SUNCOAST WATERKEEPER et al.

v.

CITY OF ST. PETERSBURG

UNITED STATES DISTRICT COURT
MIDDLE DISTRICT OF FLORIDA

Case No.: 8:16-cv-03319-JDW-AEP

Expert Disclosure Report

Dr. Kenneth M. Rudo, Ph.D.

May 18, 2018

Suncoast Waterkeeper et.al., v. City of St. Petersburg Expert Declaration

Kenneth M. Rudo, Ph.D., Toxicologist

May 18, 2018

I. Summary of Qualifications

I was a State Public Health and Environmental Toxicologist in North Carolina (NC) for the NC Division of Public Health from April, 1989 to January, 2017. Currently, I am a toxicology consultant. For over 29 years, I have performed human health risk assessments to protect the public from exposure to chemicals and microbiological agents, including those in raw sewage and partially treated sewage, in groundwater and surface water, soil and air, including public water systems and private drinking water wells. A central part of this process involves the evaluation of scientific data from the peer-reviewed published literature, the human health risk assessment approaches utilized by the U.S. Environmental Protection Agency (EPA), and the Agency for Toxic Substances and Disease Registry (ATSDR), (EPA/600/R-05/093F, September, 2006 ; EPA 822-S-12-001, Spring, 2012 ; EPA/630/P-03/001F, March, 2005 ; ATSDR Public Health Assessment Guidance Manual Update, January, 2005 ; ATSDR – Cancer and the Environment, April, 2010 ; USEPA Exposure Factors Handbook : 2011 Edition, EPA/600/R-09/052F, September, 2011 ; EPA/630/P-03/001F, March, 2005).

As a State Public Health and Environmental Toxicologist, and as a private toxicology consultant, I have assisted in assessing human health risks from exposure to raw sewage or partially treated sewage contamination in public water systems, private drinking water wells, in soil, and surface water systems, as well as evaluating exposure in ambient air both indoors and outdoors. For almost 28 years, I worked directly with NC residents, supplying them with health risk evaluations from raw sewage and partially treated sewage exposure. I have done dozens of investigations at the homes of NC residents, as well as occupational settings, including waste water treatment plants, to investigate potential health risks from raw sewage and partially treated sewage exposure. I have conducted these investigations, in order to determine what adverse effects may have occurred from exposure to raw sewage and partially treated sewage, in order to assist residents in understanding the health risks from these exposures, as well as assisting waste water treatment system operators in taking steps to reduce or eliminate exposure to raw sewage and partially treated sewage.

My curriculum vitae is attached.

All of my opinions expressed herein I hold to a reasonable degree of scientific certainty.

All of my opinions as set forth herein are based upon information provided to date. I reserve the right to revise or supplement my opinions based upon subsequently received information.

II. Disclosures

In the past 4 years I have testified via deposition or court testimony before a jury in several cases. The cases are: The Commonwealth of Puerto Rico v. Shell Oil Co. et.al., Case No. 07-CIV-10470, April, 2014, City of Clovis v. Shell Oil Co et.al., Case No. SCO85170, July, 2014, Orange County Water District v. Unocal Corporation et.al., Case No. SACV 03-01742-CJC (ANx), February, 2017. I am being compensated in this case at the rate of $300/hour.

III. Summary of Key Opinions

A. Based on the information in case materials (see attached list), for case number: 8:16-cv-03319-JDW-AEP, Suncoast Waterkeeper et.al., versus City of St. Petersburg, members of the plaintiff organizations in the case as well as other residents of St. Petersburg impacted by the reported overflows and discharges of raw sewage and partially treated sewage, may have had exposure to this raw sewage or partially treated sewage from September, 2011 to the present time from the St. Petersburg wastewater reclamation facilities (WRFs) and wastewater collection and transmission systems (WCTS). These overflows and discharges are referred to in the case materials as sanitary sewer overflows (SSOs), or other unpermitted sewage discharges.

B. The duration of potential exposures to raw sewage and partially treated sewage via overflows and discharges from the St. Petersburg WRFs and WCTS has been more than 6 years.[1] Human health risks may be of increased concern the longer the duration of exposure continues to chemical and microbiological agents from raw sewage and partially treated sewage.

C. The routes of potential exposures to raw sewage and partially treated sewage from the St. Petersburg WRFs and WCTS during this time frame may be via dermal exposure, inhalation exposure, hand to mouth exposure, and ingestion.

D. These exposures may have been through WRFs and WCTS, contaminating via overflows and discharges, surface water bodies throughout the St. Petersburg and Tampa Bay areas, as well as properties related to private homes and occupational settings. Some of the specific surface water bodies impacted by SSOs are located in watersheds that drain to Tampa Bay, the Gulf of Mexico, and other water bodies, streams, or tributaries in or adjoining St. Petersburg

E. There are significant human health risks associated with exposure to raw sewage or partially treated sewage. The human health risks may occur throughout the duration of exposure discussed in Opinion B, if the exposure is ongoing over time. The likelihood of the occurrence of adverse human health effects may increase, the longer the duration of exposure, as well as with large releases of sewage over a period of just a few days. Human health risks may occur via the specific routes of exposure discussed in Opinion C, and from exposure to the sources of contamination from SSOs discussed in Opinion D.

[1] Exhibit A to City of St. Petersburg's Reponses to Plaintiff's First Requests for Admission.

