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LATHAM&WATKINS LLP

November 8, 2007

File No. 037484-0006

DOCKET
06-AFC-4
DATE NOV 0 8 2007
RECD. NOV 0 8 2007

VIA FEDEX

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 06-AFC-4
1516 Ninth Street, MS-4
Sacramento, California 95814-5512

Re: Vernon Power Plant Project: Docket No. 06-AFC-4

Dear Sir/Madam:

Pursuant to California Code of Regulations, title 20, sections 1209, 1209.5, and 1210, enclosed herewith for filing please find a letter from the City of Vernon to Rite-Way R.B.R. Meat, dated October 22, 2007.

Please note that the enclosed submittal was filed today via electronic mail to your attention and to all parties on the CEC's current electronic proof of service list.

Very truly yours,

Paul E. Kihm
Senior Paralegal

Enclosure

cc: CEC 06-AFC-4 Proof of Service List (w/ encl.)
Michael J. Carroll, Esq. (w/ encl.)

City of Vernon

LIGHT & POWER DEPARTMENT
Donal O'Callaghan, Director of Light & Power

October 22, 2007

Mr. Irwin Miller
President and CEO
Rite-Way R.B.R. Meat
5151 Alcoa Avenue
Vernon, CA 90058

Re: Impacts of the Use of Recycled Water In the City of Vernon's Power Plant Cooling Tower on Rite-Way Meats' Operations

Dear Mr. Miller:

In recent discussions, the City of Vernon (City) committed to demonstrate to you that the City's use of recycled water for cooling water at the proposed Vernon Power Plant would not result in a significant risk to your operations at the Rite-Way Meats facility. These analyses, which are attached, indicate that the City's use of recycled water is safe and would result in no adverse impacts to your operations. Furthermore, the analyses conclude that the water vapor emitted from the proposed Vernon Power Plant's cooling tower would not alter the relative humidity in the project area.

The use of recycled water at the Vernon Power Plant is allowable provided that the water meets certain standards set by the California Department of Health Services. Section 60306(a) of Title 22 of the California Code of Regulations governs the use of recycled water for industrial cooling purposes that involve the use of a cooling tower, such as the one to be located at the proposed Vernon Power Plant. This section requires that the recycled water be "a disinfected tertiary recycled water" that meets strict criteria set forth in other sections of Title 22. The recycled water proposed to be provided by the Central Basin Municipal Water District for use by the City meets these criteria.

As explained in the attachments, multiple studies have concluded that the use of recycled water is safe when the standards set forth in Title 22 are met. In fact, multiple agencies and organizations support the use of recycled water. Because the recycled water to be used at the proposed Vernon Power Plant meets the standards in Title 22, the use of this recycled water for cooling water would not result in adverse health impacts, including at your facility.

Furthermore, we have determined through air dispersion modeling that the water vapor emitted from the proposed Vernon Power Plant's cooling tower would not measurably alter the relative humidity in the project area. The maximum expected change in relative humidity predicted by the air dispersion modeling is so low that it could not be measured. Accordingly, there would be no impact on your facility from any change in relative humidity, as there would be no measurable change.

We hope that these analyses address your concerns about the proposed Vernon Power Plant. Please contact me at (323) 583-8811, extension 834 if you have any further questions.

Sincerely,

CITY OF VERNON

Donal O'Callaghan
Director of Light and Power

DO:rmt
Enclosure

c: Document Control

1

PARSONS
4701 Hedgemore Drive • Charlotte, North Carolina 28209 • (704) 529-6246 • Fax: (704) 527-2740

August 17, 2007

Krishna Nand

City of Vernon Engineering Dept.

Vernon, CA

Dear Mr. Nand:

At your request I conducted a site walk down and inspection of the HVAC systems and the operations at the RiteWay meats facilities in Vernon, Ca with particular emphasis on the existing conditions related to the outside air intakes at this facility. The following text reflects the "as found" condition and assessment of this facility with respect to the treatment of outside air.

The RiteWay meats facility prepares meals ready to eat for many customers including airlines and school districts. The facility has compliant finishes such as washable surfaces, epoxy coated floors and walls, refrigerated preparation rooms, freezer rooms, and air locks with hand washing stations and gowning facilities in order to keep the food being prepared from being contaminated by the personnel working inside. All procedures within the facility are consistent with current good manufacturing practice (cGMP) for the type work being conducted. The only cooking operation that occurs within the facility is the baking of breads, and preparation of sauces and soups in kettles for the meals. Other than this aspect of the food preparation, all other steps in the process consist of meat cutting, and assembly of meals consisting of sandwiches, and vegetables/salads (produce). The meals once prepared are loaded into sterilized containers for shipment to the end consumers.

There are several important aspects of the facility related to the treatment of the outside air. First, all areas where food is exposed are kept under positive pressure related to non-cGMP areas and isolated with airlock/gowning areas where lab coats, hair nets and, if necessary, beard/mustache covers are donned. These areas are also equipped with hand washing and sanitizing stations. This is an industry standard practice to assure that cleanliness is maintained within the cGMP areas. The air locks serve as an isolation boundary between the cGMP and non-cGMP areas. In order to keep the food preparation areas under positive pressure, filtered outside air is fed into these areas at a rate greater than the exhaust air being removed from the spaces. The areas are kept at cold room temperatures of various set points to assure that bacterial growth is discouraged. This dictates that a small amount of outside air is introduced in each preparation area during food preparation function in order not to impose a large refrigeration load on the unit coolers which operate within each of these areas.

Second periodically during operation, wash down is conducted within the meat cutting and other refrigerated food preparation areas. During this process the temperature of these rooms is not controlled. In order to control development of fog within these areas, the refrigeration units are turned off and the area is provided with an outside air sweep of un-refrigerated or dehumidified air. This 100% outside air purge keeps the air inside the food preparation rooms above the dew-point during wash-down. There are a total of 15 air handlers with outside air intakes serving the process areas per the HVAC schedules provided by the RiteWay Meats plant manager. These outside air intakes are all located on the roof of the facility.

The heat rejected from the central refrigeration system is cooled by means of roof mounted evaporative condensers. This equipment is fed with once through water with no chemical treatment and no recirculation. Provided the hot water basins are cleaned regularly and have sufficient slope so as to prevent stagnant water from growing algae or other contaminants, these are not a potential source of contamination in the plant. The discharge from these evaporative condensers is high enough and near enough to the edge of the building that the wet plume should provide adequate dispersion.

Overall the facility is well laid out and includes a number of features intended to minimize the risks of contamination of prepared foods.

I trust the observations listed will help you in your analysis of the as found condition of the RiteWay meats facility. If you have any question or comments, or if you require further services, do not hesitate to call me at (704)907-9151.

Very truly yours,

Timothy C. Sheehan
Supervising Engineer

2

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LATHAM&WATKINS LLP

MEMORANDUM
October 11, 2007

To: Donal O'Callaghan
From: Mike Carroll
Emily Taylor
Subject: Use of Disinfected Tertiary Recycled Water Pursuant to Title 22 of the California Code of Regulations in the Vernon Power Plant

I. INTRODUCTION

The City of Vernon is developing a natural gas-fired power plant, known as the Vernon Power Plant, and intends to use recycled water for cooling. The recycled water will comply with all applicable requirements governing the use of recycled water set forth in Title 22 of the California Code of Regulations ("Title 22"), and will be supplied by Central Basin Municipal Water District.

Concerns have been expressed by an adjacent property owner regarding the potential that mist from the cooling tower will allow airborne pathogens to enter and contaminate his operations. In response to these concerns, we have conducted a literature search for studies analyzing the use of recycled water that meets the standards set forth in Title 22. This memorandum summarizes the results of our search.

Recycled water is widely used in Southern California, due to the arid environment and the high cost of importing water from elsewhere. See LACSD, Wastewater Treatment and Water Reclamation, available at http://www.lacsd.org/about/wastewater_facilities/moresanj/default.asp. Recycled water is used for a variety of non-drinking purposes, such as irrigation and cooling. As the potential for human contact with recycled water increases, Title 22 of the California Code details stricter guidelines for pre-contact treatment.

Primary treatment removes large solids from the water by passing water through screens and skimmers and then through a large sedimentation tank. See Water Reuse Study, Appendix G: Science, Technology, and Regulatory Issues G-24 (Mar. 2006), available at http://www.sandiego.gov/water/waterreusestudy/pdf/ir06appeng.pdf ("Water Reuse Study"). Secondary treatment uses bacteria to remove approximately 90 to 95 percent of remaining solids and uses a disinfectant, such as chlorine, to destroy bacteria, viruses, and other pathogens. See Dublin San Ramon Services District, Recycled Water Frequently Asked Questions, http://www.dsrsd.com/what_we_ do_services_offered/recycledwaterfaq.html ("Frequently Asked Questions"). Tertiary treatment generally consists of filtration, followed by disinfection with chlorine. Tertiary treatment removes microorganisms as well as particles that may protect harmful microorganisms from the disinfectant. See Water Reuse Study.

II. REGULATION OF RECYCLED WATER

The use of recycled water for cooling is governed by 22 Cal. Code Regs. § 60306, which reads:

> (a) Recycled water used for industrial or commercial cooling or air conditioning that involves the use of a cooling tower, evaporative condenser, spraying or any mechanism that creates a mist shall be a disinfected tertiary recycled water.

22 Cal. Code Regs. § 60306(a). "Disinfected tertiary recycled water" is defined as "filtered and subsequently disinfected wastewater" that meets certain criteria:

> (a) The filtered wastewater has been disinfected by either:
>
> > (1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measure at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or
> >
> > (2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.
>
> (b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

Id. § 60301.230. "Filtered wastewater" is defined as "an oxidized wastewater" that:

> (a) Has been coagulated and passed through natural undisturbed soils or a bed of filter media pursuant to the following:
>
> > (1) At a rate that does not exceed 5 gallons per minute per square foot of surface area in mono, dual or mixed media gravity, upflow or pressure filtration systems,

or does not exceed 2 gallons per minute per square foot of surface area in traveling bridge automatic backwash filters; and

(2) So that the turbidity of the filtered wastewater does not exceed any of the following:

(A) An average of 2 NTU within a 24-hour period;

(B) 5 NTU more than 5 percent of the time within a 24-hour period; and

(C) 10 NTU at any time.

(b) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:

(1) 0.2 NTU more than 5 percent of the time within a 24-hour period; and

(2) 0.5 NTU at any time.

Id. § 60301.320.

III. SCIENTIFIC STUDIES OF TERTIARY TREATED RECYCLED WATER

Various scientific studies have been conducted to test the health implications of tertiary water treatment. Generally, the studies have shown that "disinfected tertiary-treated recycled water is virtually free from all pathogens, including viruses." Frequently Asked Questions. Tertiary treatment has been found to reduce contaminants such as particles, bacteria, viruses, parasites, inorganics, organics, and radionuclides. See Water Reuse Study.

A. Pomona Virus Study

Using the methods set forth in Title 22, the Sanitation Districts of the County of Los Angeles conducted the Pomona Virus Study on tertiary treated recycled water in 1977. See G. Fred Lee, Ph.D., P.E., D.E.E. & Anne Jones-Lee, Ph.D., Public Health Significance of Waterborne Pathogens in Domestic Water Supplies and Reclaimed Water (Dec. 1993), available at http://www.gfredlee.com/path-2.htm ("Public Health Significance"). The Pomona Virus Study tested the abilities of four different tertiary treatment systems to remove viruses. The study added laboratory-cultured viruses and coagulant to a water sample and passed it through treatment facilities consisting of a clarifier and a sand filter meeting the requirements of sections 60301.230 and 60301.320 of Title 22. See State of California, Division of Drinking Water and Environmental Management, Treatment Technology Report for Recycled Water App. A at 27 (Aug. 2003). The treatment "reduced the concentration of virus plaque-forming units to 1/100,000th of the concentration in the wastewater upstream from the filter, when the chlorine residual was at least 5 milligrams per liter and at least sufficient to reduce the concentration of total coliform bacteria to less than 2 per hundred milliliters." Id. The study thus concluded that virus removal through tertiary treatment was possible.

Multiple regulations and guidelines for the use of recycled water have been based on the Pomona Virus Study. See University of Guelph, Water Reclamation and Reuse Information Center, http://www.soe.uoguelph.ca/webfiles/khosrow/wrric/Health/pomona.htm. In addition, the study was referenced as "the basis for comments to the regional water quality control boards on proposed recycling project requirements, to ensure adequate public health protection when recycled water is used." Initial Statement of Reasons, Water Recycling, Chapter 3 Water Recycling Criteria, at 4.

B. Whittier Narrows Study

In 1978, a study was conducted to determine whether the Whittier Narrows water reclamation treatment procedure had any adverse effect on the health of individuals ingesting treated groundwater. The study included "extensive microbiological and chemical water quality characterization, percolation studies, toxicological studies, and epidemiological studies." James Crook, Water Reuse Experience in the U.S. 12, available at http://www.p2pays.org/ref/19/18610.pdf ("Water Reuse Experience"). The study "did not demonstrate any measurable adverse effects on the area's groundwater or the health of the population ingesting the water." Id.

C. Monterey Wastewater Reclamation Study for Agriculture Study

Beginning in 1980, the ten-year Monterey Wastewater Reclamation Study for Agriculture researched the ability of the methods detailed in Title 22 to remove enteric viruses, as well as the survivability of enteric viruses on food crops, mainly those eaten raw. See Water Reuse Study. No enteric viruses were detected in the recycled water or recovered from crop samples during the study. See id. In addition, aerosols generated from sprinkler irrigation did not contain bacteria of wastewater origin. See id. The study concluded that "process controls required by [Title 22] ... were sufficient to exclude the possibility of residual pathogen content in recycled water ...." Id.

D. Tertiary Water Food Safety Study

The 1997 Tertiary Water Food Safety Study, was conducted to determine the continued viability of the Monterey Wastewater Reclamation Study for Agriculture and "did not detect any Salmonella, Cyclospora, E. Coli 0157:H7, Cryptosporidium, or Legionella in any of the samples of disinfected tertiary recycled water." Water Reuse Study. This study determined that effluent did not produce significant health effects and that the risks of using tertiary treated water were similar to risks estimated for the use of commonly used surface water. See Public Health Significance.

E. Water Factory 21 Study

The Orange County Sanitary District's Water Factory 21 Study determined that the tertiary treatment procedure "reliably produces high-quality water." Water Reuse Experience. The virus sampling in this study indicated that "the effluent is essentially free of measurable levels of viruses." Id. There were no significant health effects from using this tertiary treated water and no risks greater than the risk of using surface water. See Public Health Significance.

F. City of San Diego Health Effects Study

The City of San Diego's Health Effects Study monitored tens of thousands of gallons of non-chlorinated effluent from its tertiary treatment wastewater plant and found that the plant "consistently produced high quality effluent." Water Reuse Experience. The study ultimately concluded that "the health risks associated with the use of the ... [plant] as a raw water supply [are] less than or equal to that of the existing City raw water." Id.

