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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD FEB - 9 2004

STATE OF ILLINOIS
Pollution Control Board

IN THE MATTER OF:	)	
	)	
Petition of Noveon, Inc.	)	
	)	**AS 02-5**
	)	
for an Adjusted Standard from	)	
35 Ill. Adm. Code 304.122	)	

NOTICE OF FILING

Dorothy M. Gunn, Clerk
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph Street
Suite 11-500
Chicago, IL 60601

Deborah Williams
Assistant Counsel
Division of Legal Counsel
Illinois Environmental Protection Agency
1021 N. Grand Avenue East
Springfield, IL 62794-9276

Bradley P. Halloran
Hearing Officer
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph Street
Suite 11-500
Chicago, IL 60601

PLEASE TAKE NOTICE that on **Monday, February 9, 2004**, we filed the attached **MOTION TO WITHDRAW AND SUBSTITUTE WRITTEN EXPERT TESTIMONY OF T. HOUSTON FLIPPIN** with the Illinois Pollution Control Board, a copy of which is herewith served upon you.

Respectfully submitted,

NOVEON, INC.

By: ______________________
One of Its Attorneys

Richard J. Kissel
Mark Latham
Sheila H. Deely
GARDNER CARTON & DOUGLAS LLP
191 N. Wacker Drive – Suite 3700
Chicago, IL 60606

THIS FILING IS SUBMITTED ON RECYCLED PAPER

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MOTION TO WITHDRAW AND SUBSTITUTE WRITTEN EXPERT TESTIMONY OF T. HOUSTON FLIPPIN

Noveon, Inc., hereby moves to withdraw the testimony of T. Houston Flippin that was filed Friday, February 6, 2004, and substitute the attached written testimony. In support thereof, Noveon states as follows:

1. To assist in expediting the hearing on this matter, Noveon prepared written testimony for most of its witnesses. Testimony includes that for T. Houston Flippin, Noveon's expert of the treatability of its wastewater.

2. On Friday, February 6, 2004,when testimony was pre-filed, Mr. Flippin inadvertently sent a draft version of his testimony. This testimony was then mistakenly pre-filed.

3. As soon as counsel for Noveon learned of the error, counsel contacted the hearing officer to disclose the erroneous filing, and subsequently prepared a motion as directed to correct the filing.

4. Noveon does not believe any prejudice will result from this correction, as Illinois EPA was promptly served with the corrected version of testimony, and the pre-filed testimony will still serve to expedite the hearing on this matter.

WHEREFORE, Noveon hereby moves to withdraw and substitute the attached testimony of T. Houston Flippin.

Respectfully submitted,
NOVEON, INC.

By: ____________________
One of Its Attorneys

Richard J. Kissel
Mark Latham
Sheila H. Deely
GARDNER CARTON & DOUGLAS LLP
191 N. Wacker - Suite 3700
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CH02/22292356.1

CERTIFICATE OF SERVICE

The undersigned certifies that a copy of the foregoing **Notice of Filing** and **MOTION TO SUBSTITUTE WRITTEN EXPERT TESTIMONY OF T. HOUSTON FLIPPIN** was filed by hand delivery with the Clerk of the Illinois Pollution Control Board and served upon the parties to whom said Notice is directed by

Dorothy M. Gunn, Clerk
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Bradley P. Halloran
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on Monday, February 9, 2004.

CH02/22292364.1

Petition of Noveon, Inc. For An Adjusted Standard
NPDES Adjusted From 35 ILL ADM. Code Standard 304.122, B 02-5
And
Noveon, Inc. v. Illinois Protection Agency, PCB 91-17

Written Testimony of
T. Houston Flippin as wastewater treatment expert
representing Noveon, Inc. in this proceeding.

Introduction and Experience of T. Houston Flippin as Wastewater Treatment Expert Representing Noveon Inc.

My name is Thomas Houston Flippin. I was retained by Noveon, Inc in December 1989 to provide wastewater treatment consulting services and have continued to provide such services for the last 14 years. During this entire time period, I have served as lead process engineer on all Noveon-Henry Plant matters in which my firm Brown and Caldwell has been involved. My firm was previously known as Eckenfelder Inc and was acquired by Brown and Caldwell in 1998.

I received two degrees from Vanderbilt University. I received my Bachelor of Engineering Degree in Civil and Environmental Engineering in 1982 and my Master of Science Degree in Environmental and Water Resources Engineering in 1984.