F. From a public health standpoint, one of the most significant concerns regarding the overflows and discharges of raw sewage and partially treated sewage from the St. Petersburg system are the very large spills that take place over several days, such as the Clam Bayou releases.[2] In these cases, millions of gallons of sewage were released at a time. The releases impacted streets when the sewage was released out of manhole covers, local waterways were contaminated in areas where residents went swimming, as well as releases into waterways where human contact would occur from the exposure routes discussed above. These bolus releases of sewage impact activities and result in human exposure in area waterways where boating/kayak/fishing related activities may occur. As a result of these acute exposures to large amount of sewage released over a period of few days, the risk of adverse health impacts to people may be significantly increased from the chemical and microbiological agents in the sewage via the exposure routes discussed in Opinions C, D, and E.

G. The general classes of, and specific agents, both chemical and microbiological, that may be found in raw sewage and partially treated sewage from SSOs, are referenced and reported in the published scientific literature, from both peer-reviewed sources and non-peer reviewed sources. Human health risks from many of these agents have also been reported in the published scientific literature, again from peer-reviewed sources and non-peer reviewed sources. I have listed published documents below that reference these agents.

H. Raw sewage and/or partially treated sewage from SSOs may contain agents such as:

- Chemicals from solvents, detergents, cleansers, inks, pesticides, paints, pharmaceuticals, and other chemicals used by households and businesses, and then discarded to sewage collection systems, as well as other sources such as hospital wastes, handling of dead animals, fish, and shellfish exposed to sewage (this includes chemical and microbiological agents).
- These chemicals may also result in exposure through food chain bio-accumulation in the affected waters that result in contamination of fish which may be consumed by humans.
- Raw sewage and partially treated sewage may contain viruses, protozoa, bacteria, human waste, and mold spores, along with human viral, bacteriological, and parasitic pathogens.
- Nutrients that are found in raw sewage and partially treated sewage may result in an increased occurrence of algal blooms, which may lead to fish kills. Human exposures related to algal blooms and fish kills may pose an increased human health risk.
- Chemicals in raw sewage or partially treated sewage may result in exposure to elevated levels of odors that may pose an increased human health risk.
- References are listed below that discuss the specific agents and some of the adverse human health effects.

[2] Table A to Plaintiffs' Response to St. Petersburg's Contention Interrogatories.

I. Risk communication with the public is a critical issue in scenarios involving the overflows and discharges related to raw sewage and partially treated sewage. In this specific case, where SSOs have been documented as occurring from the City of St. Petersburg's WCTS and WRFs over an extended period of time, with the potential for a continuation of these problems, it is recommended that the City of St. Petersburg take steps to improve their notification of these SSOs to the public. Of course, the best approach is to prevent unpermitted discharges of raw or partially treated sewage as the best line of defense for public health. However, if an unpermitted discharge occurs, public notice is vital to prevent or reduce exposure and increased health risks to the public.

It is recommended that the city improve their notifications to the public. This will allow the residents to avoid contact/exposure that will increase their health risk. This also may involve no consumption of fish and shellfish until they are shown to be safe to eat after sampling and analysis for agents both chemical and microbiological found in sewage.

A failure to notify residents of a spill, whether it is over just a few days, or over a more extended period of time, results in the City of Petersburg putting the health of the residents of impacted areas at a significantly increased risk from exposure to the chemicals and microbiological agents contained in the sewage. When residents are not notified, it increases the duration of exposure, and increases the risk of exposure to sewage from the exposure routes discussed in Opinion C (inhalation, ingestion, dermal, hand to mouth exposure).

The increased use of public service announcements (PSAs) via television, newspapers, and online outlets, including social media, will let the public know immediately after an SSO is reported and detected. In this manner, exposures to contaminated sources may be reduced.

Additionally, in the case of ongoing SSOs in water-bodies that are utilized for recreational activities, as well as for consumption of fish and shellfish, advisories can be posted on these waterways to reduce public exposure.

Another recommended step to reduce the risk to residents in St. Petersburg, as well as to define areas of concern from an exposure standpoint after a spill has occurred, is to conduct sampling and screening in the affected areas for agents contained in sewage. Additionally, it is recommended for the City Water and Sewer Department to promptly notify the health department, and to conduct screening/surveillance surveys to identify people who may have been exposed, and specific areas of the city most at risk from sewage overflows and discharges.

This has several significant impacts for human health risk assessment. One is to proactively monitor people who may have been adversely impacted, which may also assist in their treatment for specific symptoms potentially associated with a sewage overflow or discharge. A second impact is identifying specific areas where sewage overflows and discharges occur. When these specific areas have been identified, steps to notify the public when a sewage overflow or discharge occurs (especially as it relates to public service announcements/the posting of warning/health advisory signs in impacted areas) will be more effective in helping residents avoid exposure to sewage releases. Of course, limiting the public's use of Tampa Bay's aquatic resources that are affected by sewage overflows and discharges is only a short term solution -- stopping unpermitted discharges is the longer term solution necessary to protect public health.

I have attached some tables that describe the specific agents in sewage and some of their potential human health risks.

Below is a list of references I may rely upon to support the opinions listed above.

Dr. Kenneth M. Rudo, Ph.D.