IV. CONCLUSION

Various studies have concluded that the use of recycled water is safe when the methods of treatment detailed in Title 22 of the California Code are properly used. Because the proposed power plant will use disinfected tertiary recycled water for its cooling tower, and because this use will comply with the requirements of Title 22, no adverse health effects from the use of this recycled water should result.

Recognition of the beneficial and safe uses of recycled water has led the United States Environmental Protection Agency, the California State Water Resources Control Board, the California Department of Health Services, the California Conference of Directors of Environmental Health, the United States Bureau of Reclamation, and the WateReuse Association of California to adopt a joint statement in support of the use of recycled water. See Statement of Support for Water Recycling, available at http://www.datainstincts.com/images/pdf/ healthsafety.pdf. The statement notes that "California's extensive experience with water reclamation provides reasonable assurance that the potential health risks associated with water reclamation in California are minimal, provided all regulations ... are adhered to" and that "California law and regulations are fully protective of human health." Id.

Analysis of Potential Impacts on Rite-Way Meats from Vernon Power Project Cooling Towers

PREPARED FOR: City of Vernon

PREPARED BY: Jerry Salamy

DATE: October 11, 2007

In recent discussions, the City of Vernon committed to providing Rite-Way Meats with several analyses to demonstrate that the City's use of recycled water in the proposed Vernon Power Plant's cooling tower would not result in a significant risk to its operations. The City tasked CH2M HILL to prepare these analyses, which include a determination of the probability of pathogens from the recycled water entering the Rite-Way Meats facility through the air inlet system and a determination of whether the cooling tower exhaust would alter the relative humidity in the project area. The results of these analyses are presented below.

Approved Uses of Recycled Water

Disinfected tertiary-treated recycled water is proposed for use in the Vernon Power Plant. This is a specific classification of recycled water, which the California Department of Health Services (DHS) requires to meet specific water quality requirements, including pathogen limitations. Acceptable uses of disinfected tertiary-treated recycled water include industrial cooling, involving the use of a cooling tower[1], as well as the following:[2]

- Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop
- Parks and playgrounds
- School yards
- Residential landscaping
- Unrestricted access golf courses

Pathogens From the Recycled Water Will Not Adversely Impact the Rite-Way Meats Facility

During our literature review, we identified a study prepared by DHS entitled "*Review of Health Risks Related to Ingestion and Inhalation of Constituents of Reclaimed Water*" (1992). The document (attached as Exhibit 1) contains a methodology to "Demonstrate Safe Conditions," for the use of recycled water, including an analysis of the probability of a worker getting sick from ingestion or inhalation of cooling tower drift from cooling towers that use disinfected tertiary-treated reclaimed (i.e., recycled) water. This analysis, although not exactly the same as the situation of most concern to Rite-Way Meats, does, however,

[1] Section 60306 (a) of California Code of Regulations, Title 22, Article 3.

[2] Section 60304 (a) of California Code of Regulations, Title 22, Article 3.

provide a conservative estimate of the probability of pathogens contaminating products within the Rite-Way Meats facility.

The methodology presented in the DHS study incorporates the following parameters:

- The location of the cooling tower relative to the building of interest
- The percent of time per month that winds blow toward the building of interest
- Seasonal pathogen concentration factors by month
- Cooling tower drift rates
- Dilution effect on cooling tower drift due to downwind distances
- Dilution due to aging of the water in the cooling tower and blowdown
- Duration of exposure
- Ingestion/inhalation rates

In light of the above parameters, the analysis assumed that Rite-Way Meats could be impacted when winds were blowing in a northerly through easterly direction (winds blowing towards these compass directions). Note that this is a conservative assumption resulting in an overestimate of the probability.[3] Furthermore, the analysis assumed that no dilution of the cooling tower drift would occur and that the recycled water in the cooling tower had not "aged," which also is a conservative assumption that further biases the probability on the high side. Lastly, the analysis conservatively assumed that exposure would occur every hour of every day. The result of incorporating these conservative assumptions was an annual highest conceivable risk that a worker in the Rite-Way Meats building would contract an infectious virus, which could cause an enteric illness, is 0.08 in a million.

The exposure pathway of concern for Rite-Way Meats is the potential deposition of a pathogenic organism on ready-to-eat foods, incubation and growth of those organisms, followed by ingestion and exposure. Establishments preparing foods for sale adhere to safety provisions[4], including maintaining temperatures of foods after preparation (i.e., keeping "hot food" hot or keeping "cold food" cold). Maintaining food temperatures after preparation is intended to minimize the growth of microorganisms, should these become introduced into foods after preparation. Adherence to these safety provisions during food preparation, storage and transport would assure that secondary risks of ingesting foods that had received deposition of a pathogenic organism would not increase over the level previously calculated for direct exposure to a worker. These food safety considerations are implemented to control more significant sources of microbiological contamination present in food preparation establishments; they would also minimize the risk of microbiological contamination and illness associated with the deposition of pathogenic organisms potentially in cooling tower drift.

The Cooling Tower Exhaust Would Not Measurably Alter Relative Humidity in the Project Area

The City requested CH2M HILL to review the letter submitted by Bimbo Bakery (dated February 8, 2007) to the California Energy Commission. After review, it was determined

[3] Due to the revisions to the Vernon Power Plant general arrangement plan, winds blowing to the north-north-east through the north-east would impact Rite-Way Meats.

[4] U.S. Department of Agriculture. 2005. Guidance for School Food Authorities: Developing a School Food Safety Program Based on the Process Approach to HACCP Principles. USDA Food and Nutrition Service. June 2005.

that Bimbo Bakery uses evaporative cooling in its facilities, which would be expected to increase moisture within its building and could contribute to mold growth during warmer weather periods. Because Rite-Way Meats does not use evaporative cooling for the food processing areas, there should not be a similar issue.

To assess the potential for the cooling tower to alter the humidity levels in the area, CH2M HILL performed air dispersion modeling to estimate the worst-case water vapor concentration. Modeling was performed with methodologies and meteorological data used in the Vernon Power Plant's air quality permit application. Exhibit 2 provides details on the modeling assumptions.

The cooling tower water vapor emission rate was based on the maximum potential cooling tower water recirculation rate and includes water losses from both cooling tower drift and evaporation. To be conservative, the highest water emission rate was used in the dispersion modeling. It was assumed that all of the water from the cooling tower would disperse in the ambient air and that no loss through deposition or condensation would occur, once the water leaves the cooling tower.

The results of this analysis show that the maximum expected change in relative humidity is so low that it could not be measured. Thus, if the relative humidity were measured when the proposed Vernon Power Plant was operating and not operating, there should not be a detectable difference between the two measurements.

Conclusion

In summary, there is a very low probability, approaching zero, that use of recycled water in the proposed Vernon Power Plant's cooling tower would emit pathogens that could impact Rite-Way Meat's employees, let alone ready-to-eat products. Further, water vapor emissions from the cooling tower are unlikely to cause a measurable change in the local humidity levels.

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY PETE WILSON, Governor

DEPARTMENT OF HEALTH SERVICES
714/744 P STREET
P.O. BOX 942732
SACRAMENTO, CA 94234-7320

EXHIBIT 1

May 23, 1994

Dr. Richard Sakaji
East Bay Water
P. O. Box 24055
Oakland, CA 94623-1055

Dear Dr. Sakaji:

Enclosed is a copy of a list of members of the Blue Ribbon Panel on Assessment and Acceptability of Risk and a copy of the document entitled Review of Health Risks Relating to Ingestion and Inhalation of Constituents of Reclaimed Water.

Sincerely,

Michael L. Kiado
Senior Sanitary Engineer
Drinking Water Program

Members of Blue Ribbon Panel On
Assessment and Acceptability Of Risk

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REVIEW OF HEALTH RISKS RELATING TO INGESTION AND INHALATION OF CONSTITUENTS OF RECLAIMED WATER

Department of Health Services

1992

REVIEW OF HEALTH RISKS RELATING TO INGESTION AND INHALATION OF CONSTITUENTS OF RECLAIMED WATER 1992

1. INTRODUCTION

This document discusses risks to public health associated with used of water reclaimed by various levels of disinfection of municipal wastewater (sewage), that can result in swallowing particles downwind from activities that generate mist with such water.

The Department's attention is directed to enteric viruses rather than just to bacteria because: (1) generally fewer enteric viruses are required to infect the intestine after being swalloed; and (2) the small size of viruses causes them to be generally encased within protective masses of fecal bacteria and other matter and thus more shielded against disinfecting agents than bacteria. (An infection is the establishment and propagation of an organism in a host, whether or not it results in detectable pathogenic effects. An infection may be demonstrated by antibody response, other subclinical effects, or the presence of the organisms in samples from the host.)

Table I-1 cites, under the headings "One percent of infections" and "Four percent of infections", symtons or diseases which Asano et al. (1984) list with associated groups of viruses excreted into municipal wastewater by infected persons. The table cites symptoms or diseases that DHS would expect to olccur generally with 1, 4, and 95 percent, respectively, of infected Californians with normal acquired immunities. These assumed frequencies of symptoms among infected persons are based upon the observation (Werner 1991) that among persons contracting infections of polioviruses (which infect the intestine) without prior inoculation roughly one percent have a severe symptom, four percent have a mild symptom, and 95 percent have non-apparent infections of no consequence to the infected person. (DHS considers infections of poliovirus inconsequential for the purposes of this discussion, as Californians are inoculated for immunity to polioviruses.)

Figure I-1 shows the variation of probability of infection with mean dose for enteric viruses found excreted with feces into municipal wastewater by infected persons (rotavirus, Poliovirus III, Echovirus 12, and Poliovirus I).

"Because no minimum infectious dosage data are available for most viruses, the dose-response data for rotavirus, the most infectious virus, could be assumed for viruses with no dose-response curve."

The following are other symptoms or diseases which Asano et al. (1984) list with associated groups of viruses excreted into municipal wastewater: (1) respiratory disease, associated with coxsakie A and B viruses, Echoviruses, new enteroviruses, adenovirus, and adeno-associated virus; (2) acute eye hemorragic conjunctivitis, associated with new enteroviruses; and (3) eye infections, associated with adenoviruses.

Maintaining the existing record of safety is especially important for the sake of: (1) children under eight years of age, who may not have acquired immunities to all illnesses that can be caused by the array of enteric viruses that might occur in municipal wastewater; (2) adults who were not previously infected with enteric viruses which are better tolerated in childhood (e.g., hepatitis A virus); and (3) elderly persons, whose immunities are apt to wane.

2. UNDISINFECTED SECONDARY EFFLUENT

Table II-1 presents a statistical summary of data on viruses detectable by Buffalo Green Monkey (BGM) kidney cell culture, in unchlorinated secondary effluent of five facilities operated in California: four activated sludge facilities and one trickling filter facility. DHS gratefully acknowledges also the support of the County Sanitation Districts of Los Angeles County (LACSD), Monterey Regional Water Pollution Control Agency, Las Virgenes Municipal Water District (LVMWD), and Orange County Water District for the efforts they undertook to compile their data for statistical analysis.

The symbol < in Table II-1 means "less than", and > means "more than". The value cited in the column headed "median value" is the concentration which is exceeded 50 percent of the time, and equals or exceeds other concentrations 50 percent of the time. The value cited in the column headed "< 90% value" is the concentration which is exceeded 10 percent of the time, and equals or exceeds other concentrations 90 percent of the time.

Figure II-1 depicts frequencies of occurrence of virus concentrations in undisinfected activated sludge effluent when the logarithms of concentrations conform to a statistically normal variation with percent of time the concentration is exceeded, between:

(1) the "median value" and "< 90% value" cited in Table II-1 in the row labelled "Total" in the first column (2 virus units per 100 liters, and 500 virus units per 100 liters, respectively); and

(2) the "< 90% value" cited in Table II-1 in the row labelled "Total" in the first column (500 virus units per 100

liters) and the high 1.7-percentile concentration DHS presumes is indicated by the high concentration cited the column "Min.-Max. Viral Unit/100 L," for effluent of the LACSD's Pomona facility: 13659 virus units per 100 liters, as the highest concentration of those in 60 samples (1/60 equlas 0.017).

The median concentration is plotted on Figure II-1 above the point on the horizontal scale for 50 percent "time higher concentrations occur", indicating that half the time concentrations higher than the median concentration occur. The "< 90% concentration is plotted on Figure II-1 above the point on the horizontal scale for 10 percent "time higher concentrations occur" indicating that 10 percent of the time concentrations higher than the "< 90%" concentration occur.

Figure II-1 depicts frequencies of occurrence of virus concentrations in undisinfected trickling filter effluent when the logarithms of concentrations conform to a statistically normal variation with percent of time the concentration is exceeded, between:

(1) The "median value" and "< 90% value" (the concentration which is not exceeded 90 percent of the time) cited in Table II-1 in the top row labelled "Orange County Water District" in the first column (3160 virus units per 100 liters, and 17,562 virus units per 100 liters, respectively); and

(2) the "< 90% value" (17,562 virus units per 100 liters) and the high 0.7-percentile concentration DHS presumes is indicated by the high concentration cited in the column "Min.-Max. Viral Unit/100 L," in the top row labelled "Orange County Water District": 26,420 virus units per 100 liters, as the highest concentration of those in 145 samples (1/145 equals 0.007).

DHS assumes that viruses other than polioviruses can comprise 90 percent of enteric viruses in chlorinated effluent that can infect BGM kidney cells in summer and fall, and 74 percent of such viruses in winter and spring, as indicated by data presented by Camann et al. (1988) for undisinfected trickling filter effluent sampled on three days in August 1982 and one day in March 1982.

3. DISINFECTED UNFILTERED SECONDARY EFFLUENT

Figure III-1 shows concentrations of viruses detectable by BGM kidney cell culture DHS presumes would occur in disinfected, unfiltered activated sludge effluent with 200,000 coliform bacteria/100 ml virus -- like that of LVMWD's Tapia plant (Trussell 1980) -- were chlorinated for a 30-minute modal time to attain a final concentration of total coliform bacteria of:

(1) 2.2 per 100 ml: The limit of detection for concentration of total coliform bacteria and the criterion for the most highly disinfected water reclaimed from municipal wastewater without filtration, cited in Title 22 CCR as a concentration that shall not be exceeded as a median in reclaimed water used for surface irrigation of food crops and as a source of supply restricted recreation impoundments.

(2) 23 per 100 ml: The concentration Title 22 CCR does not allow to be exceeded as a median in reclaimed water used to irrigate golf courses, cemeteries, landscapes at freeways, and landscapes in other areas where the public has similar access or exposure, and pasture for milking animals and as a source of supply for a landscape impoundment; and

(3) 240 per 100 ml: The concentration Title 22 CCR allows to be exceeded on non-consecutive days in reclaimed water used to irrigate golf courses, cemeteries, landscapes at freeways, and landscapes in other areas where the public has similar access or exposure.

Figure III-2 does likewise for disinfected, unfiltered trickling filter effluent with a pre-disinfection concentration of 200,000 coliform bacteria/100 ml.

