“Regulation of Emerging Wastewater Constituents (Contaminants)”

U.S. Poultry and Egg Association –

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Definition of Emerging Constituents

“Emerging constituents" can be broadly defined as any synthetic or naturally occurring chemical or any microorganism that is not commonly monitored in the environment but has the potential to enter the environment and cause known or suspected adverse ecological and(or) human health effects. In some cases, release of emerging chemical or microbial contaminants to the environment has likely occurred for a long time, but may not have been recognized until new detection methods were developed. In other cases, synthesis of new chemicals or changes in use and disposal of existing chemicals can create new sources of emerging contaminants.”

Emerging Contaminants

Historically, ***emerging contaminants*** have not been thought to be widely distributed within the environment and therefore not a concern. However, numerous contaminants have been found to be persistent, bioaccumulative, and toxic and are now a concern. Among these emerging contaminants are natural and synthetic estrogens, pharmaceuticals, personal care products, surfactants, and flame retardants. These substances have the potential to cause subtle ecological and human health responses at low environmental concentrations. Further study is needed around these emerging contaminants to determine in more detail their long-term effects on environmental and human health, and the optimum point of treatment.

Endocrine disrupting compounds *are* a wide variety of compounds that exert an array of effects on growth, development and reproduction in wildlife and humans. Examples include natural and synthetic hormones, some pesticides and surfactants, dioxins and furans, DDT and PCBs. Many are chemicals that are in everyday use by industries and households.

Pharmaceuticals **and** ***Personal Care Products*** *are* a diverse group of chemical compounds which include analgesics, lipid regulators, antibiotics, steroids, synthetic hormones, surfactants, musk fragrances, sunscreen agents, and household cleaning and laundry products. Thousands of these chemicals are used annually in households. Low concentrations of these chemicals have been found in drinking water, surface water, groundwater and municipal wastewater effluent in North America and Europe. The risks of long-term exposure to and consumption by aquatic organisms and humans are unknown.

Brominated Flame Retardants are chemicals used in the textile, furniture, electronic component and building sectors to slow the spread of fire. Brominated flame retardants are persistent organic pollutants that undergo long-range transport and have an affinity for fats. It is unknown how brominated flame retardants are released into the environment and their presence is becoming an increasing environmental concern. They can be found everywhere — water and the aquatic environment, air, soil, birds, as well as humans. They have been detected in human blood, serum, fat tissues, breast milk, placental tissue and the brain. Currently, knowledge about these chemical, their sources, environmental behaviour and toxicity is limited.

EPA Meat and Poultry ELG Statement on Antibiotics and Other Animal Drugs

- Given the statutory and regulatory barriers in place to prevent residues of antibiotics and other animal drugs, as well as pesticides, in food for human consumption above established tolerance limits, EPA assumes that it is highly improbable that antibiotics, other animal drugs, or *Section 7. Selection of Pollutants and Pollutant Parameters for Regulation* pesticides are present routinely in detectable concentrations in the treated effluent of livestock or poultry processing plants. Obviously, the possibility of the slaughter of livestock or poultry containing drug or pesticide residues above tolerance limits exists. The financial self-interest of livestock and poultry producers suggests, however, that such occurrences would be infrequent and highly random. Thus, the probability of detection would be low, especially when pretreatment processes such as anaerobic lagoons with relatively long hydraulic detention times are used. **Therefore, EPA has concluded that establishing effluent standards for antibiotics and other animal drugs and pesticides and requiring routine monitoring could impose an unnecessary burden on livestock and poultry processors.**

Periodic Table of Wastewater Permit Constituents
EPA Meat & Poultry ELG

HEAVY METALS

- Antimony
- Arsenic
- Barium
- Berylium
- Boron
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Manganese
- Mercury
- Molybenum
- Nickel
- Selenium
- Silver
- Thallium
- Tin
- Titanium
- Vanadium
- Yttrium
- Zinc