References:

USEPA, EPA-833-R-04-001, August, 2004

Geo Health Newsletter, Vol.12, No.1, 2015 – Chemicals Found in Treated Wastewater are Transported from Streams to Groundwater, USGS

Pollutants in Urban Waste Water and Sewage Sludge, ec.europa.eu/environment/archives/waste/sludge/pdf/sludge_pollutants_3.pdf

Pollutants in Urban Waste Water and Sewage Sludge, ec.europa.eu/environment/archives/waste/sludge/pdf/sludge_pollutants_7.pdf

Naidoo and Olaniran, Int. J. Environ. Res. Public Health, 11(1): 249-270, 2014

Bradley et.al., Environ. Pollution, 193: 173-180, 2014

Diseases Involving Sewage, Indiana State Department of Health, May, 2018

USEPA, Keeping Raw sewage and Contaminated Stormwater Out of the Public's Water, Chapter 4, 2011

USEPA, Public Health Concerns About Infectious Disease Agents, https://www3.epa.gov/npdes/pubs/mstr-ch5.pdf

Chemical Composition of Wastewaters in Alexandria and Giza, Egypt, www.fao.org/docrep/t0551e/t0551e03.htm

Shraim et.al., Arabian J. Chemistry, 10(1): s719-s729, 2017

Tiwari, Ind. J. Occup. Environ. Med., 12(3): 112-115, 2008

Akpor and Muchie, Afr. J. Biotech., 10(13): 2379-2387, 2011

USEPA, EPA/625/R-93/002, Chapter 3, Wellhead Protection: A Guide for Small Communities

Shadab et.al., J. Clin. Diag. Res., 8(4): BC11, 2014

Florida Department of Environmental Protection, Investigation Report Regarding City of St. Petersburg's Sanitary Sewer Overflows, February, 1, 2017

Documents Considered

Documents considered include:

DATE	TITLE
September 19, 2016	Email from Shannon Herbon to Melissa Terzi Re: Sewage dumping!
July 24, 2017	Florida Department of Environmental Protection, Consent Order, OGC No. 16-1280
March 6, 2018	Deposition of Lane Longley, Vol. 1
March 8, 2018	Deposition of Lane Longley, Vol. 2
March 9, 2018	Deposition of John Palenchar, Vol. 1
May 10, 2018	Deposition of John Palenchar, Vol. 2
October 13, 2016	Florida Fish and Wildlife Conservation Commission, Environmental Investigation, Report Number ISR013257 (01) (Certified Copy)
August 20, 2015	Florida Fish and Wildlife Conservation Commission, Environmental Investigation, Report Number ISR013944 (01) (Certified Copy)
December 9, 2015	Environmental Consulting & Technology, Inc., Clam Bayou Central Stormwater Pond Assessment
March 2016	Janicki Environmental, Inc., Estimates of Total Nitrogen Loadings to Tampa Bay, Florida: 2012-2014
September 28, 2017	City of St. Petersburg, Scope of Work - Microbial Source Tracking in Salt Creek, St Petersburg, FL
April 13, 2018	Table A to Plaintiffs' Responses to City of St. Petersburg's Contention Interrogatories
2017	City of St. Petersburg, 2017 Water Quality Report Card
December 22, 2017	Janicki Environmental, Inc., Professional Services for Water Quality Report Card – Sanitary Sewer
Undated	City of St. Petersburg, Powerpoint Presentation titled "Surface Water Quality Monitoring"

Attachment 1

Curriculum Vitae

In Support of

Expert Disclosure Report

Submitted by:

Dr. Kenneth M. Rudo, Ph.D.

May 18, 2018

Curriculum Vitae

Name: Kenneth Mark Rudo

Date and Place of Birth: August 24, 1955 – Baltimore, Maryland

Citizenship: United States

Marital Status: Married

Address: 202 Lakeview Drive, Summerville, SC 29485

Education: B.S., Entomology, University of Maryland, 1978

M.S., Toxicology, University of Maryland, 1981

Ph.D., Toxicology, North Carolina State University, 1988

Chronology of Employment:

1981 – 1983 - Northrop Services Inc.
Research Triangle Park, NC 27709

1983 – 1985 - Environmental Health Research Testing, Inc.
Research Triangle Park, NC 27709

1985 – 1989 - National Institute of Environmental Health Sciences
Research Triangle Park, NC 27709

1989 – Jan. 2017- State Environmental/Public Health Toxicologist
State of North Carolina
Department of Health and Human Services
Division of Public Health
Occupational and Environmental Epidemiology Branch
Raleigh, NC

1993 – Present - Rudo Toxicological Consultants
202 Lakeview Drive
Summerville, SC 29485
Current Phone Number – Cell – 919-247-2975

Email address - krudo@earthlink.net

Scope of Work from April, 1989 – Present

- To protect human health by evaluating the toxicological impacts of chemical, radiological and biological agents

- Perform human health risk assessments to establish the link between exposure and potential adverse impacts

- Evaluate the human risk from chemical, radiological and biological contamination of drinking water and ambient air with an emphasis on lead, MTBE, trichloroethylene, benzene, bacteria/viruses, arsenic, PCBs, chromium, PFOA, GenX, and formaldehyde

- Evaluate the human risk from exposure via ingestion, dermal exposure and/or inhalation to chemical, biological and radiological agents in drinking water and ambient air, from hazardous waste sites, PFOA/GenX/PFAS contaminated drinking water sites, petroleum contamination sites, sewage treatment system contamination sites, heavy metal contaminated sites, chlorinated solvent and pesticide contaminated sites, Agent Orange exposure in Vietnam, landfills, and other sources of environmental contamination

- Perform human health risk assessments that are based on hazard identification, dose response assessment, exposure assessment and risk characterization

- Risk communication of adverse impacts of chemical, radiological and biological agents with an emphasis on direct risk communication via site visits, public meetings, telephone conversations and written risk assessments. Risk assessments are also communicated to toxicologists, epidemiologists and physicians from other states, the federal government, industry, individual consultants and environmental groups. Risk assessments are also communicated to the legal community as well as local, state and federal public officials.

- Risk assessments are clearly communicated to people with contamination issues

- A toxicological approach to protecting human health with an emphasis on the evaluation of peer-reviewed published scientific literature in the fields of toxicology, epidemiology and medicine, and the utilization of established human health risk assessment protocols and procedures.