DHS derived these concentrations by multiplying virus concentrations shown in Figures III-1 and III-2 for "undisinfected secondary" by fractions indicated by the percent survivals cited in the fourth column of Table III-1 and III-2 for chlorinated, unfiltered activated sludge effluent and chlorinated, unfiltered trickling filter effluent with final concentrations of coliform bacteria of 240 per 100 ml, 23 per 100 ml, and 2.2 per 100 ml. DHS derived the percent survivals cited in the fourth column of Table III-1 based on: (1) the observed percent survival of native virus and coliform bacteria reported by Trussell et al. (1980) in unfiltered activated sludge effluent of LVMWD's Tapia treatment plant in January-April 1980 after chlorination in contactors with short circuits that reduced actual detention time to 30 minutes; (2) a relationship between survival of coliform bacteria and the CT value (the product of multiplying chlorine residual concentration and chlorine contact time) presented by Miele et al. (1977); and (3) a relationship between percent survival of laboratory-cultured viruses added to settled primary effluent and the CT value, derived from data presented by Lothrop and Sproul (1969).

Greater inactivation of viruses by chlorination may occur when unfiltered secondary effluent is: (1) exposed to a chlorine residual substantially longer than a 30-minute modal time or, (2) exposed for at least a 30-minute modal time to chlorination with a residual greater than that required to reduce the concentration of coliform bacteria from 200,000/ml to the above-cited final bacteria concentrations. The latter might occur when secondary effluent containing substantially more coliform bacteria than 200,000/ml is chlorinated to obtain the above-cited final bacteria concentration.

4. DISINFECTED TERTIARY RECLAIMED WATER

In developing requirements for disinfected tertiary reclaimed water, the Department intends to assure that the concentration of enteric viruses in reclaimed water, that can ostensibly infect BGM kidney cells, will be lower than the detection limit of 1 virus unit per 100 liters. Reclaimed water produced pursuant to this criteria is referred to below as Disinfected Tertiary Reclaimed Water.

5. SPRAY IRRIGATION WITH UNFILTERED SECONDARY EFFLUENT

5.1 Findings of the Hancock Farm Study

Camann et al. (1988) report the following findings of an epidemiological study of 378 residents of homes at least 46 meters (approximately 150 feet) from an area spray irrigated with undisinfected trickling filter effluent as part of the Lubbock Land Treatment System Research and Demonstration Project in 1982 and 1983:

"To serologically detect infections, semiannual blood samples were assayed for antibody titers to 24 viruses and bacteria known or suspected to be present in the sprayed wastewater. A series of routine stool specimens was analyzed to detect new enteric infections by overt and opportunistic bacterial pathogens and by enteric viruses.

"Three different statistical approaches provided similar evidence that the rate of viral infections was slightly higher among members of the study population who had a high degree of aerosol exposure. The risk ratio for viral infections was between 1.5 and 1.8. More than the expected number of statistically significant associations of the presence of infection with wastewater aerosol exposure were found in the independent infection episodes using Fisher,s exact test.

"The association of viral infections with aerosol exposure showed a dose effect, because more associated episodes occurred in 1982 when the study population was exposed to more enteroviruses via the wastewater aerosols than in 1983. In an episode of poliovirus 1 seroconversions in Spring, 1982, some of the infections were probably caused by wastewater aerosol exposure because a strong association existed and no alternative explanation could be identified."

The area irrigated was the Hancock farm near Wilson, Texas.

Table V-1 indicates the percent distribution of types of viruses in those samples of air (as Coxsackie B5, Echoviruses, polioviruses, and other unidentified viruses). Enteric viruses other than polioviruses comprised 1.4 percent to 92 percent of the enteric viruses in samples of air taken downwind from spray irrigation in August.

5.2 Buffer Zone

When a substance is emitted to air the resulting concentration of that substance in air downwind depends on the extent to which substances are dispersed in air laterally and vertically as those substances move downwind. Dispersion factors presented by Turner (1970) for a full array of meterologic conditions between one hour after sunrise to one hour before sunset indicate that concentrations of substances in air downwind from a source of emissions would be highest with a wind speed of 1 meter per second (1 m/sec equals 2.2 miles per hour) and an atmospheric structure that can occur during overcast conditions in any season (Turner 1970, Ranzieri 1992) and during fog (Ranzieri 1992): an atmospheric structure in Class D stability category. As can be seen from a record of mean wind speeds for Baldwin Park, in Los Angeles County (Table V-2), there can be a site where wind speeds equal to or below 2.2 mph (1 m/sec) occur a substantial portion of time (about 33 percent of the time in summer and 26 percent in fall at Baldwin Park).

Night-time air temperature inversions at and near large unpaved areas in any season can result in an atmospheric structure in Class F stability category when wind speed is 2 to 3 m/sec. Those meteorologic conditions provide the least lateral and vertical dispersion of emitted substances of all meteorologic conditions, and result in the greatest downwind concentrations of substances in air.

As meteorologic conditions resulting in highest day-time concentrations of substances in air (overcast sky with wind speed 1 m/sec) can occur in any season, meteorologic conditions that may have occurred in spring when infections were contracted downwind from irrigation at the Hancock Farm could not generally have resulted in higher downwind concentrations of enteric viruses than could occur in another season when the same number of enteric viruses is emitted to the air.

The following discussion by Kelly and Sanderson (1960) of seasonal variation in detectable enteric viruses in sewage indicates that concentrations of enteric viruses in air downwind from such irrigation can be expected to be considerably higher on an overcast summer day with wind speed 1 m/sec than could generally have occurred in the spring downwind from the Hancock Farm:

"Samples of raw and treated sewage were collected from several treatment plants as the liquid expressed from cheesecloth swabs exposed to flowing sewage for t24 to 48 hr.

"The density of plaque-forming enteroviruses in sewage, estimated from the density of PFU in swab expressions, was from < 2 (less than 2) to 44 PFU/100ml.

"Peak densities were usually found in August and early September, the period which coincides with that of maximum frequency of isolation. Minimal or undetectable amounts were encountered from December through May."

Division of the concentrations of enteric viruses indicated in Figure II-1, for activated sludge effluent chlorinated to the three concentrations of coliform bacteria indicated, by one-twentieth of the concentrations of enteric viruses indicated in Figure II-2 for undisinfected trickling filter effluent (presumably corresponding to the seasonally low concentrations of viruses when infections were contracted in the spring at least 150 feet downwind from the Hanford Farm), indicates that at least one percent of the time the concentration of enteric viruses in chlorinated activated sludge effluent in the summer and fall can exceed that of spring-time undisinfected trickling filter effluent. This circumstance warrants, prohibition of spraying of undisinfected reclaimed water and control of spray irrigation with Disinfected Secondary-2.2 Reclaimed Water and Disinfected Secondary-23 Reclaimed Water so that the outer periphery of the irrigated area is not within 100 feet of:

(1) A downwind residence off the property occupied by the reclaimed water use area, or a yard associated with such a residence; or

(2) A downwind place where the public might be.

No such control would be warranted when Disinfected Tertiary Reclaimed Water is used.

6. DISINFECTED TERTIARY RECLAIMED WATER IN SYSTEMS WITH EVAPORATIVE COOLING TOWERS

6.1 Rate of Emission Drift

Water droplets, emitted with the exhaust air stream from open circuit, evaporative cooling towers and called "drift," will contain particles and other substances that are in the circulating water. Particulate aerosols, that remain in the air after the water of the droplets evaporate downwind from the cooling tower, would be significant to public health if they contain viable organisms that can cause illness in persons who become infected after inhaling them.

The California Air Resources Board (ARB) learned, from a 1986 survey of 2000 operators of systems with cooling towers, how vastly cooling towers in California vary in the rate of generation of drift, in gallons of drift per minute per gallons of water circulated in the tower per minute (gpm drift per gpm water circulated, or gpm/gpm). Holliday et. al. (1989) state the following based on that survey:

"Tower drift fractions (based on design specification) were indicated for 185 cooling towers. All of the towers reported high drift fractions (higher than 0.00008 gpm/gpm). The drift fraction values are in the range of 0.00001 gpm/gpm to 0.1 gpm/gpm. For about half of the 185 drift reporting towers, a drift fraction value of 0.002 gpm/gpm was indicated. This suggests that most cooling towers are not equipped with high efficiency drift reducers."

"Drift reducers are broadly classified as having a low or high efficiency. If the drift rate (expressed as the fraction of circulating water flow rate emitted) is 0.00008 or less, the device is considered a high efficiency drift reducer."

"To compensate for a pressure drop which is likely to result from installation of high efficiency drift reducers, and maintain cooling efficiency, mechanical draft towers must restore the air flow rate by increasing the speed or adjusting the pitch of the tower fans. Additional power is required to operate the fans under these conditions; the additional power results in an increased cost."

"...according to an EPA survey, high-efficiency drift reducers can be retrofitted to all counterflow comfort cooling towers and to 95% of the crossflow comfort cooling towers; the remaining 5% of the crossflow comfort cooling tow3ers do not have enough space to adapt a second drift reducer. Manufacturers indicate that retrofitting high-efficiency drift reducers is difficult only for small size crossflow cooling towers that may not have sufficient space for a second drift reducer."

6.2 Dilution of Drift

DHS assumes that persons downwind from a cooling tower using reclaimed water would likely want assurance that risk to health is negligible: e.g., that the highest conceivable annual probability of intestinal infection with virus would not exceed 1 in 10,000 DHS also assumes that such persons would want the basis for the assurance to be more analytical than statements that: (1) DTRW has fewer enteric viruses than the limit of detection of 0.01 per liter; and (2) treatment of circulating water that the operator of the cooling tower should know enough to provide, to avoid biological slimes and proliferation of Legionella bacteria associated with negligent or ignorant operation of cooling towers, will provide further assurance of safety.

Project specific information is required to provide an analytical demonstration of what DHS suspects will be typically attainable: negligible risk. The absence of a typical volume of air emitted per gpm water circulated prevents the generalization that the amount of exhaust air accompanying drift will make the concentration of particulate aerosols in the exhaust air safe to breathe continuously. After acquiring information of the type the ARB received in the above-cited 1986 survey, the purveyor of DTRW can determine, from Figures VI-1 and VI-2, the volume of air throughout which particulate aerosols emitted from a tower with drift must be dispersed before entry into an outdoor breathing zone or an air intake of an occupied building, to limit the annual highest conceivable probability of intestinal infection with virus to 1 in 10,000. Figure VI-1 is relevant to the situation where affected persons would breathe diluted cooling tower exhaust for a portion of a year that consists of 365 24-hours days in a downwind residential unit or institution. Figure VI-2 is relevant to the situation where affected persons would breathe diluted cooling tower exhaust for a portion of a year that consists of 260 eight-hour working days.

DHS constructed Figures VI-1 and VI-2 for use in calculations pertaining to towers in which the DTRW being circulated is:

(1) fresh (age: 0 days), with enteric viruses that can infect BGM kidney cells, other than polioviruses, at a concentration of 0.009 virus unit per liter in July through October, 0.005 virus unit per liter in June and November, and 0.0003 virus unit per liter in December through May; and

(2) aged 1 to 10 days after containing such viruses at concentrations cited above when fresh.

In constructing Figure VI-1, DHS determined the volume of air throughout which particulate aerosols emitted from a tower with drift must be dispersed before entry into an outdoor breathing zone or air intake of an occupied building by first: (1) determining the volume of air breathed by a person in 365 24-hour days, at the average adult's intake of 22 cubic meters per day: 8000 cubic meters; (2) determining the number of viruses swallowed to cause a 1 in 10,000 highest conceivable probability of infection, from the equation discussed above for probability of intestinal infection from ingestion of rotavirus 1-(1 + #/0.042)E-0.26: 0.00016 virus; and (3) dividing the volume of air breathed by the person per year by the number of viruses that would cause a 1 in 10,000 highest conceivable probability of infection, to get 50 million cubic meters per virus. Then DHS determined the volume of air, in cubic meters per minute per gallon of water circulated in the tower per minute, throughout which viruses emitted from a tower per unit time with drift must be dispersed before entry into an outdoor breathing zone or an air intake of an occupied building, by multiplying 50 million cubic meters air per virus by:

(1) the number of gallons per minute of drift per gallon of water circulated in the tower per minute;

(2) the fraction of viruses in fresh DTRW calculated to remain at the age of the DTRW, from the equation f + exp (-.69d) discuussed above;

(3) the conversion factor 3.79 liters per gallon;

(4) the fraction of the mass of particulate aerosols which DHS assumes will be of a size that will cause them to be deposited in the upper respiratory tract and then swallowed, 0.59, discussed below;

(5) the fraction of viruses that can infect BGM kidney cells which are not polioviruses, 0.9, indicated in Table V-3 for undisinfected trickling filter effluent observed by Camann et al. (1988) on August 4, 1982; and

(6) the annual peak concentration of enteric virus in DTRW that can infect BGM kidney cells, that DHS presumes is slightly less than the concentration detection limit.

DHS assumes that the size distribution of the mass of particles added to air by spray irrigation of DTRW will be the same as the size distribution of the mass of particles in filtered primary effluent. DHS determined the portion of particles in filtered primary effluent that could be swallowed after being inhaled, and the portion that could be deposited in the lungs. DHS determined those portions on the basis of:

(1) the distribution of mass of particles among six size ranges, presented by Levine et al. (1991) for filtered primary effluents of Orange County, the City of San Diego, the University of California at Davis, and Clear Lake, Wisconsin; and

(2) estimates Armentrout and Locke (1986) present of of fraction of inhaled particles that is deposited in the upper respiratory region, and the fraction deposited in the pulmonary region, on the basis of particle size.

DHS' calculations indicate the following regarding filtered primary effluent:

(1) particles comprising roughly 59 percent of the total mass were large enough to be deposited in the upper respiratory

region, and the fraction deposited in the pulmonary region, on the basis of particle size.

(2) particles comprising roughly 17 percent were of a size that would allow them to be carried to and deposited in the lungs.

In constructing Figure VI-2, DHS first determined the probability of infection per eight-hour shift that will cause a 1 in 10,000 highest conceivable probability of infection from 260 episodes, from the following which Regli et al. (1991) present for determining the probability of contracting an infection in a period of time and mutliple exposures. each of which poses a Ps probability of contracting an infection:

P = 1 - (1- Ps)En

where:

En indicates that the preceding expression is to be raised to the n power.

DHS set P equal to 1/10,000 and n equal to 260, to get Ps = 0.00000038/ The DHS determined: (1) the number of viruses swallowed per eight-hour shift to cause a 0.00000038 probability of infection, from the equation discussed above for probability of intestinal infection from ingestion of rotavirus 1-(1 + #/0.42)E-0.26: 0.00000062: and (2) the volume of air breathed by a person per eight-hour shift, at the average adult's intake of 22 cubic meters per day: 7.3 cubic meters. DHS divided the volume of air breathed by the person per eight-hour shift by 0.00000062, to get 12 million cubic meters of air per virus. Then DHS determined the voulme of air, in cubic meters per minute per gallon of water circulated in the tower per minute, throughout which viruses emitted from a tower per unit time with drift must be dispersed before entry into an outdoor breathing zone or an air intake of an occupied building, by multiplying 12 million cubic meters air per virus by the six factors cited in the above discussion of the construction of Figure VI-1.