CONVENTIONAL

- BOD 16 mg/l
- TSS 20 mg/l
- O & G 8 mg/l
- pH 6 to 9
- Fecal Coli 400/100 ml

BACTERIA

- Aeromonas
- Crypto
- Total Coli
- Fecal Strep
- Salmonella

NONCONVENTIONAL

- COD
- TOC
- TDS
- TVS
- Chloride
- TRC
- TP
- OP
- TKN
- TN 103 mg/l
- NH3N 4 mg/l
- NO3N+NO2N

PESTICIDES

- Carbaryl

OTHER

- AntIbiotics
- Animal Drugs

Wastewater Permit Constituents – TMDL's

HEAVY METALS (16372)

- Antimony
- Arsenic
- Barium
- Berylium
- Boron
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Manganese
- Mercury **(8874)**
- Molybenum
- Nickel
- Selenium
- Silver
- Thallium
- Tin
- Titanium
- Vanadium
- Yttrium
- Zinc

ORGANIC ENRICHMENT (6400)

- BOD
- TSS (6292)
- COD
- TOC
- TVS

BACTERIA (10654)

- O & G (155)
- pH (3809)
- Fecal Coli
- Aeromonas
- Crypto
- Total Coli
- Fecal Strep

NUTRIENTS (6825)

- TDS (1732)
- Chloride
- TRC (34)
- TP
- OP
- TKN
- TN
- NH3N (356)
- NO3N+NO2N

PESTICIDES (1798)

- Carbaryl
- Transpermithrin

OTHER TOXIC ORGANICS (459)

- AntIbiotics
- Animal Drugs
- Endocrine Disruptors
- Pharmaceuticals
- Brominated Flame Retardants

Example of Wastewater Permit Constituents
Poultry Further Processing Plant

HEAVY METALS

Antimony	Arsenic	Barium	Berylium
Boron	Cadmium	Chromium	Cobalt
Copper report	Lead	Manganese	Mercury report
Molybenum	Nickel	Selenium	Silver
Thallium	Tin	Titanium	Vanadium
Yttrium	Zinc report		

CONVENTIONAL

BOD 10 mg/l	TSS 10 mg/l
O & G 8 mg/l	pH 6 to 9
Fecal Coli 200/100 ml	DO >6 mg/l

BACTERIA

Aeromonas	Crypto
Total Coli	Fecal Strep

Whole Effluent Toxicity
Chronic Acute

NONCONVENTIONAL

COLOR report	PHENOLS 0.005 mg/l
TDS (4700 mg/l) & (Osmonic Pressure)	TEMP
	TRC 0.5 mg/l
TP 1 mg/l	HARDNESS report
TKN	TN 20 mg/l
NH3N 2 mg/l	NO3N+NO2N

PESTICIDES

Carbaryl	Transpermithrin

OTHER

AntIbiotics	Animal Drugs

EMERGING CONSTITUENTS

Endocrine Disruptors	Pharmaceuticals	Brominated Flame Retardants

Example of Wastewater Permit Constituents
Poultry Processing & Rendering Plant

HEAVY METALS

Antimony	Arsenic	Barium	Berylium
Boron	Cadmium	Chromium	Cobalt
Copper	Lead	Manganese	Mercury
Molybenum	Nickel	Selenium	Silver
Thallium	Tin	Titanium	Vanadium
Yttrium	Zinc		

Chronic Whole Effluent Toxicity
7-day IC25 Ceriodaphnia Dubia
7-day IC25 Pimephales Promelas

CONVENTIONAL

BOD 18 mg/l	TSS 25.5 mg/l
O & G 5 mg/l	pH 6 to 8.5
Fecal Coli 200/100 ml	DO >5 mg/l

BACTERIA

Aeromonas	Crypto
Total Coli	Fecal Strep

NONCONVENTIONAL

COLOR	PHENOLS
Specific Conductance 1,275 umhos/cm max	
	TRC 0.01 mg/l max
TP report	UNIONIZED NH3N 0.02 mg/l max
TKN 10 mg/l	TN report
NH3N report	NO3N+NO2N report

