IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel. W.A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA	)	
Plaintiff,	)	
vs.	)	Case No. 4:05-cv-00329-GKF-PJC
TYSON FOODS, TYSON POULTRY, INC., TYSON CHICKEN, INC., COBB-VANTRESS, INC., AVIAGEN, INC., CAL-MAINE FOODS, INC., CAL-MAINE FARMS, INC., CARGILL, INC., CARGILL TURKEY PRODUCTS, LLC, GEORGE'S, INC., GEORGE'S FARMS, INC., PETERSON FARMS, INC., SIMMONS FOODS, INC., AND WILLOWBROOK FOODS, INC.	)	
Defendants.		

AFFIDAVIT OF DR. CHRISTOPHER M. TEAF

The undersigned, Christopher M. Teaf, does solemnly swear and state:

1. My name is Dr. Christopher M. Teaf. I received a Bachelor's degree in Biology (with Honors) from Pennsylvania State University and a Master's degree in Biological Science from Florida State University. I earned my Ph.D. in Toxicology from the University of Arkansas for Medical Sciences (Little Rock,

EXHIBIT "C"

Arkansas) and conducted my research at the Division of Genetic Toxicology, National Center for Toxicological Research (Jefferson, Arkansas).

2. I presently hold positions as Associate Director at the Center for Biomedical & Toxicological Research and Waste Management at Florida State University (since 1983), as well as Director of Toxicology for the research firm of Hazardous Substance & Waste Management Research, Inc. since 1985 (President since 1989). I have held adjunct teaching appointments at the Florida State University/State University System Program in Medical Sciences and the Florida A & M University College of Pharmacy and Pharmaceutical Sciences.

3. My research and scientific advisory activities principally are in the area of risk assessment for human exposure to occupational and/or environmental chemical and biological hazards. My principal activities for approximately 25 years have included the performance of risk assessments concerning human health and the evaluation of adverse effects of chemical and biological exposures under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, Superfund), Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), the Occupational Safety and Health Act (OSHA), and other related federal or state legislation. My activities have involved evaluation of potential human health impacts of many organic substances (e.g., petroleum products, pesticides, chlorinated and non-chlorinated solvents), inorganic agents (e.g., acids/caustics, metals, particulates, fibers) and microbiota (e.g., bacteria, molds, fungi) in air, water, soils and sediments.

4. I have served as a peer reviewer for publications submitted to numerous scientific journals and presently serve on the Editorial Boards for several of these scientific journals. I am Senior Human Health Editor for the international journal *Human & Ecological Risk Assessment*. I have published many scientific papers, articles and book chapters concerning toxicological effects and risk evaluations related to occupational and environmental exposures and effects.

5. For over 25 years, I have directed and conducted research projects and human health education activities for many agencies such as the World Health Organization (WHO), the North Atlantic Treaty Organization (NATO), the U.S. Environmental Protection Agency (U.S. EPA), the U.S. Department of Energy (U.S. DOE), the U.S. Department of Agriculture (U.S. DOA), the federal Agency for Toxic Substances and Disease Registry (ATSDR), the Florida Department of Environmental Protection (FDEP), the Florida Department of Health (FDOH), the Florida Department of Community Affairs, and many local governmental entities. These activities have been conducted in the United States, as well as Eastern Europe (e.g., Bulgaria, Czech Republic, Hungary, Poland), in Central Asia (e.g., Kazakhstan), and in Russia.

6. I have provided advisory services on toxicology, risk assessment, and environmental health issues to the U.S. Department of Justice, Florida State Attorney's Office, and Attorneys General for Florida, Washington, and Oklahoma. I have been qualified to provide expert testimony to federal and state courts, to administrative proceedings, and to regulatory or legislative groups concerning toxicology, environmental chemistry, occupational exposure, health effects of chemicals, and risk assessment since 1986.

7. I have been retained in this case by the Oklahoma Office of the Attorney General to provide technical analysis and opinions in the areas of toxicology and human health for issues associated with the land application of poultry waste within the Illinois River Watershed (IRW).

8. I have reviewed the Expert Report of Timothy J. Sullivan, dated January 29, 2009, as well as the deposition of Dr. Sullivan, taken on April 7 and April 8, 2009.