As Figures VI-1 and VI-2 represent 12 months of 24-hour days or eight-hour shifts at the peak concentration of viruses in fresh DTRW that can infect BGM kidney cells, values read from the vertical scale of the figure must be multiplied by facgtors to represent the seasonal variation in virus concentration in DTRW.

As noted earlier in this document, DHS assumes that the concentration of enteric viruses in DTRW, other than polioviruses, that can infect BGM kidney cells can approach 0.009 virus unit per liter in July through October, 0.0003 virus unit per liter in December through May, and 0.005 virus unit per liter in June and November.

To correct readings from Figure VI-1 to correspond to a concentration other than 0.009 virus unit per liter for enteric viruses that can infect BGM kidney cells, other than polioviruses, multiply by the following virus concentration factors:

Season	Month	Virus concentration factor	Season	Month	Virus concentration factor
summer	June	0.042	winter	December	0.003
	July	0.083		January	0.003
	August	0.083		February	0.003
fall	September	0.083	fall	March	0.003
	October	0.083		April	0.003
	November	0.042		May	0.003

DHS obtained the above virus concentration factors by dividing the assumed concentration of enteric viruses that can infect BGM kidney cells, other than polioviruses, for the month and multiplying that by 1/12 (the fraction of a year comprised by a month). Values read from Figure V--24 must also be multiplied by the fraction of time the breathing zone or air intake of a building is downwind from the exhaust area of the tower, determined from meterologic data.

If calculations performed with the use of Figure VI-1 or Figure VI-2 indicate that the volume of air required to limit the annual highest conceivable probability of intestinal infection with virus to 1 in 10,000 is less than or equal to volume of exhaust air emitted with the drift, no diluition of exhaust air downwind from the cooling tower would be required to assure that the highest conceivable probability of intestinal infection with virus will be less than 1 in 10,000. Otherwise, there would be a need to ascertain that the dispersion throughout an indicated greater volume of air will occur upwind from the outdoor breathing zone or air intake of an occupied building, based on consideration of the wind speed, stability class of the atmospheric structure, difference between elevations of the cooling tower exhaust area and the breathing zone or air intake, and distance between the tower exhaust area and the air intake.

Before entering Figure VI-1 or Figure VI-2, determine age of constituents in circulating water from the following equation provided by Chettle (1992):

$$T = 1.385V/BD$$

Where:

T is retention time, in days;
v is the system volume, in gallons; and

BD is the sum of losses by blowdown and drift, in gallons per day.

An example of calculation of age pertains to a cooling system at a power plant, which has a system volume 680,000 gallons, a blowdown rate of 285 gallons per minute (gpm) when the tower operates at five cycles of concentration, a loss of 280 gpm as drift, a circulation rate of 72,5000 gpm, and an evaporation loss of 1140 gpm. The total loss by drift and blowdown, 565 gpm, equals 806,000 gallons per day. Solving the above equation for T (=1.385 times 680,000 gallons divided by 806,000 gallons per day) yields a retention time slightly over a day (1.2 day).

Then find the sum of the monthly products of multiplication of: (1) the fraction of time that an outdoor breathing zone or the air intake of an occupied building is downwind from the operating tower, by (2) the above-cited virus concentration factor for the month.

Extend a vertical line in Figure VI-1 or Figure VI-2 from the tower's presumed rate of emission in gallons per minute (gpm) drift per gpm water circulated. Read the vertical scale at the height of the intersection of your vertical line with the sloping line that represents the age of reclaimed water being circulated in the tower. Multiply the value so read by the above-cited sum of the monthly products of multiplication of fraction of time and virus concentration factor.

The following is an example of the use of Figure VI-1. The air intake of an institution that houses people 24 hours per day throughout the year is southeast of a cooling tower that is operated throughout the yera. Wind is from the northwest 11.3 percent of the time during June through August, 9.6 percent of the time during September through November, 7.1 percent of the time during December through February, and 13.4 percent of the time during March through May. The DTRW being circulated is four days old. The tower emits 0.1 gpm of drift per gpm of water circulated.

The sum of the monthly products of multiplication of fraction of time and virus concentration factor is 0.045. A vertical line in Figure VI-1 from 0.1 gpm of drift per gpm of water circulated intersects the sloping line for 4-day old water at a value of 6300 on the left-hand vertical scale. Multiply by the above-cited sum of monthly products, 0.045, to get 290 cubic meters of air per 0.1 gallon (380 grams, at one gram per milliliter) of drift would have to disperse throughout 290 cubic meters of air (including cooling tower exhaust air) before reaching the air intake of the institution to assure that the annual highest conceivable probability of intestinal infection with virus will be less than 1 in 10,000. Or, equivalently, the particulate aerosols emitted with 1 gram of drift would have to disperse throughout 0.8 cubic meter of air (including cooling tower exhaust air) before reaching the air intake.

If the cooling tower in this example emits no more than 0.34 gallon drift per cubic meter of exhaust air, equivalent to 1.3 gram drift per cubic meter of exhause air, no dilution of exhaust air downwind from the cooling tower would be required to assure that the highest conceivable probability of intestinal infection with virus will be less than 1 in 10,000. If it emits more than that amount of drift per cubic meter of exhaust air, there would be a need to ascertain that particulate aerosols emitted with each gram of drift disperse throughout at least 0.8 cubic meter of air before reaching the air intake.

6.3 Demonstration of Safe Condition

Figure VI-3 allows the determination of the annual highest conceivable probability of intestinal infection with virus, from knowledge of the volume of air throughout which particulate aerosols emitted from a tower with each gram of drift will be dispersed before entry into an outdoor breathing zone or an air intake of an occupied building. The symbol < in the figure means "less than," consistent with the premise that the highest concentration of viruses that can infect BGM kidney cells, in fresh DTRW produced pursuant to subdivision (ee) of Section 60301 of the proposed regulations, is less than the detection limit of 0.01 virus unit per liter.

Before entering Figure VI-3, find the sum of the monthly products of multiplication of: (1) the fraction of time that an outdoor breathing zone or the air intake of an occupied building is downwind from the operating tower, by (2) the virus concentration factor for the month. To use Figure VI-3, extend a vertical line on the figure from the point on the horizontal scale for the age of the water being circulated in the tower. Read the vertical scale of the figure corresponding to the height of your vertical line where it intersects the sloping line that represents the situation of interest--i.e., either:

(1) breathing diluted cooling tower exhaust for a portion of a year that consists of 365 24-hour days in a downwind residential unit or institution (the upper sloping line); or

(2) breathing diluted cooling tower exhaust for a portion of a year that consists of 260 eight-hour working days (the lower sloping line).

Multiply the number so read by the above-cited sum of the monthly products of multiplication of fraction of time and virus concentration factor. Multiply that result by the number obtained by dividing your presumed number of grams of drift emitted by the tower per cubic meter of exhaust air by the number of cubic meters of air throughout which particulate aerosols emitted with drift will be sidpersed before reaching the breathing zone (including the volume of exhaust air emitted from the tower with your presumed number of grams of drift).

The result is the lowest estimate, of the annual probability of infection of the intestine with virus, that can be supported with data from procedures that have a detection limit of 1 virus unit that can infect BGM kidney cells, per 100 liters of reclaimed water. It may be said that the annual probability of infection is presumably less than that result.

The following is an example of the use of Figurg VI-3. The air intake of an office building is due south of a cooling tower that is operated during June through September, as part of a major water-consuming HVAC system for comfort cooling. The tower operates at a cooling range of 10 Fahrenheit degrees, and high cost of water has obliged the owner to have it well designed to conserve water, so that it emits only 0.34 gallon of drift per thousand cubic meters of exhaust air. The DTRW being circulated is four days old. Wind is from the north 5.4 percent of the time during June through August, and 4.1 percent of the time during September through November. Dispersion coefficients based on consideration of the wind speed, stability class of the atmospheric structure, difference between elevations of the cooling tower exhaust area and the air intake of the building, and the distance between the tower exhaust area and the air intake of the building, indicate that particulate aerosols emitted with each cubic meter exhaust air will have been dispersed throughout 4 cubic meters of air (including the one cubic meter of exhaust air) before reaching the air intake of the office building when is is downwind.

The sum of the monthly products of multiplication of fraction of time and virus concentration factor is 0.020. A vertical line in Figure 4 from the point on the horizontal scale for 4-day old water intersects the sloping line for 8-hour work shifts downwind at a value 0.00039 on the left-hand vertical scale. Multiply by the above-cited sum of monthly products, 0.020, to get 0.0000078.

At a density of one gram per milliliter, one gallon would contain 3790 grams, and 0.34 gallon drift per thousand cubic meters exhaust air would be equivalent to 1.3 gram drift per cubic meter. The number obtained by dividing the number of grams of drift emitted by the tower per cubic meter of exhaust air, 1.3, by the number of cubic meters of air throughout which particulate aerosols emitted with drift will be dispersed before reaching the breathing zone, 4.0, is 0.32.

Multiply the above-cited 0.0000078 by 0.32, to get 0.000002. The annual highest conceivable probability that an office worker in the building will contract an intestinal infection with virus is less than 0.000002, or less than 2 in one million. This calculated highest conceivable probability represents only the system design and environmental circumstances cited above for this example of use of Figure VI-3.

7. GLOSSARY

Coxsackieviruses. Coxsackieviruses are enteric viruses named after Coxsackie, New York, where infections were observed.

Coagulated Wastewater. Coagulated wastewater means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable floc-forming chemicals or by an equally effective method.

Dairy Animal. Dairy animal means an animal which produces milk that is consumed by humans, or used for products consumed by humans.

Disinfected Secondary-2.2 Reclaimed Water. Disinfected Secondary-2.2 Reclaimed Water means reclaimed water that is at all times oxidized and disinfected so that at some location in the treatment process the median number of total coliform bacteria does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 23 per 100 milliliters in any two consecutive samples.

Disinfected Secondary-23 Reclaimed Water. Disinfected Secondary-23 Reclaimed Water means reclaimed water that is at all times oxidized and disinfected so that at some location in the treatment process the median number of total coliform bacteria does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed 240 per 100 milliliters in any two consecutive samples.

Echoviruses. Echoviruses are enteric viruses. The name is derived from the acronym ECHO: "enteric cytopathogenic human orphan."

Effluent. Effluent is water discharged from a wastewater treatment plant.

Enteric virus. An enteric virus is a virus that infects the intestine.

Filtered Effluent. Filtered effluent means an oxidized, coagulated, wastewater which has been passed through natural undisturbed soils or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units (ntu) and does not exceed 5 turbidity units (ntu) more than 5 percent of the time during any 24-hour period.

Food Crops. Food crops mean any crops intended for human consumption.

Infection. An infection is the establishment and propagation of an organism in a host, whether or not it results in detectable pathogenic effects. An infection may be demonstrated by antibody response, other subclinical effects, or the presence of the organisms in samples from the host. An infection with enteric virus can cause illness in a person who lacks immunity to the infection.

Industrial Cooling. Industrial cooling means cooling of material. It does not mean cooling of air sent to an enclosed space occupied by a person.

Landscape Impoundment. A landscape impoundment is a body of reclaimed water which is stored or used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.

Mist. Mist means droplets of water dispersed in air, and includes aerosols.

Native Virus. A native virus is a virus excreted into municipal wastewater by an infected person, rather than a virus added to municipal wastewater during an experiment.

Nonrestricted Recreational Impoundment. A nonrestricted recreational impoundment is an impoundment of reclaimed water in which no limitations are imposed on body-contact water sport activities.

Nonpotable. Nonpotable means not suitable for drinking by humans.

Norwalk agent virus. Norwalk agent virus is an enteric virus, so named as it was implicated as the agent of an outbreak of illness in Norwalk, Ohio.

Oxidized Wastewater. Oxidized wastewater means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

Pool. Pool means an artificial basin, chamber or tank used, or intended to be used, for swimming, diving, or recreative bathing. Pools include public swimming pools and pools at amusement parks where the public is splashed or otherwise wetted.

Potable. Potable means suitable for consumption by humans.

Primary Effluent. Primary effluent is the effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliter per liter of settleable solids as determined by an approved laboratory method.

Reclaimed Water. Reclaimed water means water which, as a result of treatment of wastewater, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

Reclamation Plant. Reclamation plant means an arrangement of devices, structures, equipment, processes and controls which produce a reclaimed water suitable for the intended reuse.

Recycled Water. Recycled water means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefor considered a valuable resource.

Restricted Access Golf Course. Restricted access golf course means a golf course where children do not have unsupervised access to an area irrigated with reclaimed water.

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Table 1. Symptoms Or Disease That May Occur In Up To Roughly One Percent And Four Percent Of Persons In The General Population Of California As A Result Of Contracting An Infection Of Enteric Virus In The Intestine

Virus group	Number of virus types	Symptoms or disease	
		One percent of infections a/	Four percent of infections a/
ENTEROVIRUSES b/			
Coxsackie A viruses c/	24	Meningitis, paralysis, herpangina, fever	Fever
Coxsackie B viruses	6	Meningitis, myocarditis, pericarditis, congenital heart disease and anomalies, nephritis, pleurodynia, fever, rash	Fever, rash
Echoviruses d/	34	Meningitis, myocarditis, pericarditis, diarrhea, fever, rash	Diarrhea, fever, rash
New enteroviruses	4	Meningitis, encephalitis, fever	Fever
OTHER VIRUS GROUPS			
Hepatitis A virus	1	Hepatitis A e/	Hepatitis A with mild symptoms f/
Rotavirus g/	2	Vomiting and diarrhea g/	Vomiting and diarrhea
Norwalk agent virus	1	Vomiting and diarrhea h/	Vomiting and diarrhea
Reovirus i/	3	Gastroenteritis	Gastroenteritis
Adenovirus j/	41	Diarrhea	Diarrhea

a/ The one percent and four percent incidences are rough overall estimates for the entire array of viruses that infect the intestine. Actual incidences may vary substantially from these overall estimates. Persons other than the one percent and four percent will not have symptoms that they are aware of.

b/ Enteroviruses have been detected in sewage most often, and in highest concentrations, in August and September. Minimal or undetectable concentrations have been encountered from December through May. Polioviruses, which are enteroviruses, are not cited above as inoculation programs make Californians immune to their effects.

c/ Coxsackie A viruses are also associated with respiratory illness.

d/ Echoviruses are also associated with respiratory infection.

e/ Young adults previously uninfected by hepatitis A can contract acute icteric hepatitis A, which can be disabling and require convalescence for several months. Symptoms can include fever, malaise, anorexia, nausea, and abdominal discomfort, and jaundice.

f/ Infection with hepatitis A virus causes only mild, short-term symptoms in children.