PESTICIDES

Carbaryl	Transpermithrin

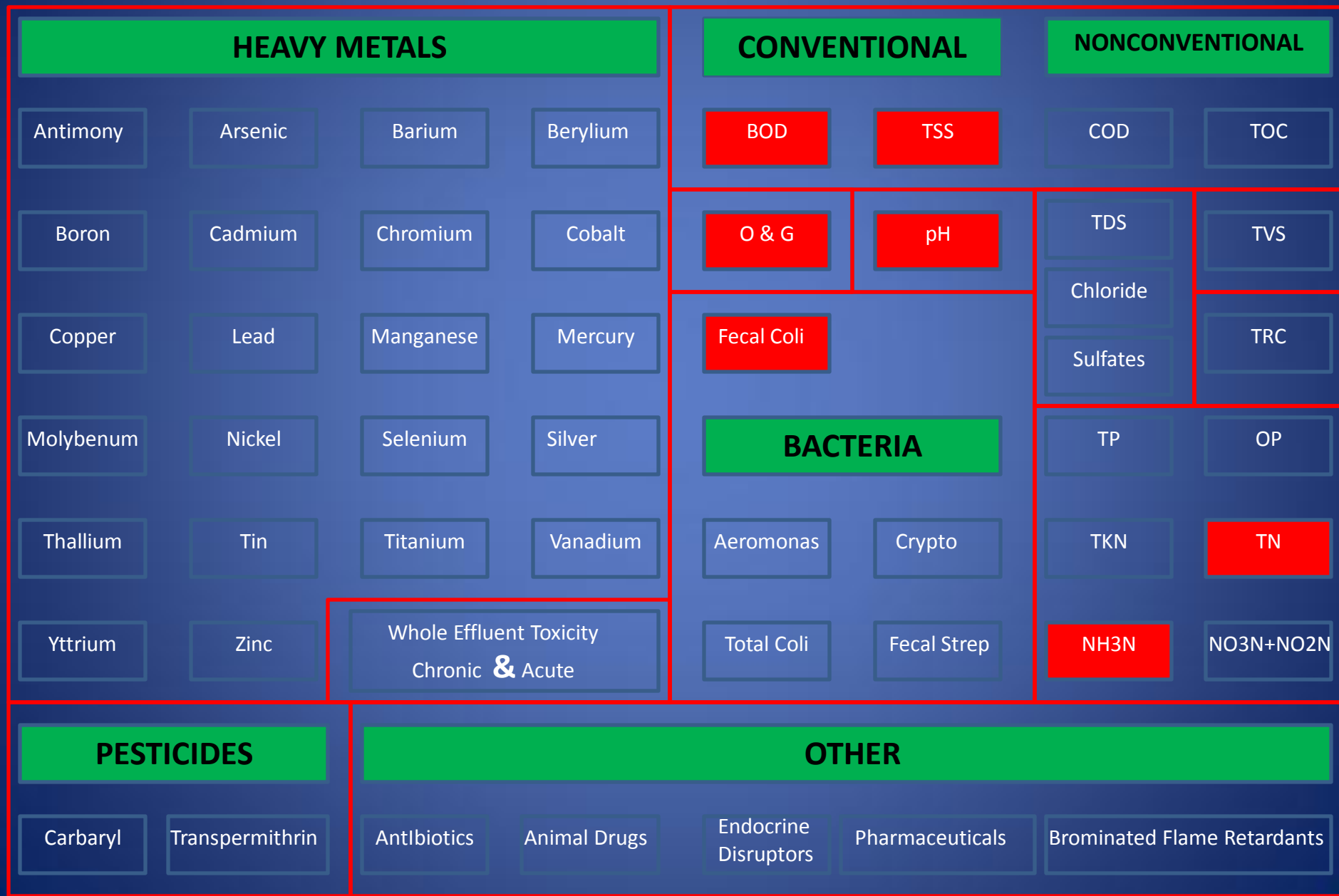
OTHER

AntIbiotics	Animal Drugs

EMERGING CONSTITUENTS

Endocrine Disruptors	Pharmaceuticals	Brominated Flame Retardants

Likely Emerging Wastewater Permit Constituents – Poultry Facilities



Why TDS Effluent Limits???

- TDS cause toxicity through increases in salinity, changes in the ionic composition of the water, and toxicity of individual ions. The composition of specific ions determines toxicity of elevated TDS in natural waters. Also, as the hardness increases, TDS toxicity may decrease. The major concern associated with high TDS concentrations relates to direct effects of increased salinity on the health of aquatic organisms.