9. Dr. Sullivan opines regarding the statistics of bacterial counts in the IRW and in other Oklahoma waterbodies, particularly concerning geometric mean values for samples collected over multiple years (e.g., deposition pgs. 277 and 279). He makes no effort in calculating those geometric means in a manner which

adheres to the requirements for such calculations as specified in the State of Oklahoma Administrative Code in Title 785, Chapter 45 (see attached). In that rule, the geometric mean must be calculated from not less than five (5) samples collected over a period of not more than 30 days. In many instances (e.g., Sullivan Expert Report Figures 2-6 through 2-13 and 2-15 through 2-17), the geometric mean calculated by Dr. Sullivan is from a period much greater than 30 days, in numerous cases over several years, which invalidates that calculation. Although Dr. Sullivan states that his calculations were intended to evaluate spatial patterns and not whether a standard was met or not met (Sullivan deposition p. 278), he compares his calculated geometric means to the Primary Body Contact Recreation (PBCR) geometric mean standards that are found in Title 785, Chapter 45 (e.g., Sullivan Expert Report Figures 2-6 through 2-13 and 2-15 through 2-17). It is worth noting that on p. 164 of his deposition, Dr. Sullivan acknowledges that the Oklahoma standard is based upon a 30 day geometric mean calculation on five (5) or more samples. Thus, it is unclear why he makes the comparisons noted above, when his calculations do not meet the standard requirement.

10. The scientific significance of Dr. Sullivan's failure to properly calculate the geometric mean values is that he subsequently uses his calculated figures to draw conclusions regarding the way in which the IRW values compare to other values in Oklahoma waterbodies. He concludes that the IRW is not meaningfully different from other waterbodies in the state in terms of bacterial levels (see Sullivan deposition p. 292), a conclusion he cannot legitimately reach given his erroneous calculation method. It is not clear from his data how many geometric means he could have calculated, nor what those values would be, if he were to have done it in the correct manner. More importantly, however, he makes no specific effort to ascribe bacterial sources to individual waterbodies in the state. This is a critical point, because while numerical bacterial levels may be similar among one or more waterbodies, their sources from location to location may be different. In one area, the principal source may be poultry waste, in another it may be urban runoff, in another it may be sewage treatment effluent. In terms of

the risk posed by PBCR uses of streams in the IRW, it is irrelevant what values may be observed elsewhere in Oklahoma, just as it is irrelevant what levels may be observed in Pennsylvania, or Texas, waterbodies.

CHRISTOPHER M. TEAF, Ph.D.

15 May 2009

Date

Attachment

State of Oklahoma Administrative Code
Title 785, Chapter 45

(d) **Highly saline water.** Highly saline water should be used with best management practices as outlined in "Diagnosis and Reclamation of Saline Soils," United States Department of Agriculture Handbook No. 60 (1958).

(e) **General criteria for the protection of Irrigation Agriculture.** This subsection prescribes general criteria to protect the Irrigation Agriculture subcategory. For chlorides, sulfates and total dissolved solids at 180°C (see Standard Methods), the arithmetic mean of the concentration of the samples taken for a year in a particular segment shall not exceed the historical "yearly mean standard" determined from the table in Appendix F of this Chapter. For permitting purposes, the long term average concentration shall not exceed the yearly mean standard. Yearly mean standards shall be implemented by the permitting authority using long term average flows and complete mixing of effluent and receiving water. Furthermore, not more than one (1) in twenty (20) samples randomly collected at a site shall exceed the historical value of the "sample standard" calculated for that segment. For permitting purposes, the short term average concentration shall not exceed the sample standard. Sample standards shall be implemented by the permitting authority using short term average flows and complete mixing of effluent and receiving water. The data from sampling stations in each segment are averaged, and the mean chloride, sulfate, and total dissolved solids at 180°C are presented in Appendix F of this Chapter. Segment averages shall be used unless more appropriate data are available.

(f) **Historic concentrations.** The table in Appendix F of this Chapter contains statistical values from historical water quality data of mineral constituents. In cases where mineral content varies within a segment, the most pertinent data available should be used.

(g) **Criteria to protect Irrigation Agriculture subcategory.** For the purpose of protecting the Irrigation Agriculture subcategory, neither long term average concentrations nor short term average concentrations of minerals shall be required to be less than 700 mg/L for TDS, nor less than 250 mg/L for either chlorides or sulfates.

(h) **Criteria to protect Livestock Agriculture subcategory.** For the purpose of protecting the Livestock Agriculture subcategory, neither long term average concentrations nor short term average concentrations of minerals shall be required to be less than 2500 mg/L for TDS.

785:45-5-14. Hydroelectric power generation [REVOKED]

785:45-5-15. Industrial and municipal process and cooling water [REVOKED]

785:45-5-16. Primary Body Contact Recreation

(a) Primary Body Contact Recreation involves direct body contact with the water where a possibility of ingestion exists. In these cases the water shall not contain chemical, physical or biological substances in concentrations that are irritating to skin or sense organs or are toxic or cause illness upon ingestion by human beings.