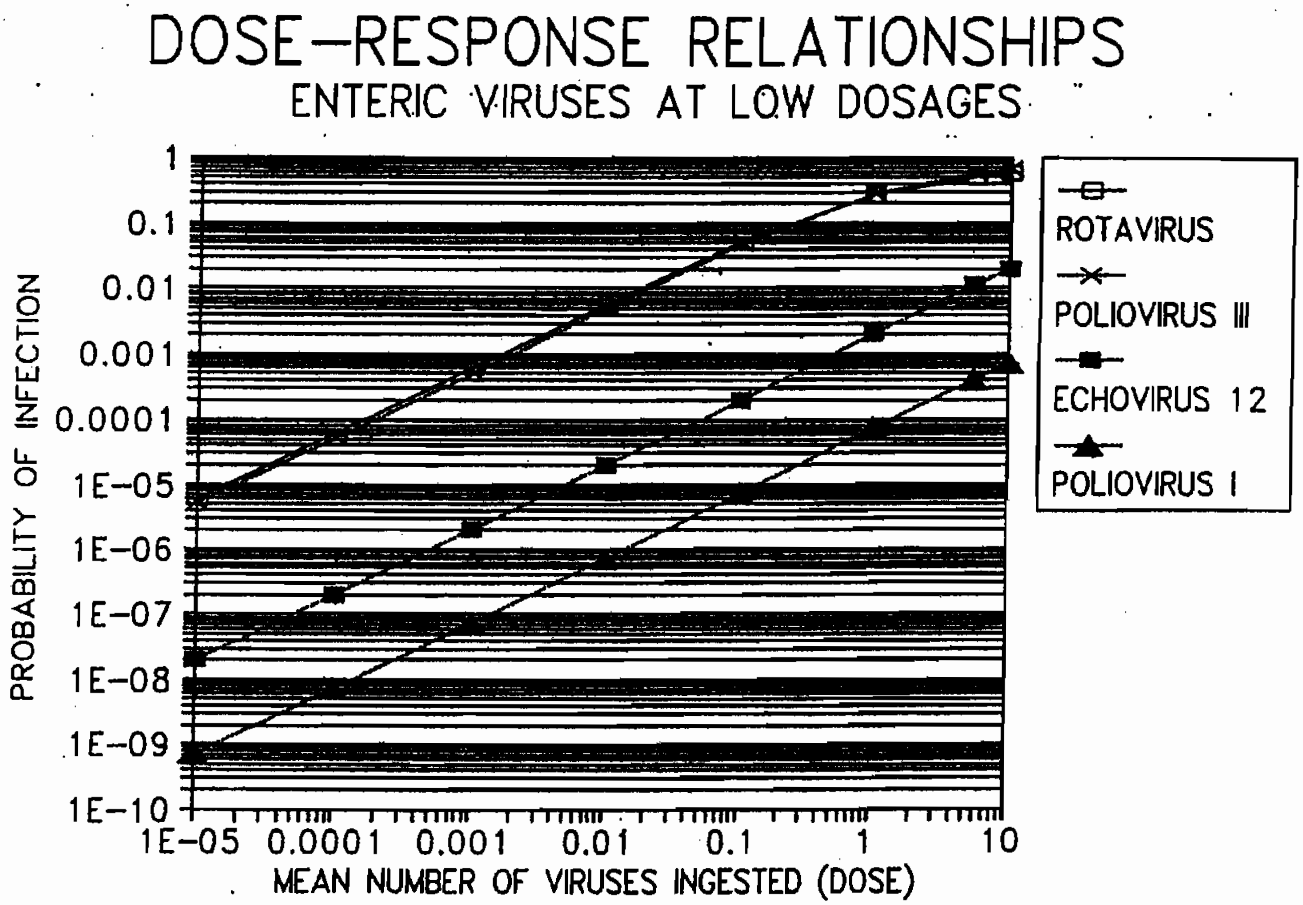
g/ Rotavirus is shed profusely by infected persons in winter and spring. Diarrhea and vomiting can cause severe dehydration in infants between 6 and 24 months of age. Hospitalization is sometimes required and death occasionally occurs.

h/ Norwalk agent virus can cause "epidemic viral gastroenteritis," also called "epidemic diarrhea and vomiting."

i/ Reoviruses are also associated with respiratory illness.

j/ Adenoviruses are also associated with eye infection, acute conjunctivitis, and respiratory illness.

Figure I-1



DOSE-RESPONSE RELATIONSHIPS
ENTERIC VIRUSES AT LOW DOSAGES
PROBABILITY OF INFECTION
1
0.1
0.01
0.001
0.0001
1E-05
1E-06
1E-07
1E-08
1E-09
1E-10
1E-05
0.0001
0.001
0.01
0.1
1
10
MEAN NUMBER OF VIRUSES INGESTED (DOSE)
ROTAVIRUS
POLIOVIRUS III
ECHOVIRUS 12
POLIOVIRUS I

Table II - 1. Symptoms Or Disease That May Occur With 1, 4, and 95 Percent Of Virus Infections Of The Intestine In Californians With Normal Acquired Immunities

Virus group	Symptoms or disease		
	One percent of infections a/	Four percent of infections a/	Ninety-five percent of infections
ENTEROVIRUSES b/			
Coxsackie A viruses	Herpangina, meningitis, fever	Fever	Symptoms not apparent to host
Coxsackie B viruses	Myocarditis, pleurodynia, meningitis, fever, rash	Fever, rash	Symptoms not apparent to host
Echoviruses	Meningitis, diarrhea, fever, rash	Diarrhea, fever, rash	Symptoms not apparent to host
New enteroviruses	Meningitis, encephalitis, fever	Fever	Symptoms not apparent to host
OTHER VIRUS GROUPS			
Hepatitis A virus	hepatitis A d/	hepatitis A with mild symptoms c/	Symptoms not apparent to host
Rotavirus	Vomiting and diarrhea e/	Vomiting and diarrhea	Symptoms not apparent to host
Norwalk agent virus f/ and other "small round viruses"	Vomiting and diarrhea	Vomiting and diarrhea	Symptoms not apparent to host

a/ Symptoms or diseases cited are listed by Asano et al. (1984), without reference to probability of occurrence, as associated with viruses in cited virus groups.

b/ Polioviruses, which are enteroviruses, are not cited as immunization programs make Californians immune to their effects.

c/ Effects of infection with hepatitis A virus cause only mild, short-term symptoms in children.

d/ Young adults previously uninfected by hepatitis A can contract acute icteric hepatitis A, which can be disabling and require convalescence for several months. Symptoms can include fever, malaise, anorexia, nausea, and abdominal discomfort, and jaundice.

e/ Rotavirus can cause "sporadic viral gastroenteritis," which can cause severe dehydration in infants between 6 and 24 months of age resulting from diarrhea and vomiting. Hospitalization is sometimes required, and death occasionally occurs.

f/ Norwalk agent virus can cause "epidemic viral gastroenteritis," also called "epidemic diarrhea and vomiting."

Table II-2. Summary of Available Enteric Virus Data On Unchlorinated Secondary Effluents in California

Agency	Facility	Study Period	Type of Secondary Treatment	No. of Samples	No. of Positive Samples	Min.-Max.[1] Viral Unit /100 L	Estimated Geometric Mean, Viral Units/100 L	Median Value	≤90 % Value
Orange County Water District	County Sanitation Districts of Orange County, Plant No. 1	1975-78	Trickling Filter	145	109	<26-26,420	185	3,160	17,562
Orange County Water District	County Sanitation Districts of Orange County, Plant No. 1	1978-81	Activated Sludge	105	53	<2->250	2	ND[2]	66
Monterey Regional Water Pollution Control Agency	Castroville	1980-85	Activated Sludge	67	53	<100-73,400	200	53	2,700
County Sanitation Districts of Los Angeles County	Pomona	1975	Activated Sludge	60	27	<44-13,659	6	ND[2]	539
Las Virgenes Municipal Water District	Tapia	1980 1988-90	Nitrified Activated Sludge	47	41	<0.26->23	2	2	>23
Total				424	283			2[3]	500[3]

[1]Less than indicated value means the limit of detection, while greater than indicated value means too numerous to count.
[2]ND = Not detected.
[3]Combined result of all activated sludge data.

Table II-3. Chlorine Inactivation Of Viruses In Wastewaters

Virus	Initial Viral Units per Liter	Probable Cl Species	Type of Water	Chlorine Residual	Temp	pH	Contact Time	Scale	% Reduction	Reference
Enteric Viruses	[illegible]	Combined	Primary	[illegible]	—	[illegible]	—	Full	[illegible]	Sattar and Westwood [illegible]
Enteric Viruses	[illegible]	Combined	Primary	[illegible]	[illegible]	[illegible]	15	Bench	[illegible]	Berg et al. [illegible]
Enteric Viruses	[illegible]	Combined	Trickling Filter	[illegible]	[illegible]	[illegible]	30	Bench	[illegible]	[illegible]
Enteric Viruses	[illegible]	Combined	Activated Sludge	[illegible]	—	—	[illegible]	Full	[illegible]	[illegible] et al. [illegible]
Enteric Viruses	[illegible]	Free	Nitrified Activated Sludge	[illegible]	—	—	30	Full	[illegible]	[illegible] et al. [illegible]
[illegible] Phage	[illegible]	Combined	Oxidation Pond	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
[illegible] Phage	[illegible]	Combined	Oxidation Pond	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
[illegible] Phage	[illegible]	Combined	Oxidation Pond	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
[illegible] Phage	[illegible]	Combined	Oxidation Pond	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
Poliovirus 1	[illegible]	Combined	Synthetic Primary	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
Poliovirus 1	[illegible]	Combined	Synthetic Primary	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
Poliovirus [illegible]	—	Combined	Trickling Filter	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible]
Poliovirus [illegible]	[illegible]	Combined	Oxidation Pond	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
Poliovirus [illegible]	[illegible]	Combined	Oxidation Pond	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
Poliovirus [illegible]	[illegible]	Combined	Trickling Filter	[illegible]	[illegible]	[illegible]	[illegible]	Full	[illegible]	[illegible]
Poliovirus [illegible]	[illegible]	Combined	Activated Sludge	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
Poliovirus [illegible]	[illegible]	Combined	Activated Sludge	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
Poliovirus [illegible]	[illegible]	Combined	Reclaimed	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
Poliovirus [illegible]	[illegible]	Combined	Reclaimed	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
[illegible]	[illegible]	Combined	Trickling Filter	[illegible]	[illegible]	[illegible]	[illegible]	Full	[illegible]	[illegible] et al. [illegible]
[illegible]	[illegible]	Combined	Trickling Filter	[illegible]	[illegible]	[illegible]	[illegible]	Full	[illegible]	[illegible] et al. [illegible]
[illegible]	[illegible]	Combined	Oxidation Pond	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
[illegible]	[illegible]	Combined	Activated Sludge	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
[illegible]	[illegible]	Combined	Activated Sludge	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]
MS2	[illegible]	Combined	Oxidation Pond	[illegible]	[illegible]	[illegible]	[illegible]	Bench	[illegible]	[illegible] et al. [illegible]

Source: Leong, L. Y. C. (1983)

Table II-4. Expected Virus Survival In Unfiltered Secondary Effluent After Chlorination To Obtain Cited Final Concentrations Of Total Coliform Bacteria

Final concentration of coliform bacteria, number/100 ml	CT required to reduce concentration of coliform bacteria from 200,000/100 ml to cited concentration, minutes-mg/liter a/	Percent virus remaining with chlorination at cited CT, after data presented by Lothrop and Sproul (1969)	Percent virus remaining after multiplying by 15/1.8 to correspond to 15 percent virus survival observed by Las Virgenes MWD in 1980
2.2	650	0.32	2.6
23	230	10	33
240	82	28	81
8.5 a/	300	1.8	15 a/

a/ Fifteen percent of the native viruses in unfiltered activated sludge effluent of the Las Virgenes [illegible] Tapia plant survived chlorination that reduced the concentration of total coliform bacteria from 200,000/100 ml to 8.5/100 ml in a study conducted January-April 1980 (Trussell et al. 19[illegible]

Table II-5. Viruses Detectable in HeLa Cell Culture in Undisinfected-Trickling-Filter Effluent And In Air Downwind From The Hanford Farm Near Wilson, Texas, And in Air Downwind From Where It Was Sprayed in 1982 a/

Parameter	March 18		August 2		August 4		August 24	
	Wastewater	Air	Wastewater	Air	Wastewater	Air b/	Wastewater	Air
TITER CONCENTRATIONS pfu per liter wastewater pfu per cubic meter air	140	.0020	100	.013	2200	14.2	50	.019
PERCENT OF ISOLATES								
Coxsackie B5	—	—	25	5	36	8.1	51	—
Unidentified viruses	25	—	18	54	27	1.2	19	21
Echovirus	30	—	6	—	7	8.1	11	7
Coxsackie A9	10	—	—	—	—	—	—	—
Coxsackie A16	—	—	3	—	—	—	—	—
Coxsackie B2	—	—	—	—	—	—	3	—
Polio 1	—	—	—	—	2	84.1	5	56
Polio 2	13	67	—	5	5	2.0	5	14
Polio 3	13	33	3	—	4	2.6	—	—
OTHER PARAMETERS								
Distance between irrigation and air samples, meters/feet	—	60 / 200	—	46 / 150	—	44 / 140	—	49 / 160
Number of virus isolates in sample	31	3	32	13	35	34	36	14

a/ This table is based on data presented by Camann et al (1988).

b/ Air sampling was started at 11:21 a.m., when air temperature was 29 degrees centigrade, wind speed was 4.5 meters per second, relative humidity was 63 percent, and solar radiation was 1.1 gram-calories per square centimeter. Sampling was ended at 2:44 p.m., when air temperature was 33, wind speed was 4.0, relative humidity was 40, and solar radiation was 1.2. (Camann 1991).