PA TDS Regulations

- New Sources of High-TDS Wastewater
  - (a) DEP will not issue permits for new sources of High-TDS industrial waste unless the applicant proposes to install adequate treatment for TDS on or before January of 2011.
  - (b) For new sources of High-TDS industrial waste proposing treatment for TDS, an allocation of available assimilative capacity may be authorized (see subsections (i) and (ii) below). Such an allocation will terminate on January 1, 2011. Beyond that date, the discharge of TDS will be limited to the more stringent of the effluent standards established under regulation as described above. Wastewaters discharged from these facilities also must meet any other applicable treatment standards and requirements.
    - (i) Where analysis of a watershed determines that sufficient assimilative capacity exists to allow short-term discharges of TDS and other pollutants of concern from oil and gas wastewaters, such capacity will be allocated as allowable maximum daily mass loads, and permit limitations will be set using these allocations. Actual allocation strategies may vary by watershed, based on the specific characteristics and existing water quality of each watershed.
    - (ii) Where analysis of a watershed determines that sufficient assimilative capacity does not exist to allow new discharges of TDS or any other pollutants of concern from new sources, meaning that the receiving stream is impaired, federal regulations prohibit discharges from new sources of pollutants that cause or contribute to the impairment. In these cases, new sources can only be authorized if permits limits are set equal to the numeric water quality criteria for the pollutant(s) of concern.
  - (c) Pretreatment Facilities – New Pretreatment facilities that accept new sources of High-TDS wastewaters and discharge pretreated wastewater to a Publicly Owned Treatment Works (POTW) will be subject to local limits established by the receiving POTW, in accordance with (2)(b) below.

Iowa TDS Regulations

- For point sources that discharge directly into a general use stream (undesignated), based on the site-specific TDS approach, if a facility's discharge causes the in-stream TDS concentration above 1000 mg/L, acute toxicity tests would be required to demonstrate that the discharge will not result in toxicity to aquatic life at an in-stream concentration greater than 1,000 mg/L. This demonstration consists of collecting a sample of the discharge and having a laboratory perform a whole effluent toxicity (WET) test. The results will be used to establish an effluent limit for TDS that will be included in an NPDES permit.
- For point sources that discharge directly into a designated stream, the site-specific TDS approach allows the Department to establish a site-specific TDS effluent limit following a demonstration that the discharge will not result in toxicity to aquatic life at an effluent concentration for TDS and/or its constituent chloride that could result in an in-stream level higher than threshold levels. The in-stream threshold level for TDS is 1,000 mg/L. The in-stream threshold levels for chloride are 860 mg/L and 230 mg/L (equivalent to 304(a) criteria), as the acute and chronic threshold values respectively. This demonstration consists of collecting a sample of the discharge and having a laboratory perform a whole effluent toxicity (WET) test (both acute and chronic WET tests are required if both acute and chronic thresholds are exceeded in the receiving stream). The results will be used to establish an effluent limit for TDS that will be included in an NPDES permit.

Illinois Sulfate Limit

- The Illinois EPA is proposing the final rule that deletes the TDS general use water quality standard of 1000 mg/L, and replaces the sulfate general use water quality standard of 500 mg/L with an equation that depends on chloride and hardness to be protective of aquatic life and livestock watering uses.
- Because sulfate toxicity is dependent on chloride and hardness concentrations, water quality chemistry and characteristics are taken into consideration when setting the sulfate standard throughout the State.
- The agency asserts that in Illinois waters the toxicity associated with substances comprising a major portion of TDS is predominantly due to either chloride or sulfate.
- The toxicity of other ions that make up TDS, such as sodium, calcium, magnesium and carbonates is insignificant when compared to chloride and sulfate toxicity.
- The Illinois EPA believes that with the adoption of a sulfate standard and the existing chloride standard, the water quality standards adequately address toxicity of dissolved salts and the TDS standard is not necessary as TDS cannot predict the threshold of adverse effects to aquatic life. For example, a sample with a high chloride and TDS concentration of 2,000 mg/L is highly toxic to some species of aquatic life such as invertebrates but a sample with high sulfate at the same TDS concentration is nontoxic.