- Toxicological risk assessment and risk communication in legal settings via report writing, case research, deposition and jury testimony, with an Emphasis on Toxicological Risk Communication to Juries

Bibliography

Nesnow S, Rudo KM, Bryant B, and Easterling RE. Reanalysis and clarification of the structures of alpha-naphthoflavone dihydrodiols formed by uninduced and induced rat liver microsomes from Charles River CD and Spraque Dawley rats. Carcinogenesis 4, 425-430, 1983.

Rudo KM, Ellis S, Bryant BJ, Lawrence K, Curtis G, Garland H, and Nesnow S. Quantitative analysis of the metabolism of benzo(a)pyrene by transformable C3H10T1/2CL8 mouse embryo fibroblasts. Teratogenesis, Carcinogenesis, and Mutagenesis 6, 307-319, 1986.

Siegfried JM, Rudo KM, Bryant BJ, Ellis S, Mass M, and Nesnow S. Metabolism of benzo(a)pyrene in monolayer cultures of human bronchial epithelial cells from a series of donors. Cancer Research 46, 4368-4371, 1986.

Rudo, KM, Meyers WC, Dauterman W, and Langenbach R. Comparison of human and rat hepatocyte metabolism and mutagenic activation of 2-acetylaminofluorene. Cancer Research 47, 5861-5867, 1987.

Langenbach R, Rudo, KM, Ellis S, Hix C, and Nesnow S. Species variation in bladder cell and liver cell activation of acetylaminofluorene, Cell Biology and Toxicology 3, 303-319, 1987.

Mohapatra N, Macnair P, Bryant BJ, Ellis S, Rudo, KM, Sangaiah R, Gold A, and Nesnow S. Morphological transforming activity and metabolism of cyclopenta-fused isomers of benz(a)anthracene in mammalian cells. Mutation Research 188, 323-334, 1987.

Langenbach R and Rudo KM. Human hepatocyte and kidney cell metabolism of 2-acetylaminofluorene and comparison to the respective rat cells. Cell Biology and Toxicology 4, 453-465, 1988.

Rudo KM, Dauterman W, and Langenbach R. Human and rat kidney cell metabolism of 2-acetylaminofluorene and benzo(a)pyrene. Cancer Research 49, 1187-1192, 1989.

Crespi CL, Langenbach R, Rudo KM, Chen YT, and Davies RL. Transfection of a human cytochrome p-450 gene into the human lymphoblastoid cell line, AHH-1, and the use of the recombinant cell line in gene mutation assays. Carcinogenesis 10, 295-301, 1989.

Davies RL, Langenbach R, Rudo KM, Turner TR, and Crespi CL. Expression of human genes for a cytochrome p-450 and an epoxide hydrolase in a human lymphoblastoid cell line. Carcinogenesis 10, 885-891, 1989.

Hansen, SK, Ross JA, Siegfried JM, Leavitt S, Rudo K, Langenbach R, and Nesnow S. Transfection of a rat cytochrome P450b cDNA into C3H10T1/2 C28 mouse embryo fibroblasts. Molecular Carcinogenesis 2, 261-267, 1989.

Rudo KM, and Langenbach R. Comparative metabolism of 2-acetylaminofluorene and benzo(a)pyrene by human and rodent cells. The Nucleus 31, 87-89, 1990.

Kari FW, Driscoll SM, Abu-Shakra A, Strom SL, Jenkins WL, Volosin JS, Rudo KM, and Langenbach R,. Comparative metabolism and genotoxicity of the structurally similar nitrophenylenediamine dyes, HC Blue 1 and HC Blue 2, in mouse hepatocytes. Cell Biology and Toxicology 6, 139-155, 1990.

Taylor T and Rudo KM. Risk assessment of dioxin contaminated fish. Environmental Epidemiology Section, Division of Epidemiology, Department of Environment, Health, and Natural Resources, Raleigh, North Carolina, 1-34, April 1990.

Rudo K and Smith CG. Evaluation of Environmental Sampling Results – Carolina Solite Corporation. Environmental Epidemiology Section, Division of Epidemiology, Department of Environment, Health, and Natural Resources, Raleigh, North Carolina, p. 1-16, April 1991.

Rudo K. Methyl Tertiary Butyl Ether (MTBE) – Evaluation of MTBE Carcinogenicity Studies. Toxicol. Ind. Health 11 (2), 167-173, 1995.

Rudo K, Pate WJ, and Smith CG. The public health impact of the oxygenated fuels program in North Carolina. Occupational and Environmental Epidemiology Section, Division of Epidemiology, North Carolina Department of Environment, Health, and Natural Resources, Raleigh, North Carolina, p. 1-8, July 1995.

Rudo KM. Human and rat liver S9, microsomal, and hepatocyte metabolism and mutagenesis of 2-acetylaminofluorene. Toxicology and Applied Pharmacology (in preparation).

Rudo KM. Review of the Wisconsin DHSS report on health concerns attributed to reformulated gasoline use in southeastern Wisconsin. Toxicol. Ind. Health, 11(5), 463-466, 1995.

Moore JA and IEHR Expert Scientific Committee. An assessment of lithium using the IEHR evaluative process for assessing human developmental and reproductive toxicity of agents. Reprod. Tox, 9(2), 175-210, 1995.

Rudo KM, Pate WJ, and Smith CG. The public health impact of the oxygenated fuels program in North Carolina. The Toxicologist 15(1), 140, 1995.

Rudo KM. The oxygenated fuels program in North Carolina: A public health risk assessment. The Toxicologist, 16(1), abstract #747, 1996.