FIGURE II- 1

VIRUS DETECTABLE BY BGM CELL CULTURE

WATER FROM ACTIVATED SLUDGE EFFLUENT

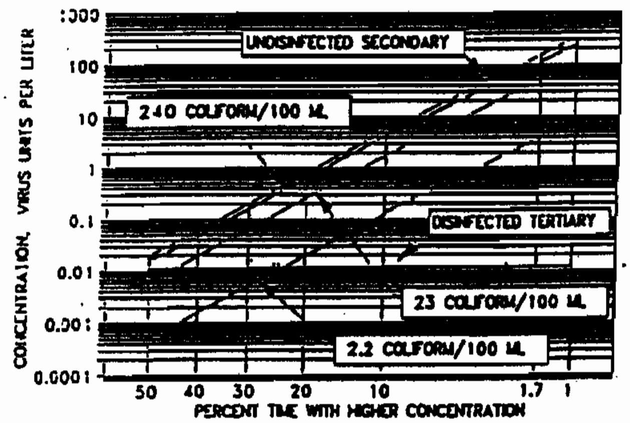


FIGURE II- 2

VIRUS DETECTABLE BY BGM CELL CULTURE

WATER FROM TRICKLING FILTER EFFLUENT

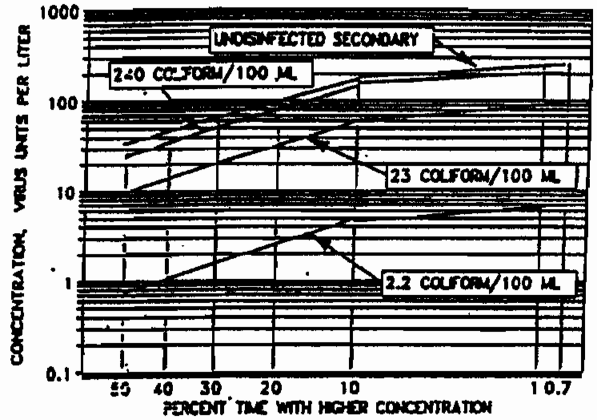
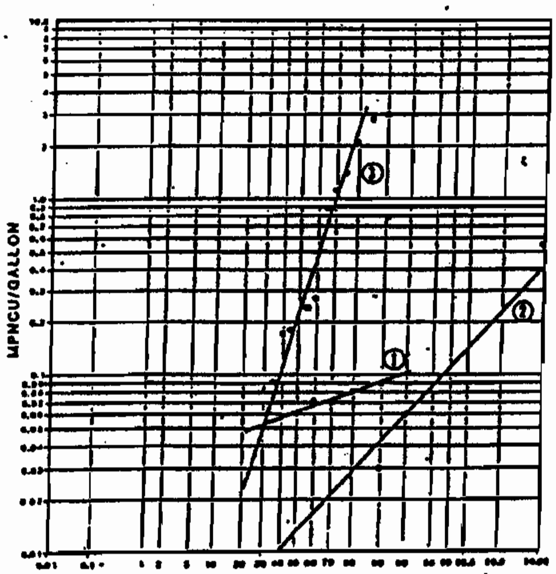


FIGURE II- 3



① LVMWD UNCHLORINATED EFFLUENT JAN– APRIL 1980

② LVMWD CHLORINATED EFFLUENT JAN– APRIL 1980

③ WATER FACTORY 21 UNCHLORINATED ACTIVATED SLUDGE EFFLUENT JAN– APRIL 1979

CONFIRMED VIRUS LEVELS IN LVMWD AND WATER FACTORY 21 EFFLUENTS

Source: Trussel et al. (1980)

FIGURE II- 4

POSSIBLE CONCENTRATIONS OF VIRUS IN DTRW THAT CAN INFECT BGM KIDNEY CELLS

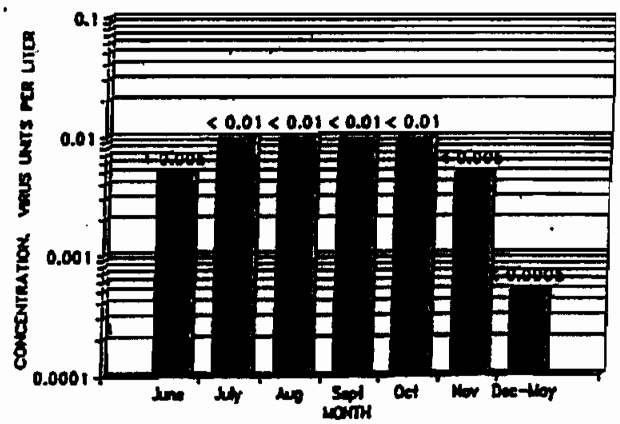


Table III-1. Use of Reclaimed Water Pursuant To Proposed Regulations

Use	Conditions in Which Use Is Allowed			
	Disinfected Tertiary Reclaimed Water	Disinfected Secondary-2.2 Reclaimed Water	Disinfected Secondary-23 Reclaimed Water	Undisinfected Secondary Reclaimed Water
supply for a non-restricted recreational impoundment	Allowed	Not allowed	Not allowed	Not allowed
flushing toilets and urinals and priming drain traps in non-residential buildings	Allowed	Not allowed	Not allowed	Not allowed
all other uses other than potable use or food preparation and other than groundwater recharge (governed by other regulations)	Allowed	Not allowed	Not allowed	Not allowed
irrigation of:				
parks, playgrounds, school yards, residential yards, and golf courses associated with residences	Spray, drip, or surface	Not allowed	Not allowed	Not allowed
restricted access golf courses, cemeteries, and freeway landscapes	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Not allowed
non-edible vegetation at other areas with limited public exposure	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Not allowed
sod farms	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Not allowed
ornamental plants for commercial use	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Not allowed
all food crops	Spray, drip, or surface	Not allowed	Not allowed	Not allowed
food crops that are above ground and not contacted by reclaimed water	Spray, drip, or surface	Drip or surface	Not allowed	Not allowed
pasture for milking animals and other animals	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Not allowed
fodder (e.g. alfalfa), fiber (e.g. cotton), and seed crops not eaten by humans	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Drip or surface
orchards and vineyards bearing food crops	Spray, drip, or surface	Drip or surface	Drip or surface	Drip or surface
orchards and vineyards not bearing food crops	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Drip or surface
Christmas trees and other trees not grown for food	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Drip or surface
food crop which must undergo commercial pathogen-destroying processing before consumption (e.g. sugar beets)	Spray, drip, or surface	Spray, drip, or surface	Spray, drip, or surface	Drip or surface

(Continued on next page)

Table III-2. (continued) Use of Reclaimed Water Pursuant To Proposed Regulations

Use	Conditions in Which Use Is Allowed			
	Disinfected Tertiary Reclaimed Water	Disinfected Secondary-2.2 Reclaimed Water	Disinfected Secondary-23 Reclaimed Water	Undisinfected Secondary Reclaimed Water
other uses:				
air conditioning and industrial cooling utilizing cooling towers	Allowed	Not allowed	Not allowed	Not allowed
industrial cooling not utilizing cooling towers, spraying, nor features that create aerosols or other mist	Allowed	Allowed	Allowed	Not allowed
industrial process with exposure of workers	Allowed	Not allowed	Not allowed	Not allowed
industrial process without exposure of workers	Allowed	Allowed	Allowed	Not allowed
industrial boiler feed	Allowed	Allowed	Allowed	Not allowed
water jetting for consolidation of backfill material around pipelines for potable water during water shortages	Allowed	Not allowed	Not allowed	Not allowed
water jetting for consolidation of backfill material around pipelines for reclaimed water, sewage, storm drainage, and gas, and conduits for electricity	Allowed	Allowed	Allowed	Not allowed
dampening soil for compaction at construction sites, landfills, and elsewhere	Allowed	Allowed	Allowed	Not allowed
washing aggregate and making concrete	Allowed	Allowed	Allowed	Not allowed
dampening unpaved roads and other surfaces for dust control	Allowed	Allowed	Allowed	Not allowed
dampening brushes and street surfaces during street sweeping	Allowed	Allowed	Allowed	Not allowed
flushing sanitary sewers (footnote b)	Allowed	Allowed	Allowed	Not allowed
fire fighting by dumping from aircraft	Allowed	Allowed	Allowed	Not allowed
supply for a restricted recreational impoundment	Allowed	Allowed	Not allowed	Not allowed
supply for basins at fish hatcheries	Allowed	Allowed	Not allowed	Not allowed
washing yards, lots, and sidewalks	Allowed	Allowed	Not allowed	Not allowed
supply for landscape impoundment without decorative fountain	Allowed	Allowed	Allowed	Not allowed
supply for decorative fountain	Allowed	Not allowed	Not allowed	Not allowed

FIGURE III 1

DOSE-RESPONSE RELATIONSHIPS

ENTERIC VIRUSES AT LOW DOSAGES

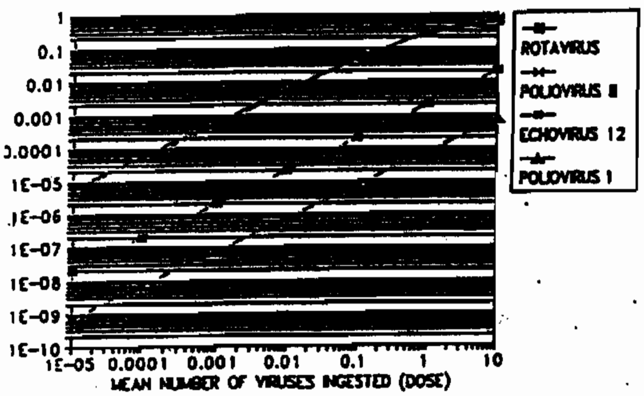


FIGURE IV 1 HIGHEST CONCEIVABLE

PROBABILITY OF INFECTION FROM ONE SWIM

FRESH ACTIVATED SLUDGE EFFLUENT

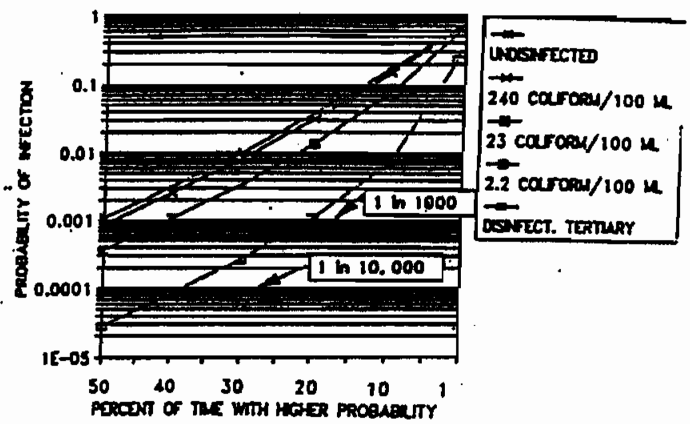


FIGURE IV 2 HIGHEST CONCEIVABLE

PROBABILITY OF INFECTION FROM ONE SWIM

3-DAY OLD ACTIVATED SLUDGE EFFLUENT

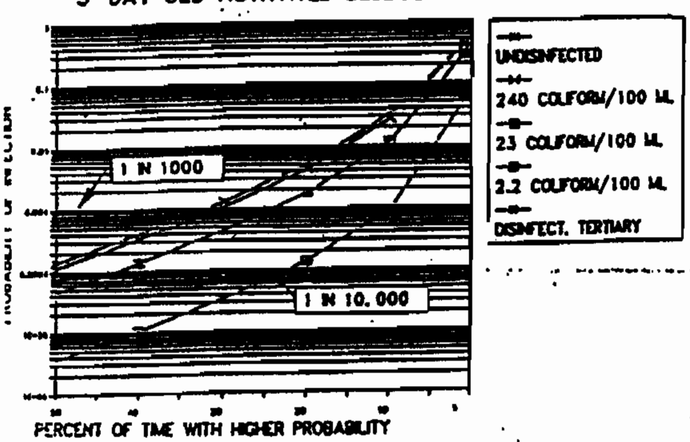


FIGURE IV 3 HIGHEST CONCEIVABLE

PROBABILITY OF INFECTION FROM ONE SWIM

5-DAY OLD ACTIVATED SLUDGE EFFLUENT

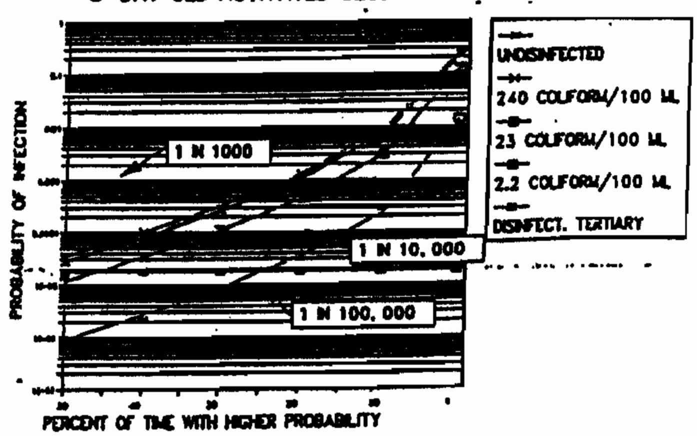


Table IV-1. Percent Of Time Highest Conceivable Probability Of 1 In 1000, 1 In 100, And 1 In 10, For Contracting A Viral Infection Of The Intestine, Is Exceeded From Ingesting Constituents Of Chlorinated Activated Sludge Effluent a/

Use	Disinfected Secondary-2.2 Reclaimed Water						Disinfected Secondary-23 Reclaimed Water					
	Coliform at 2.2/100 ml			Coliform at 23/100 ml			Coliform at 23/100 ml			Coliform at 240/100 ml		
	1 in 1000	1 in 100	1 in 10	1 in 1000	1 in 100	1 in 10	1 in 1000	1 in 100	1 in 10	1 in 1000	1 in 100	1 in 10
Swimming in fresh water	20	6	4	40	25	15	50	25	15	60	30	15
Swimming in 3-day old water	10	4	<1	25	10	6	25	10	5	30	15	6
Swimming in 5-day old water	7	2	<1	15	5	3	15	6	2	30	10	2
Swimming in 7-day old water	4	<1	<1	10	6	<1	15	6	<1	15	7	1
Eating sprayed food	7	1	<1	16	7	1	15	7	1	20	9	3
Working with water without washing hands before eating	4	<1	<1	10	6	<1	10	5	<1	16	7	1
Playing on turf irrigated previous day, without washing hands before eating	5	<1	<1	6	4	<1	5	4	<1	10	3	<1

a/ The percent of time highest conceivable probability of 1 in 1000, 1 in 100, and 1 in 10 is exceeded from ingesting constituents of undisinfected activated sludge effluent is slightly higher than that cited here for activated sludge chlorinated to obtain a concentration of total coliform bacteria of 240/100 ml.

Table IV-2. Highest Conceivable Probability Of Contracting A Viral Infection Of The Intestine From One Episode Of Ingesting Constituents Of Activated Sludge Effluent Chlorinated To Meet Coliform Criteria For Disinfected Secondary-2.2 Reclaimed Water, That Is Exceeded 30, 10, And 1 Percent Of The Time a/

Use	Coliform at 2.2/100 ml			Coliform at 23/100 ml		
	30 %	10 %	1 %	30 %	10 %	1 %
Swimming in fresh water	3 in 10,000	7 in 1000	20 percent	3 in 1000	6 percent	40 percent
Swimming in 3-day old water	3 in 100,000	9 in 10,000	5 percent	4 in 10,000	4 percent	20 percent
Swimming in 5-day old water	9 in a million	2 in 10,000	1 percent	1 in 10,000	3 in 1000	10 percent
Swimming in 7-day old water	2 in a million	6 in 100,000	3 in 1000	3 in 100,000	7 in 10,000	4 percent
Eating sprayed food	7 in a million	3 in 10,000	1 percent	9 in 100,000	2 in 1000	10 percent
Working with water without washing hands before eating	3 in a million	7 in 100,000	4 in 1000	9 in 100,000	8 in 10,000	6 percent
Playing on turf irrigated previous day, without washing hands before eating	1 in a million	6 in 100,000	2 in 1000	3 in 100,000	4 in 10,000	3 percent

a/ Probabilities of infection exceeded 50 and 90 percent of the time are generally about one-tenth and one-third that cited as exceeded 30 percent of the time, respectively.