Illinois Sulfate Limit

- Based on new toxicity test data and available toxicity data from the literature search (a total of 11 species), to achieve aquatic life protection and livestock watering uses, the following concentrations for sulfate must not be exceeded except in receiving waters for which mixing is allowed.
  - At any point where water is withdrawn or accessed for purposes of livestock watering, the average of sulfate concentrations must not exceed 2,000 mg/L when measured at a required frequency over a 30 day period.
  - The results of the following equations provide sulfate water quality standards in mg/L for the specified ranges of hardness (in mg/L as CaCO3) and chloride (in mg/L) and must be met at all times:
    - If the hardness concentration of waters is greater than or equal to 100 mg/L but less than or equal to 500 mg/L and if the chloride concentration of waters is greater than or equal to 25 mg/L but less than or equal to 500 mg/L, then:
      - Sulfate Criterion = [1276.7 + 5.508 (hardness) – 1.457 (chloride)] * 0.65
    - If the hardness concentration of waters is greater than or equal to 100 mg/L but less than or equal to 500 mg/L, and if the chloride concentration of waters is greater than or equal to 5 mg/L but less than 25 mg/L, then:
      - Sulfate Criterion = [-57.478 + 5.79 (hardness) + 54.163 (chloride)] * 0.65
- The following sulfate standards must be met at all times when hardness (in mg/L as CaCO3) and chloride (in mg/L) concentrations other than specified above are present:
  - A) If the hardness concentration of waters is less than 100 mg/L or chloride concentration of waters is less than 5 mg/L, the sulfate standard is 500 mg/L.
  - B) If hardness concentration of waters is greater than 500 mg/L and the chloride concentration of waters greater than or equal to 5 mg/L, the sulfate standard is 2,000 mg/L.
  - C) If the combination of hardness and chloride concentrations of existing waters are not reflected above, the sulfate standard will be determined on a case-by-case basis in conjunction with an applicable NPDES permitting process.

Whole Effluent Toxicity

- **Acute Toxicity Test is a test to determine the concentration of effluent or ambient waters that causes an adverse effect (usually death) on a group of test organisms during a short-term exposure (e.g., 24, 48, or 96 hours). Acute toxicity is measured using statistical procedures (e.g., point estimate techniques or a hypothesis test).**
- **Chronic Toxicity Test is a short-term test, usually 96 hours or longer in duration, in which sublethal effects (e.g., significantly reduced growth or reproduction) are usually measured in addition to lethality. Chronic toxicity is defined as TU = 100/NOEC or TU = 100/EC or IC .**
- **Whole Effluent Toxicity (WET) is the total toxic effect of an effluent measured directly with a toxicity test.**

EPA Meat and Poultry ELG Statement on Phosphorus

- EPA did not select total phosphorus, orthophosphate, or dissolved phosphorus for the final regulation. Although they are present in the wastewaters from MPP facilities, the treatment technology selected as the basis for the final rule does not include phosphorus removal technology. EPA did consider technology options that would remove phosphorus through chemical-physical treatment (Option 2.5+P and Option 4), but those technology options did not achieve a level of phosphorus reduction that justified the additional cost of the technology. (See Section 13 for additional information.)In addition, for some subcategories the technology options that included chemical phosphorus removal were associated with severe economic impacts (facility closures), and therefore EPA does not consider those options economically achievable.

Florida Numeric Nutrient Limits

- **Water Quality Standards**
- **Florida**
- **Determination that New or Revised Nutrient Water Quality Standards are Necessary for Florida**
- EPA-823-F-09-001; January 2009
- EPA has determined that new or revised numeric water quality standards for nutrients are necessary to meet the requirements of the Clean Water Act (CWA) for the State of Florida. This determination will support Florida in building upon its already strong record of water quality protection, result in standards protective of applicable designated uses, and further expand and strengthen the numerous partnerships and collaborative projects Florida has led and supported to date.

Proposed Florida Numeric Nutrient Criteria

Numeric criteria proposed for rivers and streams, defined as free-flowing surface waters in defined channels, including rivers, creeks, branches, canals (outside south Florida), and freshwater sloughs.