I immediately went to work for AWARE Incorporated in 1984 and have remained with the same company for the last 20 years in progressively more responsible positions (from project engineer to project manager to principal engineer) in the area of wastewater engineering (see Exhibit A for resume documenting this experience). My firm has changed names twice. In 1989, we renamed ourselves Eckenfelder Incorporated to honor Wes Eckenfelder our Chairman Emeritus who is still with us today. Much of what I have learned has been under Dr. Eckenfelder as a graduate student and as a co-worker.

During my career, I have personally conducted treatment (treatability) testing of industrial wastewaters and contaminated groundwaters and developed treatment process design criteria from test data. I have provided troubleshooting or optimization services for wastewater treatment facilities (WWTFs) and conducted waste minimization studies. I have also overseen the work described above, designed wastewater and contaminated groundwater treatment processes, assisted in effluent permit negotiations, supported expert testimony preparation and trained treatment plant operators. I currently serve as lead process engineer on more technically challenging projects and to train other engineers within the firm.

I am a licensed professional engineer in the states of Illinois, Michigan, Kentucky, and Tennessee. I also am certified as a Diplomat in the American Academy of Environmental Engineers in the specialty area of water supply and wastewater. This certification is held by less than 1300 people in the United States and requires stringent peer review and testing to acquire.

I have published 16 technical papers of which 7 are directly related to the Noveon-Henry Plant's issues and have provided material for 1 textbook (Activated Sludge Treatment of Industrial Wastewaters, John L. Musterman and W. Wesley Eckenfelder, Technomic Publishing Company, 1995). I also provided the technical review of a chapter from another textbook ("Granular Carbon Adsorption of Toxics" from Toxicity Reduction in Industrial Effluents, Perry W. Lankford and W. Wesley Eckenfelder, Van Nostrand Reinhold, 1992).

I have served as in instructor in numerous workshops including the following:

- "Clarifier Operation and Maintenance" sponsored by Mississippi Water Pollution Control Operators' Association in 1997;
- "Aerobic Biological Treatment" sponsored by Tennessee State University in 1997, 1998, and 1999;
- "Activated Sludge Treatment" sponsored by Brown and Caldwell and attended by more than 10 industries during each offering in November 1999, March 2000, May 2001, November 2002, and November 2003; and

- "Wastewater Strategies for Industrial Compliance: Gulf Coast Issues and Solutions" sponsored by Tulane University and Louisiana Chemical Association in December 2003.

Specific Design Experience Related to this Petition

I have developed the process design for the following biological nitrification facilities. Each of these are fully operational today and meeting permit compliance.

- Ciba Specialties, McIntosh, AL
- City of Springfield, MA
- City of Forest, MS
- Globe Manufacturing Company, Gastonia, NC

I have provided optimization assistance for the following biological nitrification facilities. Each of these are fully operational today and meeting permit compliance.

- American Proteins, Cummings, GA
- International Specialty Products, Calvert City, Kentucky
- City of Murray, Kentucky
- Noveon, Gastonia, North Carolina

I have developed process design for the following biological nitrification and denitrification facilities. One of these (Lower Bucks County) was never built due to a lack of funding. The Chesterfield County facility is fully operational and meeting effluent limits. The Puerto Rico facility is under construction and will begin operation later this year.

- Rohm and Haas combined with Lower Bucks County, Bristol, PA
- Chesterfield County, VA
- Eli Lilly, Puerto Rico

Lastly, I developed the process design for the breakpoint chlorination facility for the Allied Waste Landfill in Murfreesboro, Tennessee. This facility, unlike that considered for the Noveon-Henry

Plant, required small enough quantities of chlorine that a mucg safer chlorine source could be used, liquid sodium hypochlorite. This facility also discharged to a Publicaly Owned Treatment Works and not a receiving water body. I will present the evaluation that led to the design of this breakpoint chlorination facility at the Tennessee Solid Waste and Hazardous Waste Conference in Gatlinburg, Tennessee in April 2004. Several other technologies were considered for design development. These were struvite precipitation, ion exchange, selective membrane treatment, alkaline air stripping, and biological nitrification. Bio-inhibition was the reason that biological nitrification was not selected for treatment to remove ammonia-nitrogen from this leachate. This is the same factor that made biological nitrification at the Henry Plant expensive and unreliable.

