH and on biological processes.
- The establishment of most of the water quality standards for Hawaii, especially those described by log-normal distributions.
- Extensive research and development leading to the establishment of Ocean Thermal Energy Conversion (OTEC) system. These technologies are applicable to the installation of relatively inexpensive extensions to the Honouliuli and Sand Island outfalls.

For today's hearing I have been asked to comment specifically on the EPA findings regarding the nutrient ammonia and the toxicants dieldrin and chlordane.

The EPA found that the State of Hawaii geometric mean ammonia standard was exceeded only adjacent to the diffusers. This finding is not relevant to support a decision to require secondary treatment because of the following factors:

- The water quality standards (including those for ammonia) are written for the upper layer of the ocean above the influence of the waters in and below the thermocline. The internal wave structure frequently brings these deep waters above the depth of the diffuser and significantly changes water quality parameters (including nutrient concentrations). If the State of Hawaii wants to regulate the water quality below the thermocline they will have to expand the water quality standards.
- The statistical form of the water quality standards are properly evaluated over both time and space. The application used by EPA to evaluate the effect of nutrients at a fixed point is not correct since it does not take into account the actual growth dynamics over space. The validity of this comment is borne out by the observation that there is no increase in chlorophyll-a related to the outfalls.
- It has been conclusively shown that in the real tropical ocean the relevant nutrient parameters with respect to the growth response of phytoplankton are total nitrogen (TN) and total phosphorus (TP) and not the individual components (such as ammonia or nitrate). Consequently Hawaii should revise its water quality standards to reflect this development.
- At the depth of the diffuser light is generally limiting and not nutrient concentration hence the nutrient concentration is irrelevant.

- If secondary treatment were implemented then ammonia content of the discharge would actually increase because of the supernatant return from the anaerobic sludge processing units.
- Because of anthropogenic global warming due to the emission of greenhouse effect gases (primarily carbon dioxide) there has been a significant reduction in the primary production of the tropical Pacific. This is due to greater stratification which makes it more difficult for the nutrient rich deep water to reach the photic zone. Secondary treatment would exacerbate this problem.

Concerning dieldrin and chlordane:

These pesticides are found in the soil and ground water of Oahu and enter the ocean primarily via erosion and surface runoff. Control of these pesticides with respect to the wastewater system is best done by inflow and infiltration control. Since bacteria have had more than two decades to try to break down these pesticides in the ground without effect, a few hours of secondary treatment will be irrelevant.

The greatest protection to the environment and to potential human exposure of the Honouliuli and Sand Island discharges would be to extend the outfalls to a depth of about 600 feet to below the top of the thermocline even with the large internal wave amplitude. This solution would also be much less costly and use significantly less scarce resources.

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