Sanders AP, Messier KP, Shehee M, Rudo K, Serre M and Fry R. Arsenic in North Carolina: Public Health Implications, Environment Int., 38, 10-16, 2011

Book Chapters

Cyclopenta-fused isomers of benz(a)anthracene: II. Mutagenic effects on mammalian cells, in: A. J. Dennis and M. Cooke (Eds.), Polynuclear Aromatic Hydrocarbons, Vol. 8, Battelle Press, Columbus, Ohio, pp. 949-960, 1985.

Cyclopenta-fused isomers of benz(a)anthracene: I. Identification of the major microsomal metabolites, in: A. J. Dennis and M. Cooke (Eds.), Polynuclear Aromatic Hydrocarbons, Vol. 8, Battelle Press, Columbus, Ohio, pp. 1151-1172, 1985.

Metabolic activation pathways of cyclopenta-fused PAH and their relationship to genetic and carcinogenic activity, in: C. Ramel, B. Lambert, and J. Magnusson (Eds.), Progress in Clinical and Biological Research, Vol. 209A, Genetic Toxicology of Environmental Chemicals, Part A: Basic Principles and Mechanisms of Action, Alan R. Liss, New York, pp. 515-522, 1986.

Biological activity and metabolism of aceanthrylene and acephenanthrylene, in: A. J. Dennis and M. Cooke (Eds.), Polynuclear Aromatic Hydrocarbons, Vol. 9, Battelle Press, Columbus, Ohio, pp. 795-810, 1986.

Human and animal hepatocyte xenobiotic metabolism, in: S. Sharma (Ed.), Current Developments in Cell Genetics, Oxford & IBH Publishing Co., New Delhi, India, pp. 73-88, 1989.

Species comparisons regarding comparative metabolism of two structurally similar phenylenediamines (HC Blue 1 and HC Blue 2), in: Mutation and the Environment, Part D, Wiley-Liss, Inc., New York, pp. 305-314, 1990.

Transfection of cytochrome P-450 cDNAs into mammalian cells used in mutation and transformation assays, in: Mutation and the Environment, Part D, Wiley-Liss, Inc., New York, pp. 239-248, 1990.

Memberships – Committees and Societies

- Secretary's Scientific Advisory Board on Toxic Air Pollutants
- North Carolina Pesticide Board's Interagency Working Group
- Health Effects Institute Advisory Panel on Oxygenates
- ASTHO Review Panel for the Wisconsin DHSS Oxygenates Report
- Federal and State Toxicology and Risk Assessment Committee (FSTRAC)
- North Carolina Society for Risk Analysis
- North Carolina Society of Toxicology
- Institute for Evaluating Health Risks Expert Scientific Committee

Recent Legal Cases

I have been involved in the following legal cases as a toxicological expert since October, 2008. I have either been deposed and testified in jury cases, or have been deposed in cases that have settled. I will provide more case details upon request, as well as an update of recent cases.

- Alban v ExxonMobil, Case Number 03-c-06-0109932 – October, 2008
- City of New York v Amerada Hess Corp. et.al., Case Number 04-CIV-3417 in New York City, September, 2009
- Allison et.al., v ExxonMobil Corp. et.al., Case Number 03-c-07-003809 – Baltimore, Maryland, July, 2011
- City of Merced v Chevron USA. et.al., Case Number 148451 in Merced, California, February, 2012

- Ring v Novartis Pharmaceuticals Corp., Case Number 02-c-04-101741 in Baltimore, Maryland, November, 2009
- Manzanares v ExxonMobil Corp, Case Number BER-L-5620-06, Princeton, New Jersey, October, 2010
- Dickson v National Maintenance of Kentucky, Inc., Case Number 5:08-CV-8-R in Paducah, Kentucky, December, 2010
- Ingold v Kindred and Novartis Pharmaceuticals Corp., Case Number 06-L-415, Peoria County, Illinois, December, 2011
- New Jersey Department of Environmental Protection v. Atlantic Richfield et.al., Case No. 08-CIV-003113, May, 2013
- Commonwealth of Puerto Rico v. Shell Oil Co. et.al., Case No. 07-CIV-10470, April 17, 2014
- City of Clovis v, Shell Oil Co. et.al., Case No. SCO85170, July 18, 2014
- Orange County Water District v. Unocal Corporation et.al., Case No. SACV 03-01742-CJC (ANx), February, 2017

Attachment 2

Tables

In Support of

Expert Disclosure Report

Submitted by:

Dr. Kenneth M. Rudo, Ph.D.

May 18, 2018

POLLUTANTS OF CONCERN (US EPA 2001)	PRINCIPAL CONSEQUENCES
Bacteria (e.g. FC, E. coli, enterococci) Viruses Protozoa (e.g. *Giardia*, *Cryptosporidium*)	*Beach closures* *Adverse public health effects* *Shellfish bed closures*
Trash and floating debris	*Aesthetic impairment and devaluation of property* *Beach closures* *Adverse public health effects*
Organic compounds Metals Oil and grease Toxic pollutants	*Aquatic habitat impairment* *Adverse public health effects* *Fishing and shellfishing restrictions*
Biochemical oxygen demands (BOD)	*Reduced oxygen levels and fish kills* *Odors*
Solids deposits (sediment)	*Aquatic habitat impairment* *Shellfish bed closures* *Odors*
Nutrients (e.g. nitrogen, phosphorus)	*Aesthetic impairment* *Depletion of oxygen* *Algal blooms*
Flow shear stress	*Stream erosion*

organic pollutants where some six thousand or more compounds have been identified. Many of these cannot be routinely determined in the majority of laboratories due to lack of appropriate instrumentation, the absence of a unified methodology and expense.