Noveon-Henry Plant Experience:

1989 to 2004: Have provided the following assistance in chronological order listed below. I have also spent a cumulative of at least 2 months onsite at this facility throughout the years with no more than two years elapsing between visits. My last visit to the plant was in the Fall of 2003.

- Optimization of WWTF operations.

- Setup, conduct and oversight of treatability testing that was used to develop process design of C-18 wastewater pretreatment system and aeration basin upgrade. Testing was also used to set allowable loading rates of various wastestreams.

- Train WWTF operators in process optimization and analytical testing.

- Setup, conduct and oversight of treatability testing that was used to develop conceptual level design criteria for alternative processes for effluent ammonia-nitrogen reduction. Developed conceptual level designs for these alternative processes. Worked with construction cost estimators and venders to develop conceptual level cost estimates of these alternative processes.

- Provided as requested guidance to Noveon regarding WWTF operations and full-scale testing of processes and procedures intended to reduce effluent ammonia-nitrogen.

- Authored or reviewed all reports submitted to Noveon by Brown and Caldwell (formerly AWARE Incorporated and Eckenfelder Inc) during entire period of 1987 through 2004.

- Represented Noveon in discussions with IEPA regarding the Petition for an Adjusted Standard.

Noveon-Henry Plant Wastewater Treatment Facilities

Many of the terms that I have used above and throughout this report are defined below as the Noveon-Henry Plant Wastewater Treatment Facility (WWTF) is described. An understanding of the WWTF is critical to understanding the evaluations conducted and the conclusions reached.

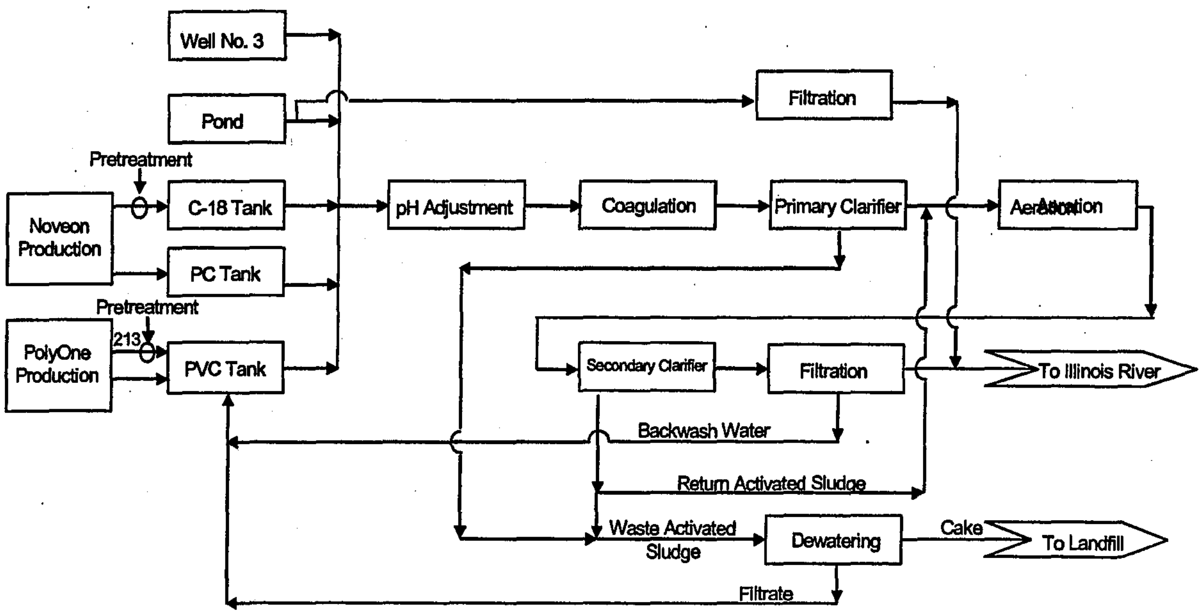

FIGURE 1

BLOCK FLOW DIAGRAM OF WASTESTREAM SOURCES AND WWTF

The wastewater treatment facility at the Henry Plant site is owned and operated by Noveon, Inc. This facility treats wastewaters discharged from two manufacturing areas (resins and specialty chemicals) that were once owned by BF Goodrich. BF Goodrich sold the resin business to the Geon Company who later sold it to the PolyOne Corporation. BF Goodrich sold the specialty chemicals business and the site's wastewater treatment facility to Noveon, Inc. The wastewaters discharged by Noveon comprise about 35 percent of the total dry weather flowrate to the WWTF with the remaining 60 percent being discharged from the PolyOne production areas.