(b) In waters designated for Primary Body Contact Recreation the following limits for bacteria set forth in (c) of this section shall apply only during the recreation period of May 1 to September 30. The criteria for Secondary Body Contact Recreation will apply during the remainder of the year.

(c) Compliance with 785:45-5-16 shall be based upon meeting the requirements of one of the three (3) options specified below for bacteria. Upon selection of one (1) group or test method, said method shall be used exclusively over that thirty (30) day period. Provided, where concurrent data exist for multiple bacterial indicators on the same waterbody or waterbody segment, no criteria exceedances shall be allowed for any indicator group.

(1) Coliform Bacteria: The bacteria of the fecal coliform group shall not exceed a monthly geometric mean of 200/100 ml, as determined by multiple-tube fermentation or membrane filter procedures based on a minimum of not less than five (5) samples collected over a period of not more than thirty (30) days. Further, in no more than 10% of the total samples during any thirty (30) day period shall the bacteria of the fecal coliform group exceed 400/100 ml.

(2) Escherichia coli (E. coli): E. coli shall not exceed a monthly geometric mean of 126/100 ml based upon a minimum of not less than five (5) samples collected over a period of not more than thirty (30) days. No sample shall exceed a 75% one-sided confidence level of 235/100 ml in lakes and high use waterbodies and the 90% one-sided confidence level of 406/100 ml in all other Primary Body Contact Recreation beneficial use areas. These values are based upon all collected samples. Analysis procedures shall follow EPA-600/4-85/076, "Test Methods for Escherichia coli and Enterococci in Water by the Membrane Filter Procedure."

(3) Enterococci: Enterococci shall not exceed a monthly geometric mean of 33/100 ml based upon a minimum of not less than five (5) samples collected over a period of not more than thirty (30) days. No sample shall exceed a 75% one-sided confidence level of 61/100 ml in lakes and high use waterbodies and the 90% one-sided confidence level of 108/100 ml in all other Primary Body Contact Recreation beneficial use areas. These values are based upon all collected samples. Analysis procedures shall follow EPA-600/4-85/076, "Test Methods for Escherichia coli and Enterococci in Water by the Membrane Filter Procedure."

785:45-5-17. Secondary Body Contact Recreation

(a) The water quality requirements for Secondary Body Contact Recreation are usually not as stringent as for Primary Body Contact Recreation.

(b) The Secondary Body Contact Recreation beneficial use is designated where ingestion of water is not anticipated.

(c) Associated activities may include boating, fishing or wading.

(d) Waters so designated shall be maintained to be free from human pathogens in numbers which may produce adverse health effects in humans.

785:45-5-18. Navigation

This beneficial use is generally more dependent upon quantity than quality of water.

785:45-5-19. Aesthetics

(a) To be aesthetically enjoyable, the surface waters of the state must be free from floating materials and suspended substances that produce objectionable color and turbidity.

(b) The water must also be free from noxious odors and tastes, from materials that settle to form objectionable deposits, and discharges that produce undesirable effects or are a nuisance to aquatic life.

(c) The following criteria apply to protect this use:

(1) **Color.** Surface waters of the state shall be virtually free from all coloring materials which produce an aesthetically unpleasant appearance. Color producing substances, from other than natural sources, shall be limited to concentrations equivalent to 70 Platinum- cobalt true color units.

(2) **Nutrients; numerical criterion applicable to waters designated Scenic Rivers.** The thirty (30) day geometric mean total phosphorus concentration in waters designated "Scenic River" in Appendix A of this Chapter shall not exceed 0.037 mg/L. The criterion stated in this subparagraph applies in addition to, and shall be construed so as to be consistent with, any other provision of this Chapter which may be applicable to such waters. Such criterion became effective July 1, 2002 and shall be implemented as authorized by state law through Water Quality Standards Implementation Plans and other rules, permits, settlement agreements, consent orders, compliance orders, compliance schedules or voluntary measures designed to achieve full compliance with the criterion in the stream by June 30, 2012.

785:45-5-20. Fish consumption

(a) **General.** The surface waters of the state shall be maintained so that toxicity does not inhibit ingestion of fish and shellfish by humans.

(b) **Water column criteria to protect for the consumption of fish flesh.** The water column numerical criteria (total recoverable) identified in the "Fish Consumption" column in Table 2 of Appendix G protect