The type of pollutants and the magnitude of loadings to the WWTS system are a complex function of:

- Size and type of conurbation (commercial, residential, mixed);
- Plumbing and heating systems;
- Domestic and commercial product formulation and use patterns;
- Dietary sources and faeces;
- Atmospheric quality, deposition and run-off;
- Presence and type of industrial activities;
- Use of metals, and other materials in construction;
- Urban land use;
- Traffic type and density;
- Urban street cleaning
- Maintenance practices, for collecting systems and stormwater controls:
- Accidental releases.

Quantitative information on both metal and organic pollutants in urban runoff arising from anthropogenic activities is difficult to evaluate, due to the lack of information on background levels of these substances in the environment. Background concentrations relate to natural geochemical sources and biological sources, and include amounts in soils, dusts and waters derived from historical pollution.

The specific potentially toxic elements (PTEs) and organic contaminants considered in this report are listed in Table 7.1.

Table 7.1 Potentially toxic elements and organic contaminants examined in the review of pollutants in urban waste water and sewage sludge

Potentially toxic elements	Organic contaminants
Zinc (Zn)	Linear alkylbenzene sulphonates (LAS)
Copper (Cu)	Nonylphenolethoxylates (NPE)
Nickel (Ni)	Di-(2-ethylhexyl)phthalate (DEHP)
Cadmium (Cd)	Polycyclic aromatic hydrocarbons (PAHs)
Lead (Pb)	Polychlorinated biphenyls (PCBs)
Chromium (Cr) III and VI	Polychlorinated dibenzo-p-dioxins (PCDDs)
Mercury (Hg)	Polychlorinated dibenzo-p-furans (PCDFs)
Platinum group metals (PGMs)	Nitro musks (chloronitrobenzenes)
Other PTEs*	Pharmaceuticals
	Oestrogenic compounds:
	Endogenous forms: 17β-oestradiol, oestrone
	synthetic steroids: ethinyloestradiol
	Polyelectrolytes (polyacrylamide)
	Other organics**

*- such as Arsenic, Silver, Molybdenum and Selenium
**- such as Adsorbable organo halogens (AOX) and chlorinated paraffins

Summary of analytical results of residuals for each WRF for the pollutants identified in 40 CFR 503.13.

SOUTHWEST WRF - FLA 128848

Parameter	July	August	September	October	November	December
Arsenic	2.45 U	5.2	5.3	5.2	2.6 U	2.6 U
Cadmium	0.3	0.3	0.3	0.3	0.3	0.3
Copper	154	298	201	215	171	171
Mercury	0.14	0.23	0.13	0.11	0.092	0.035
Molybdenum	3.8	5.1	3.5	3.5	3.8	3.3
Nickel	22.2	30.0	23.9	14.8	24.0	19.3
Lead	17.4	22.7	17.8	18.2	1.8	20.9
Selenium	2.65 U	2.6 U	2.85 U	2.75 U	2.8 U	2.8 U
Zinc	337	501	330	294	278	296
pH	12.5	12.5	12.4	12.5	12.5	12.5
Total Solids	25.8	22.2	21.9	23.4	25.1	23.4
Total Nitrogen	4.35	4.34	4.17	4.13	3.30	4.01
Total Phosphorus	1.39	1.74	1.19	1.19	0.987	1.58
Total Potassium	0.435	0.437	0.353	0.362	0.406	0.549

Parameter	January	February	March	April	May	June
Arsenic	2.6 U	2.6 U	2.6 U	2.65 U	2.65 U	2.6 U
Cadmium	0.3	0.3	0.3	0.3	0.3	0.3
Copper	140	163	179	95.4	176	203
Mercury	0.17	0.12	0.099	0.009 U	0.11	0.13
Molybdenum	0.5	3.3	0.5	0.5	0.5	3.3
Nickel	21.7	20.3	16.3	18.3	15.6	18.2
Lead	1.8	17.6	12.8	1.8	12.3	13.8
Selenium	2.8 U	2.8 U	2.8 U	2.85 U	2.85 U	2.8 U
Zinc	242	256	307	283	268	292
pH	12.6	12.5	12.5	12.5	12.5	12.6
Total Solids	25.8	26.1	25.6	24.8	25.2	24.1
Total Nitrogen	3.47	3.73	3.70	4.23	3.94	3.91
Total Phosphorus	1.05	1.31	1.07	1.16	1.06	1.10
Total Potassium	0.387	0.46	0.420	0.446	0.423	0.399

NR - Not Reported

PART 2. EFFLUENT LIMITATIONS

A. Outfalls

During the period from April 15, 2013 to April 14, 2016 the permittee is authorized to discharge a mixture of pretreated and domestic wastewater to the City of St. Petersburg's sewer system from the private lateral sewer pipelines running from the various hospital buildings. These laterals discharge into the City sewer running along 9th Avenue North as indicated on the sewer map included as page 5 of this IWDP.

The permittee shall apply in writing to the Director for permission to discharge any other process wastewater at any other outfall than those indicated above. Reasons for the change and detailed plans and drawings of the proposed new outfall shall accompany the request.

B. Specific Discharge Limitations

During the period from April 15, 2013 to April 14, 2016 the discharge from the outfalls listed above shall not exceed the following effluent limitations

EFFLUENT LIMITATIONS

Parameter	Average Daily Maximum	Units
Total Flow	60,000	Gallons/day
pH	>5 & <11.5	Standard units
cBOD [a]	10,000	mg/L
Chemical Oxygen Demand (COD)	10,000	mg/L
Arsenic	300	ug/L
Boron	3,320	ug/L
Cadmium	120	ug/L
Chromium	1,510	ug/L
Copper	1,170	ug/L
Lead	660	ug/L
Mercury	70	ug/L
Molybdenum	-	ug/L
Nickel	1,120	ug/L
Selenium	270	ug/L
Silver	720	ug/L
Zinc	3,090	ug/L
Suspended Solids, Total	-	mg/L
Chloride	1,350	mg/L

[a] cBOD - Carbonaceous Biochemical Oxygen Demand is the quantity of oxygen utilized in the carbonaceous biochemical oxidation of organic matter present in water or wastewater in five days at 20 degrees Centigrade.