Wastewaters from the Noveon-Henry Plant production areas discharge to one of two places as illustrated in Figure 1. All wastewaters excluding those from C-18 manufacturing discharge directly to an equalization tank (the PC Tank), as shown in Figure 1. The wastewaters from C-18 manufacturing discharge to a pretreatment system and are then pumped to an equalization tank (C-18 Tank). Prior work that I either conducted or oversaw defined the pretreatment of the C-18 wastewater that would be required for the WWTF to treat these wastewaters while complying with effluent BOD limits. Prior to installing pretreatment, the bulk of the C-18 wastewaters were collected and transported for off-site treatment and disposal. After this pretreatment was installed, the pretreatment allowed the Noveon-Henry Plant to treat all C-18 wastewaters onsite while maintaining compliance with effluent BOD limits. This pretreatment was not required of the other Noveon wastewaters. This pretreatment also had no effect on effluent ammonia-nitrogen concentrations nor would it have any such effect if applied to any other Noveon wastewater.

Wastewaters from the PolyOne Plant production areas discharge to one of two places as illustrated in Figure 1. All wastewaters excluding those from 213 manufacturing discharge directly to an equalization tank (the PVC Tank). The wastewaters from 213 manufacturing discharge to a pretreatment system and are then pumped to same equalization tank (PVC Tank). This pretreatment was not required of the other Polyone wastewaters. This pretreatment also had no effect on effluent ammonia-nitrogen concentrations nor would it have any such effect if applied to any other Polyone wastewater.

Stormwater from the both the Noveon and PolyOne sites and discharges from cooling towers, boilers, and river water treatment are discharged to the Storm/Utility Pond (the "Pond") as illustrated in Figure 1. A portion of the Pond contents are pumped through a filter to remove TSS prior to discharge the Illinois River. The remaining portion is pumped to the PVC Tank for subsequent treatment. The amount of Pond Water returned to the PVC Tank is a function of the capacity of the filter treating the Pond Water, the PVC Tank operating level, and the need for other wastewater to compliment the required PC Tank discharge flowrate. The PVC Tank has a minimum allowable operating level, below which the tank mixer shuts off. Work that I have conducted and overseen has indicated that the PC Tank discharge must be limited to approximately 23 percent of the combined influent flow to the aeration basins to maintain compliance with effluent BOD limits. The PC Tank discharge contains compounds that can inhibit or slow down the bacteria responsible for BOD removal if their concentrations are allowed to exceed certain critical concentrations. So the amount of Pond water diverted to the PVC Tank for subsequent treatment increases during a wet weather period when the capacity of the filter on the pond discharge is approached, when the PVC Tank level nears its minimum operating level, and when the flow contribution of the PC Tank discharge approaches 23 percent. The contents of the PVC Tank, PC Tank, and C-18 Tank are pumped to a pH adjustment tank along with groundwater from a well (Well No. 3). The pH of the combined wastewater is adjusted. Coagulant and polymer are added to the combined wastewater to assist in removing solids from the combined wastewater in the sedimentation basin (also known as primary clarifier). The solids settle for approximately one hour in the primary clarifier. The settled solids then combine with solids discharged from the bottom of the second sedimentation basin (also known as the secondary clarifier) and are dewatered using a filter press. The dewatered solids are disposed in a permitted off-site landfill. The filtrate from sludge dewatering is returned to the PVC Tank for reprocessing through the WWTF. When the filter press is not operating, the sludge from the primary clarifier underflow is pumped back to the PVC Tank for reprocessing in the WWTF and sludge discharge from the secondary clarifier is ceased.