Table IV-3. Highest Conceivable Probability Of Contracting A Viral Infection Of The Intestine From One Episode Of Ingesting Constituents Of Activated Sludge Effluent Chlorinated To Meet Coliform Criteria For Disinfected Secondary-23 Reclaimed Water, That Is Exceeded 30, 10, And 1 Percent Of The Time a/

Use	Coliform at 23/100 ml			Coliform at 240/100 ml		
	30 %	10 %	1 %	30 %	10 %	1 %
Swimming in fresh water	3 in 1000	4 percent	20 percent	4 in 1000	24 percent	20 percent
Swimming in 2-day old water	4 in 10,000	4 percent	24 percent	1 in 1000	3 percent	40 percent
Swimming in 5-day old water	1 in 10,000	4 in 1000	10 percent	3 in 10,000	7 in 1000	20 percent
Swimming in 7-day old water	3 in 100,000	7 in 10,000	4 percent	7 in 100,000	3 in 1000	4 percent
Eating sprayed food	9 in 100,000	3 in 1000	10 percent	2 in 10,000	6 in 1000	20 percent
Walking with water without washing hands before eating	3 in 100,000	9 in 10,000	5 percent	8 in 100,000	2 in 1000	10 percent
Playing on turf irrigated previous day, without washing hands before eating	4 in 100,000	5 in 10,000	6 percent	4 in 100,000	1 in 1000	6 percent

a/ Highest conceivable probability of infection exceeded 5 percent of the time is generally about five times that cited as exceeded 10 percent of time. Highest conceivable probability of infection from ingesting constituents of undisinfected activated sludge effluent is generally about 25 percent higher than that cited for Disinfected Secondary-23 Reclaimed Water with coliform concentration at or above level 240/100 ml.

Table IV-4. Highest Conceivable Probability Of Contracting A Viral Infection Of The Intestine From One Episode Of Ingesting Constituents Of Disinfected Tertiary Reclaimed Water and Water Reclaimed From Activated Sludge Effluent By Chlorination, That Is Exceeded 30, 10, And 1 Percent Of The Time

Use	Coliform bacteria concentration at median prescribed by proposed regulations			Coliform bacteria at high concentration allowed to be exceeded on non-consecutive days		
	30 %	10 %	1 %	30 %	10 %	1 %
Eating food sprayed with reclaimed water two days previously						
Disinfected Tertiary Reclaimed Water	1 in 100,000	1 in 100,000	1 in 100,000	1 in 100,000	1 in 100,000	1 in 100,000
Disinfected Secondary-2.2 Reclaimed Water	7 in a million	2 in 10,000	1 percent	9 in 100,000	3 in 1000	10 percent
Disinfected Secondary-23 Reclaimed Water	9 in 100,000	3 in 1000	10 percent	3 in 10,000	6 in 1000	20 percent
Working with reclaimed water without washing hands before eating						
Disinfected Tertiary Reclaimed Water	5 in a million	6 in a million	6 in a million	6 in a million	4 in a million	4 in a million
Disinfected Secondary-2.2 Reclaimed Water	3 in a million	3 in 100,000	4 in 1000	3 in 100,000	3 in 10,000	5 percent
Disinfected Secondary-23 Reclaimed Water	3 in 100,000	8 in 10,000	5 percent	5 in 100,000	8 in 1000	10 percent
Playing on turf irrigated previous day with reclaimed water, without washing hands before eating						
Disinfected Tertiary Reclaimed Water	3 in a million	3 in a million	3 in a million	3 in a million	3 in a million	3 in a million
Disinfected Secondary-2.2 Reclaimed Water	1 in a million	5 in 100,000	3 in 1000	3 in 100,000	5 in 10,000	3 percent
Disinfected Secondary-23 Reclaimed Water	3 in 100,000	3 in 10,000	3 percent	4 in 100,000	1 in 1000	6 percent

Table IV-5. Percent Of Time Highest Conceivable Probability Of 1 In 1000, 1 In 100, And 1 In 10, For Contracting A Viral Infection Of The Intestine, Is Exceeded From Ingesting Constituents Of Chlorinated Trickling Filter Effluent a/

Use	Disinfected Secondary-2.2 Reclaimed Water						Disinfected Secondary-23 Reclaimed Water					
	Coliform at 2.2/100 ml			Coliform at 23/100 ml			Coliform at 23/100 ml			Coliform at 240/100 ml		
	1 in 1000	1 in 100	1 in 10	1 in 1000	1 in 100	1 in 10	1 in 1000	1 in 100	1 in 10	1 in 1000	1 in 100	1 in 10
Swimming in fresh water	> 50	> 50	30	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50	> 50
Swimming in 3-day old water	> 50	20	< 1	> 50	> 50	10	> 50	> 50	30	> 50	> 50	> 50
Swimming in 5-day old water	> 50	6	< 1	> 30	> 50	6	> 50	> 50	5	> 50	> 50	20
Swimming in 7-day old water	20	< 1	< 1	> 30	25	< 1	> 50	25	< 1	> 50	> 50	< 1
Eating sprayed food	50	< 1	< 1	> 50	60	< 1	> 50	60	< 1	> 50	> 50	30
Working with water without washing hands before eating	30	< 1	< 1	> 50	30	< 1	> 50	30	< 1	> 50	> 50	< 1
Playing on turf irrigated previous day, without washing hands before eating	15	< 1	< 1	> 50	30	< 1	> 50	60	< 1	> 50	40	< 1

a/ The percent of time highest conceivable probability of 1 in 1000, 1 in 100, and 1 in 10 is exceeded from ingesting constituents of undisinfected trickling filter effluent is slightly higher than that cited here for trickling filter effluent chlorinated to attain a concentration of total coliform bacteria of 240/100 ml.

Table IV-6. Highest Conceivable Probability Of Contracting A Viral Infection Of The Intestine From One Episode Of Ingesting Constituents Of Trickling Filter Effluent Chlorinated To Meet Coliform Criteria For Disinfected Secondary-2.2 Reclaimed Water, That Is Exceeded 30, 10, And 1 Percent Of The Time a/

Use	Coliform at 2.2/100 ml			Coliform at 23/100 ml		
	30 %	10 %	1 %	30 %	10 %	1 %
Swimming in fresh water	7 percent	10 percent	20 percent	40 percent	50 percent	60 percent
Swimming in 3-day old water	1 percent	3 percent	4 percent	10 percent	10 percent	20 percent
Swimming in 5-day old water	3 in 1000	8 in 1000	1 percent	2 percent	6 percent	10 percent
Swimming in 7-day old water	7 in 10,000	2 in 1000	3 in 1000	6 in 1000	2 percent	3 percent
Eating sprayed food	2 in 1000	5 in 1000	9 in 1000	4 percent	7 percent	9 percent
Working with water without washing hands before eating	6 in 10,000	3 in 1000	4 in 1000	1 percent	3 percent	4 percent
Playing on turf irrigated previous day, without washing hands before eating	4 in 10,000	1 in 1000	2 in 1000	6 in 1000	2 percent	2 percent

a/ Probabilities of infection exceeded 50 and 40 percent of the time are generally about half and seven-tenths that cited as exceeded 30 percent of the time, respectively.