Watershed region	Total N (mg/L)	Total P (mg/L)
Panhandle	0.824	0.043
Bone Valley	1.798	0.739
Peninsula	1.205	0.107
North Central	1.479	0.359

Chesapeake Bay Nutrient Limits

- Total Nitrogen – 3 mg/l
- Total Phosphorus – 0.3 mg/l
- West Virginia Permits –
  - TN – 5 mg/l
  - TP – 0.5 mg/l

Existing Effluent Quality – Poultry Processing and Rendering Facility

HEAVY METALS

Antimony <2.5 ug/l	Arsenic <2.5 ug/l	Barium 19.7 ug/l	Berylium <2.5 ug/l
Boron	Cadmium <1 ug/l	Chromium <10 ug/l	Cobalt
Copper <10 ug/l	Lead <5 ug/l	Manganese	Mercury <0.2 ug/l
Molybenum	Nickel <10 ug/l	Selenium <2.5 ug/l	Silver <0.625 ug/l
Thallium <2.5 ug/l	Tin	Titanium	Vanadium
Yttrium	Zinc 55.8 ug/l	Whole Effluent Toxicity Chronic Acute	

CONVENTIONAL

BOD 6.7 mg/l	TSS 8.8 mg/l
O & G 5 mg/l	pH 6.6 to 7.2
Fecal Coli 35/100 mg/l	

BACTERIA

Aeromonas	Crypto
Total Coli	Fecal Strep

NONCONVENTIONAL

COD 55 mg/l	TOC 13.3 mg/l
TDS 1,253 mg/l	TVS
Chloride 167 mg/l	
Sulfates 332 mg/l	TRC 0.08 mg/l
TP 14.3 mg/l	OP
TKN	TN 60.4 mg/l
NH3N 1.17 mg/l	NO3N+NO2N 58.9 mg/l

PESTICIDES

Carbaryl	Transpermithrin

OTHER

Antibiotics	Animal Drugs	Endocrine Disruptors	Pharmaceuticals	Brominated Flame Retardants

Proposed Permit Limits – Poultry Processing and Rendering Facility

HEAVY METALS

Antimony <2.5 ug/l	Arsenic <2.5 ug/l	Barium 19.7 ug/l	Berylium <2.5 ug/l
Boron	Cadmium <1 ug/l	Chromium <10 ug/l	Cobalt
Copper <10 ug/l	Lead <5 ug/l	Manganese	Mercury <0.2 ug/l
Molybenum	Nickel <10 ug/l	Selenium <2.5 ug/l	Silver <0.625 ug/l
Thallium <2.5 ug/l	Tin	Titanium	Vanadium
Yttrium	Zinc 55.8 ug/l		

Whole Effluent Toxicity
Chronic & Acute

CONVENTIONAL

BOD 6.7 mg/l 4 mg/l	TSS 8.8 mg/l
O & G 5 mg/l	pH 6.6 to 7.2

Fecal Coli 35/100 mg/l

BACTERIA

Aeromonas	Crypto
Total Coli	Fecal Strep

NONCONVENTIONAL

TDS 1,253 mg/l 1,000 mg/l	Sulfates 332 mg/l 250 mg/l
Chloride 167 mg/l 100 mg/l	

TRC 0.08 mg/l

TP 14.3 mg/l 4 mg/l

TKN	TN 60.4 mg/l 15 mg/l
NH3N 1.17 mg/l 1 mg/l	NO3N+NO2N 58.9 mg/l 10 mg/l

PESTICIDES

Carbaryl	Transpermithrin

OTHER

Antibiotics	Animal Drugs	Endocrine Disruptors	Pharmaceuticals	Brominated Flame Retardants

So What Now???

- Stay engaged in watershed initiatives and TMDL's
- Implement aggressive chemical screening process as part of EMS to minimize use of:
  - Toxic sanitation chemicals
  - High nutrient content ingredients and sanitation chemicals
  - High TDS, sulfate, and chloride ingredients and sanitation chemicals
- Select wastewater treatment technologies that balance costs and performance across all parameters to minimize potential for inadequate systems resulting from changing regulations