Table 2 POTENTIAL HARMFUL COMPONENTS OF COMMON HOUSEHOLD PRODUCTS

Product	Toxic or Hazardous Components
Antifreeze (gasoline or coolants systems)	Methanol, ethylene glycol
Automatic transmission fluid	Petroleum distillates, xylene
Battery acid (electrolyte)	Sulfuric acid
Degreasers for driveways and garages	Petroleum solvents, alcohols, glycol ether
Degreasers for engines and metal	Chlorinated hydrocarbons, toluene, phenols, dichloroperchloroethylene
Engine and radiator flushes	Petroleum solvents, ketones, butanol, glycol ether
Hydraulic fluid (brake fluid)	Hydrocarbons, fluorocarbons
Motor oils and waste oils	Hydrocarbons
Gasoline and jet fuel	Hydrocarbons
Diesel fuel, kerosene, #2 heating oil	Hydrocarbons
Grease, lubes	Hydrocarbons
Rustproofers	Phenols, heavy metals
Car wash detergents	Alkyl benzene sulfonates
Car waxes and polishes	Petroleum distillates, hydrocarbons
Asphalt and roofing tar	Hydrocarbons
Paints, varnishes, stains, dyes	Heavy metals, toluene
Paint and lacquer thinner	Acetone, benzene, toluene, butyl acetate, methyl ketones
Paint and varnish removers, deglossers	Methylene chloride, toluene, acetone, xylene, ethanol, benzene, methanol
Paint brush cleaners	Hydrocarbons, toluene, acetone, methanol, glycol ethers, methyl ethyl ketones
Floor and furniture strippers	Xylene
Metal polishes	Petroleum distillates, isopropanol, petroleum naphtha
Laundry soil and stain removers	Hydrocarbons, benzene, trichloroethylene, 1,1,1-trichloroethane
Other solvents	Acetone, benzene
Rock salt	Sodium concentration
Refrigerants	1,1,2-trichloro-1,2,2-trifluoroethane
Bug and tar removers	Xylene, petroleum distillates
Household cleansers, oven cleaners	Xylenols, glycol ethers, isopropanol
Drain cleaners	1,1,1-trichloroethane
Toilet cleaners	Xylene, sulfonates, chlorinated phenols
Cesspool cleaners	Tetrachloroethylene, dichlorobenzene, methylene chloride
Disinfectants	Cresol, xylenols
Pesticides (all types)	Naphthalene, phosphorus, xylene, chloroform, heavy metals, chlorinated hydrocarbons
Photochemicals	Phenols, sodium sulfite, cyanide, silver halide, potassium bromide
Printing ink	Heavy metals, phenol-formaldehyde
Wood preservatives (creosote)	Pentachlorophenols
Swimming pool chlorine	Sodium hypochlorite
Lye or caustic soda	Sodium hydroxide
Jewelry cleaners	Sodium cyanide

Source: "Natural Resources Facts: Household Hazardous Wastes," Fact Sheet No. 88-3, Department of Natural Science, University of Rhode Island, August 1988.

3.1.1 Domestic and Commercial Sources

A study carried out in France in 1996 by ADEME, showed the sources of the main organic micropollutants in sludge from WWTS were mainly domestic and commercially related (see Table 3.1). Another study, by SFT (in collaboration with the wider Norwegian government environmental study programme and the A/S Sentralrenseanlegget RA-2 WWTS), investigated sources of PAH, PCB, phthalates, LAS and NPE. This study found that sewage from domestic sources, in this instance from an isolated housing estate with a separate sewage and stormwater drainage system, does make a significant contribution of the above organic pollutants to urban wastewater [SFT report 98/43].

Table 3.1 Principal sources of organic micropollutants in urban wastewater treatment works [ADEME, 1995] +++ very likely, ++ likely, + less likely present

POLLUTANT	ORIGIN	Domestic usage	Storm runoff	Commercial effluent
Aliphatic hydrocarbons	Fuel	++	++	++
Monocyclic aromatic hydrocarbons	Solvents, phenols	+	+	++
PAHs	By-products of petrol transformation and insecticides	+	+	+
Halogens	Solvents, plastics, chlorination	++	+	++
Chlorophenols and Chlorobenzenes	Solvents, pesticides	+	+	++
Chlorinated PAHs	PCB, hydraulic fluids	(+)	+	++
Pesticides		+	+	++
Phthalate esters	Plastifier	+	+	++
Detergents		++	+	++
Nitrosamines	Industrial by-products (rubber)	0	+	++

Soil is also a major repository of organic matter and the soluble fractions can leach/run-off in to water courses, especially in upland areas where measures to remove colour and formation of trihalomethanes during drinking water treament is important.

A. PAHs and PCBs

Table 3.2 shows that the PAH concentration profiles for three Swedish WWTS varies. This may in part be due to differences in the catchment areas, with the sources of the pollutants coming from different local industries. Most of these PAHs are expected to derive from diffuse commercial activities and traffic but PAHs such as pyrene, which is believed to be derived from at least 50% domestic sources, is present in all the samples at more consistent concentrations than some of the other compounds.