FIGURE IV 4 HIGHEST CONCEIVABLE PROBABILITY OF INFECTION FROM ONE SWIM
7-DAY OLD ACTIVATED SLUDGE EFFLUENT

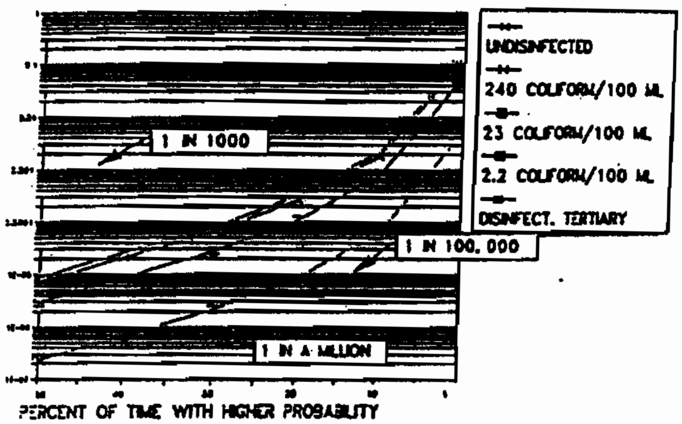


FIGURE IV 5 HIGHEST CONCEIVABLE PROBABILITY OF INFECTION, ONE MEAL
ACTIVATED SLUDGE EFFLUENT

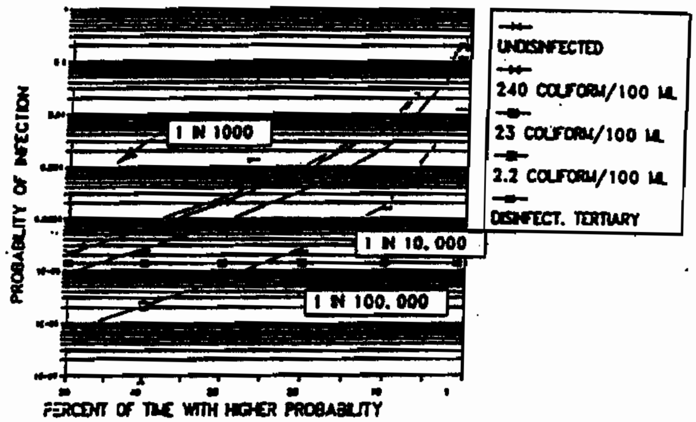


FIGURE IV 6 HIGHEST CONCEIVABLE PROBABILITY OF INFECTION, ONE JETTING
ACTIVATED SLUDGE EFFLUENT

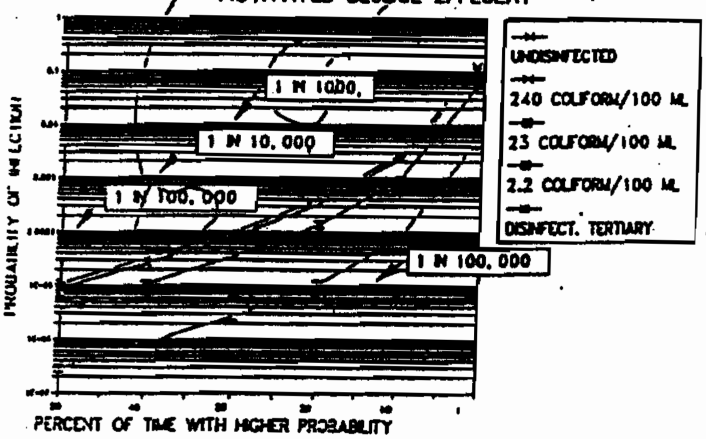


FIGURE IV 7 HIGHEST CONCEIVABLE PROBABILITY OF INFECTION, ONE PLAY
ACTIVATED SLUDGE EFFLUENT

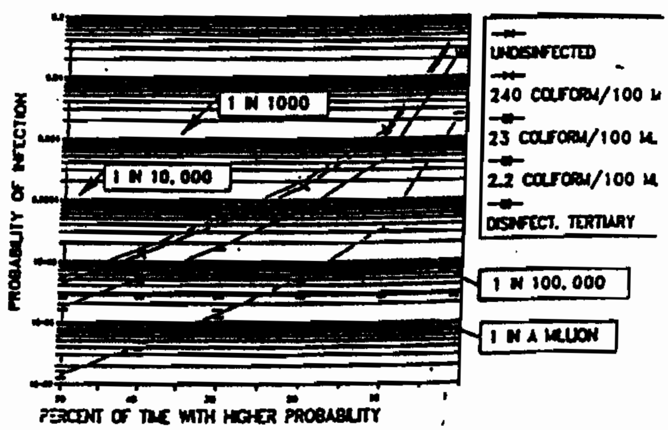


FIGURE IV 8 HIGHEST CONCEIVABLE PROBABILITY OF INFECTION FROM ONE SWIM
FRESH TRICKLING FILTER EFFLUENT

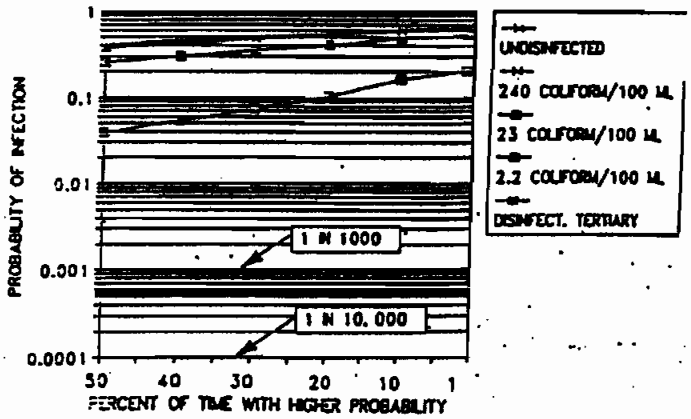


FIGURE IV 9 HIGHEST CONCEIVABLE PROBABILITY OF INFECTION FROM ONE SWIM
3-DAY OLD TRICKLING FILTER EFFLUENT

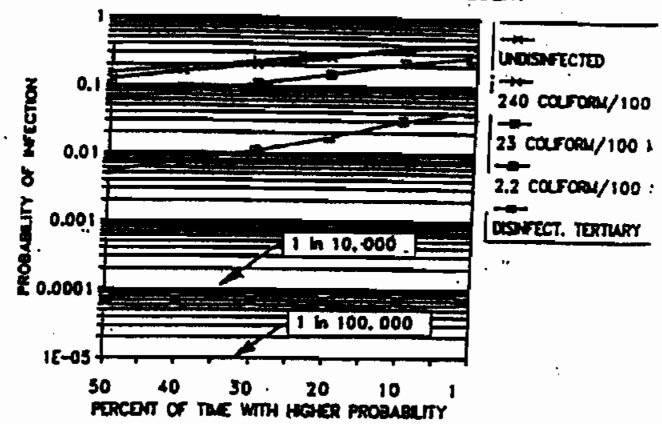


FIGURE IV 10 HIGHEST CONCEIVABLE PROBABILITY OF INFECTION FROM ONE SWIM
5-DAY OLD TRICKLING FILTER EFFLUENT

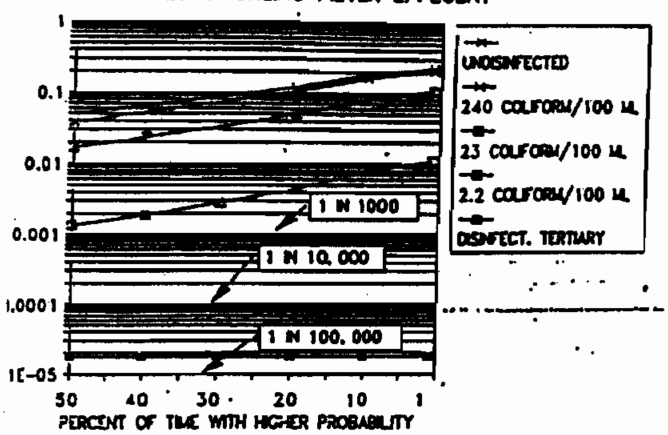


FIGURE IV 11 HIGHEST CONCEIVABLE PROBABILITY OF INFECTION FROM ONE SWIM
7-DAY OLD TRICKLING FILTER EFFLUENT

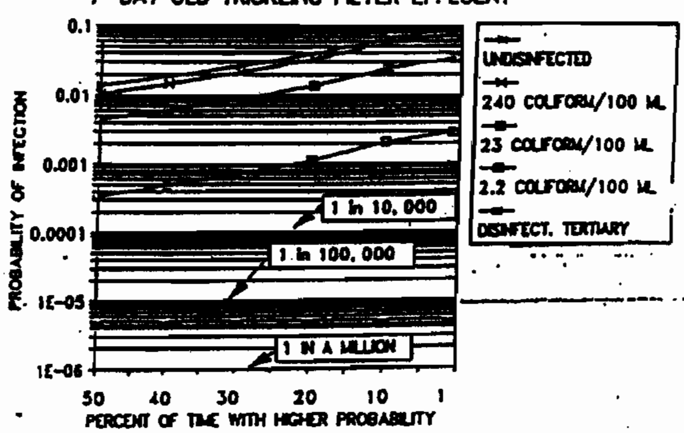


FIGURE IV 12 HIGHEST CONCEIVABLE
PROBABILITY OF INFECTION FROM ONE_MEAL
TRICKLING FILTER EFFLUENT

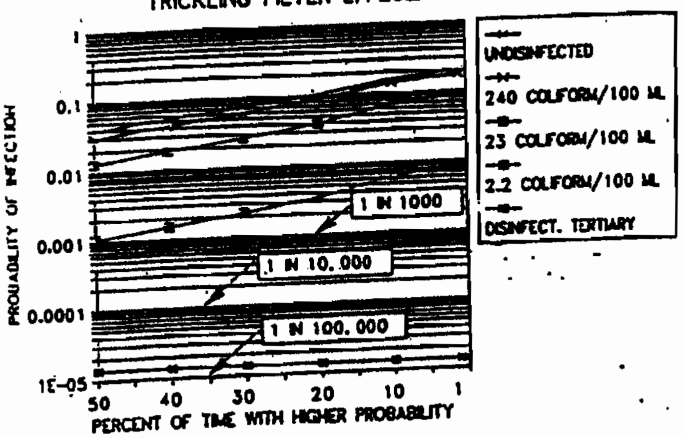


FIGURE IV 13 HIGHEST CONCEIVABLE
PROBABILITY OF INFECTION, ONE JETTING
TRICKLING FILTER EFFLUENT

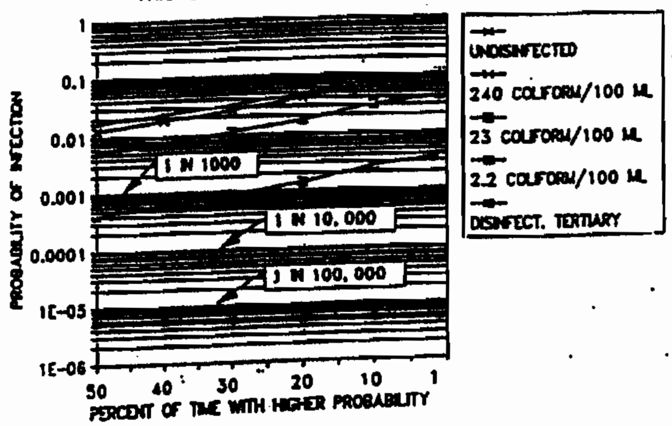


FIGURE IV 14 HIGHEST CONCEIVABLE
PROBABILITY OF INFECTION FROM ONE_PLAY
TRICKLING FILTER EFFLUENT

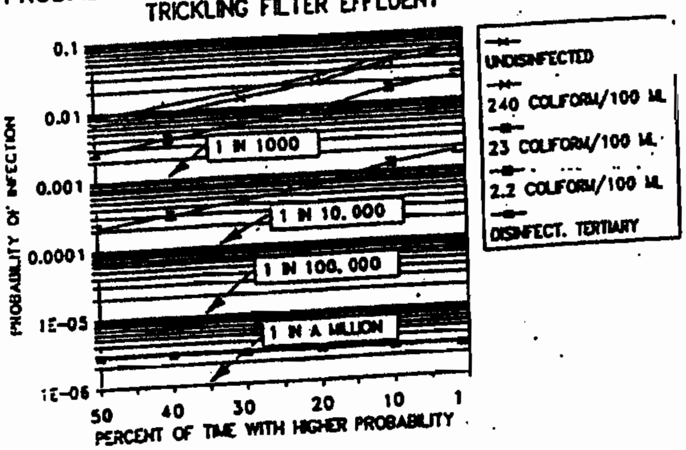


Table V-2. Highest Conceivable Probability Of Contracting A Viral Infection Of The Intestine From One Episode Of Ingesting Coliforms Of Drinking Water Without Chlorination To Meet Coliform Criteria For Undisinfected Secondary-Treated Value, That Is Exceeded 30, 10, And 1 Percent Of The Time a/

Use	Coliform at 23/100 ml			Coliform at 240/100 ml		
	30 %	10 %	1 %	30 %	10 %	1 %
Swimming in fresh water	60 percent	60 percent	60 percent	60 percent	60 percent	60 percent
Swimming in 7-day old water	60 percent	60 percent	30 percent	30 percent	30 percent	60 percent
Swimming in 1-day old water	2 percent	4 percent	60 percent	7 percent	20 percent	30 percent
Swimming in 7-day old water	9 in 1000	2 percent	3 percent	2 percent	6 percent	7 percent
Eating sprayed food	4 percent	7 percent	9 percent	7 percent	60 percent	30 percent
Walking with water without washing hands before eating	1 percent	3 percent	4 percent	3 percent	7 percent	9 percent
Playing on land irrigated previous day, without washing hands before eating	6 in 1000	2 percent	2 percent	1 percent	4 percent	9 percent

a/ [illegible]

Table V-1. Concentration Of Substances In Air Downwind From Spray Irrigation During Cited Meteorologic Condition Divided By Concentration During Class D Stability And Wind Speed 4.0–4.5 Meters Per Second. Assuming Same Rate Of Emission Of Substances

Circumstances in which irrigation occurs	Stability category	Wind speed								
		1 m/sec (2.2 mph)	2 m/sec (4.5 mph)	3 m/sec (6.7 mph)	4 m/sec (9.0 mph)	5 m/sec (11 mph)	6 m/sec (13 mph)	7 m/sec (16 mph)	10 m/sec (22 mph)	15 m/sec (33 mph)
Summer or fall night-time irrigation in rural area	D	20 a/	8 a/	8 a/	4 a/	3 a/	3	2	2	0.8
	D-E	—	—	—	4-7 b/	3-6 b/	—	—	—	—
	E-F	—	10-20 b/	8-20 b/	—	—	—	—	—	—
Summer or fall night-time irrigation in urban area	D	20 a/	8 a/	6 a/	4 a/	3 a/	3	3	2	0.8
	D-E	—	—	—	4-7 b/	3-6 b/	—	—	—	—
	E	—	10	6	—	—	—	—	—	—
Day-time irrigation in any season during overcast or fog	D	20	8	6	4	3	3	fog dispersed	fog dispersed	fog dispersed
Fall day-time irrigation, no overcast or fog	A	2	1	—	—	—	—	—	—	—
	B	4	2	1	1	0.8	—	—	—	—
	C	—	—	3	2	2	1	—	—	—
	D	—	—	—	—	3	3	2	2	0.8
Summer day-time irrigation, no overcast or fog	A	2	1	0.8	—	—	—	—	—	—
	B	—	2	1	1	0.8	—	—	—	—
	C	—	—	—	—	2	1	1	0.8	0.4
Winter or spring day-time irrigation, no overcast or fog	B	4	2	—	—	—	—	—	—	—
	C	—	4	3	2	2	—	—	—	—
	D	—	—	—	—	3	3	3	2	0.8

a/ Class D stability occurs in overcast conditions during night or day.
b/ Low number represents a night that is more than half cloudy or is thinly overcast. The high number represents a night when clouds cover less than half the sky.

FIGURE VI- 1

.R VOLUME AT BREATHING ZONE FOR <.0001
CHANCE OF VIRAL INTESTINAL INFECTION

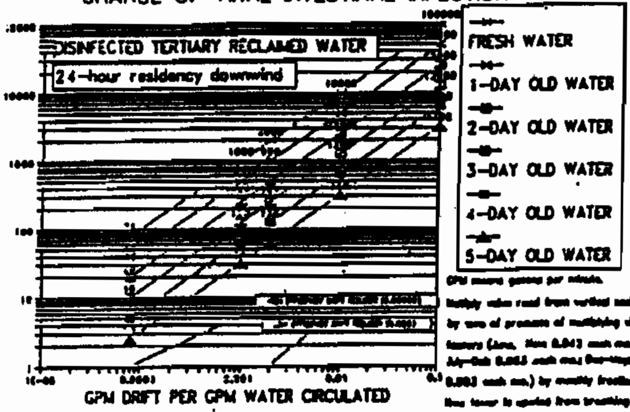


FIGURE VI- 2

AIR VOLUME AT BREATHING ZONE FOR <.0001
CHANCE OF VIRAL INTESTINAL INFECTION

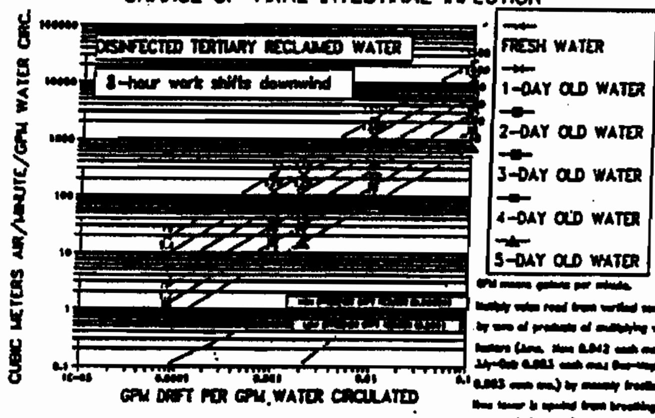


FIGURE VI- 3

CHANCE OF VIRAL INTESTINAL INFECTION
PER GRAM/CUBIC METER BREATHING ZONE AIR

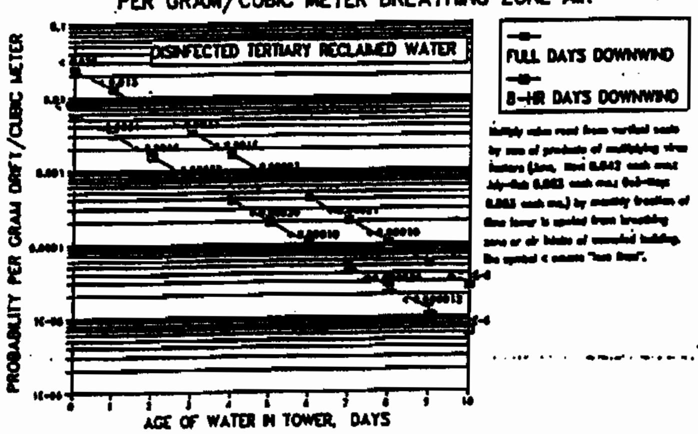


Exhibit 2: Supporting Documentation

Estimate of RWM Relative Humidity Change

Relative Humidity Impact at RWM

Temperature (°F)	45	50	55	60	65	70	75	80	85	90
Saturation pressure (mmHg)	7.617	9.209	11.085	13.29	15.772	18.88	21.845	26.271	30.745	36.068
RH% increase	**3.2%**	**2.7%**	**2.2%**	**1.8%**	**1.6%**	**1.3%**	**1.1%**	**0.9%**	**0.8%**	**0.7%**

1. Air dispersion modeling was performed to estimate the water vapor concentration at the RWM facility.
2. It was assumed that there would be no condensation after the water vapor emitted from the cooling tower.
3. Water vapor emissions from the cooling tower were conservatively assumed to be the amount emitted at 105°F and 35% relative humidity.
4. Modeling result is for 8-hour average concentration.

Calculation Factors:

Water Emissions from Cooling Tower:

3,870 Gallons/min
32,299 lb/min
1,937,941 lb/hour
244,181 g/s

Modeled Unit Dispersion Factor at RWM:

9.72 $(ug/m^3)/(g/s)$
(ISCST3 modeling results)

Estimated Ground Level Concentrations:

At RWM	2373435.3 ug/m^3
	0.132 $mole/m^3$
mole fraction	0.00322
partial pressure	0.245 mmHg
Molar volume	0.02446 m^3/mole, at 77 °F

Exhibit 2: Supporting Documentation

Monthly Temperature and Relative Humidity Summary
Period of Data Record : 1/ 1/1914 to 4/30/2007
Station: Los Angeles Civic Center, CA (045115)

Temperature Summary (Unit: °F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum	66.4	67.5	68.9	71.1	73.1	77.1	82.5	83.2	81.8	77.5	72.9	67.6	74.1
Average Minimum	48.4	49.7	51.2	53.5	56.6	59.8	63.2	64	62.7	58.8	53.4	49.3	55.9

Source: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca5115

Relative Humidity Summary (Unit: %)

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
4AM	70	74	79	80	83	85	86	86	84	80	72	69	79
10AM	55	59	61	61	66	68	68	68	65	59	53	53	61
4PM	60	63	65	64	66	67	68	69	67	65	61	60	65
10PM	69	72	75	76	80	82	83	83	80	77	71	69	76

Source: http://www.wrcc.dri.edu/cgi-bin/clilcd.pl?ca23174

STATE OF CALIFORNIA
ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

In the Matter of:	)	Docket No. 06-AFC-4
	)	
Application for Certification,	)	**ELECTRONIC PROOF OF SERVICE**
for the VERNON POWER PLANT PROJECT	)	**LIST**
by the City of Vernon	)	
	)	(Revised October 17, 2007]
	)	

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DECLARATION OF SERVICE

I, Paul Kihm, declare that on November 8, 2007, I deposited a copy of the attached:

LETTER FROM CITY OF VERNON TO RITE-WAY R.B.R. MEAT, DATED OCTOBER 22, 2007

with FedEx overnight mail delivery service at Costa Mesa, California with delivery fees thereon fully prepaid and addressed to the California Energy Commission. I further declare that transmission via electronic mail was consistent with the requirements of California Code of Regulations, title 20, sections 1209, 1209.5, and 1210. All electronic copies were sent to all those identified on the Proof of Service List above.

I declare under penalty of perjury that the foregoing is true and correct. Executed on November 8, 2007, at Costa Mesa, California.

Paul Kihm