Mattson *et al* (1991) referenced in Paxéus (1996a) found that PAHs from food, an often overlooked source of this pollutant, from households can reach 50-60 % of the total UWW collecting system load for pyrene and phenanthrene. This is an important observation as household sources of PAHs are likely to be more difficult to control than commercial sources.

Another source of PAHs from domestic and commercial activities is the use of phenol and creosol in products such as wood preservatives. In Finland, 430 tonnes of wood preservatives were used in 1995 [Finnish Environmental Institute, 1997]. PAHs may enter UWW as a result of spillages or as surface runoff from rainwater.

TABLE 5.2 Typical Numbers of Microorganisms Found in Various Stages of Wastewater and Sludge Treatment

Microbe	Number Per 100 ml Of Effluent				Numbers Per Gram of Sludge	
	Raw Sewage	Primary Treatment	Secondary Treatment	Tertiary[a] Treatment	Raw	Digested[b]
Fecal coliform MPN[c]	1,000,000,000	10,000,000	1,000,000	<2	10,000,000	1,000,000
Salmonella MPN	8,000	800	8	<2	1,800	18
Shigella MPN	1,000	100	1	<2	220	3
Enteric virus PFU[d]	50,000	15,000	1,500	0.002	1,400	210
Helminth ova	800	80	0.08	<0.08	30	10
Giardia lamblia cysts	10,000	5,000	2,500	3	140	43

[a] Includes coagulation, sedimentation, filtration and disinfection
[b] Mesophilic anaerobic digestion.
[c] MPN = Most Probable Number
[d] PFU = Plaque-forming units

SOURCES: EPA, 1991 and 1992a; Dean and Smith, 1973; Feachem et al., 1980; Engineering Science, 1987; Gerba, 1983 and Logsdon et al., 1985.

Thus, the technical knowledge is available for the design of processes that can adequately reduce the number of infectious agents present in raw wastewater and solids to safe levels. The important public health concern lies in the ability of these processes to reliably produce an acceptable product. Such reliability must be a critical element in the design and operation of wastewater treatment plants or other facilities producing these materials.

In California, treatment processes specified by the Water Reclamation Criteria (California Water Code, 1994) can achieve a 5 orders of magnitude reduction *in situ* of viruses. This level of reduction produces effluent that is accepted as being "free" of viruses. In the Monterey Wastewater Reclamation Study for Agriculture (Sheikh et al., 1990), tests conducted over a 5-year period of over 80,000 gal of reclaimed water that met Title 22 requirements found no viruses (Engineering Science, 1987). Virus seeding studies were conducted that verified the 5-log reduction in viruses from the treatment process. Additionally, a 99 percent natural die-off rate over 5 days was demonstrated under both field and laboratory conditions for the virus T99. A rough calculation illustrates the very low level of viruses to be expected after irrigation with reclaimed water of this quality on food crops. In the Monterey study, the median number of viruses detected in the raw wastewater influent was 8 plaque-forming units (pfu) in 67 samples, so that even without treatment, the number of viruses that might

TABLE 5.1 Examples of Pathogens Associated With Raw Domestic Sewage and Sewage Solids

Pathogen Class	Examples	Disease
Bacteria	*Shigella sp.*	Bacillary dysentery
	Salmonella sp.	Salmonellosis (gastroenteritis)
	Salmonella typhi	Typhoid fever
	Vibrio cholerae	Cholera
	Enteropathogenic-*Escherichia coli*	A variety of gastroenteric diseases
	Yersinia sp.	Yersiniosis (gastroenteritis)
	Campylobacter jejuni	Campylobacteriosis (gastroenteritis)
Viruses	Hepatitis A virus	Infectious hepatitis
	Norwalk viruses	Acute gastroenteritis
	Rotaviruses	Acute gastroenteritis
	Polioviruses	Poliomyelitis
	Coxsackie viruses	"flu-like" symptoms
	Echoviruses	"flu-like" symptoms
Protozoa	*Entamoeba histolytica*	Amebiasis (amoebic dysentery)
	Giardia lamblia	Giardiasis (gastroenteritis)
	Cryptosporidium sp.	Cryptosporidiosis (gastroenteritis)
	Balantidium coli	Balantidiasis (gastroenteritis)
Helminths	*Ascaris sp.*	Ascariasis (roundworm infection)
	Taenia sp.	Taeniasis (tapeworm infection)
	Necator americanus	Ancylostomiasis (hookworm infection)
	Trichuris trichuria	Trichuriasis (whipworm infection)

The final link in the infectious disease transmission chain is the exposure of the sus-ceptible human population to infectious agents. The primary route of exposure to wastewater-associated pathogens is by ingestion, although other routes, such as respiratory and ocular, can be involved. If reclaimed water and sludges are to be used in the production of human food crops, particularly those that are eaten raw, then there is a chance of exposure through ingestion. Consequently, there is a greater need to reduce pathogen numbers to low levels prior to soil application, or at least prior to crop harvesting or livestock exposure.

Available engineering knowledge and technology can produce reclaimed water of the desired quality for use in such activities as agriculture, landscape irrigation, and ground water recharge. Data in Table 5.2 are illustrative of the effect of tertiary (advanced) treatment of wastewater in the removal of pathogens. The technology has advanced such that, in a number of instances, the use of reclaimed water to augment of water sources for drinking water supplies is either being seriously proposed or is a reality (City of San Diego, 1992; Gunn and Reberger, 1980; James M. Montgomery, Inc., 1983; Lauer and Johns, 1990). Treatment processes are also available to effectively reduce the concentration of pathogens in sewage sludge to levels safe for direct contact. Some examples include lime treatment, heat treatment, drying and com-posting (EPA, 1992b).