The effluent from the primary clarifier is pumped to four aeration basins (2.0 million gallons combined volume) that operate in parallel. These basins are aerated to mix the tank contents and to maintain a minimum operating dissolved oxygen concentration of 1.5 mg/L. Sludge is returned from the bottom of the secondary clarifier to keep these tanks supplied with an acclimated culture of bacteria. pH is controlled as needed to maintain an optimum range for bacterial growth (pH 6.5 to pH 8.5). The bacteria grown in this tank remove organic compounds with the aid of dissolved oxygen, ammonia-nitrogen, and phosphorus. In the process of this removal these bacteria also break away ammonia-nitrogen from organic compounds containing amines (also known as organic nitrogen compounds). Both biological treatment steps are illustrated below. Dissolved oxygen needed for biodegradation is provided by the aeration equipment. The two predominant nutrients required for biological degradation are ammonia-nitrogen and phosphorus. Ammonia-nitrogen is present in the wastewater and is formed through degradation of the organic nitrogen compounds such as amines, morpholine, and mercaptobenziothiazole. Phosphorus is added to the return sludge going back to the aeration tanks.

Biological Treatment Reactions

Organic compounds (measured as BOD, Biochemical Oxygen Demand) + Ammonia-Nitrogen + Phosphorus+ Dissolved Oxygen + Bacteria yields More Bacteria (reproduction and growth) + Carbon Dioxide + Water

Organic Nitrogen (an organic compound with essentially ammonia-nitrogen attached) + Phosphorus+ Dissolved Oxygen + Bacteria yields Organic Compound + Ammonia-Nitrogen…The Organic compound then gets degraded just like above using some of the ammonia-nitrogen generated.

The bacteria stay in the aeration tanks about 2.5 days where they degrade organic compounds and organic nitrogen. They are then discharged through a line where they get conditioned with polymer to help them settle better in the secondary clarifier. They settle approximately 3 hours in the secondary clarifier. They are removed continuously off the bottom of the clarifier and sent back to the aeration tanks to degrade more organic compounds and organic nitrogen. A portion of the bacteria is removed from the system (termed "sludge wasting") to control population growth and keep the average age of the bacteria (the Mean Cell Residence Time) and Food-To-Mass (F/M) ratio in an optimal range. The bacteria removed from the system are discharged to the filter press for sludge dewatering and subsequent off-site disposal in a landfill.

The treatment described includes pretreatment, primary treatment (pH adjustment, coagulation and primary clarifier), and secondary treatment (aeration and secondary clarifier with sludge return). This treatment is defined by USEPA as the "Best Available Technology Economically Available" for the Organic Chemicals, Plastics, and Synthetic Fibers industrial category (Code of Federal Regulations Title 40, Part 414.83, Subpart H).This industrial category includes Noveon and PolyOne. However, Noveon treats the wastewater even further by discharging the effluent from the secondary clarifier to a filter to remove additional solids. This additional treatment process is termed tertiary treatment. Noveon also filters the water coming out of the Pond to remove solids. These two filtered wastewater streams combine and discharge through the effluent compliance point that Noveon monitors for flow and regulated compounds such as specific organics, BOD and TSS.

The design and operation of Noveon's WWTF are compatible with conditions defined by 35 ILL. Admin. Code 370.920, 35 ILL. Admin. Code 370.1210, and Ten State Standards to grow nitrifying or ammonia-degrading bacteria as illustrated below in Table 1. However, these bacteria do not grow in Noveon's WWTF. The Illinois regulations cited and the Ten State Standards are design and operating standards that are intended to promote complete nitrification in municipal wastewater treatment facilities. These standards are intentionally excessive (or conservative) and allow for a significant margin of error in waste load determinations and operating conditions based on my experience. These regulations and standards are principally used by regulators to critique WWTF designs to ensure they provide adequate facilities to support complete nitrification. There are no Illinois or Ten State standards for single stage nitrification of industrial wastewater treatment facilities since the nature of these wastewaters varies from industry to industry. These industrial design standards are developed on a site specific basis using wastewater characterization data, treatability testing, and professional experience. It should be noted, though, that the Noveon-Henry Plant does provide the equipment and treatment conditions necessary to achieve and maintain biological nitrification. Its lack of nitrification is not due to a lack of equipment or unfavorable treatment conditions, but due to the presence of bio-inhibiting compounds.

Nitrifying or ammonia-degrading bacteria are much more sensitive than the bacteria that degrade organic compounds and organic nitrogen. The reason these bacteria will not grow is because there are compounds present in the Noveon wastewater that prevent or inhibit their growth. If the bacteria were not inhibited and could grow in the aeration tanks they would provide ammonia removal in the same tankage as the other bacteria used to provide organics removal. Consequently, the treatment would be termed single stage nitrification since in the same existing tankage (same stage) both organics removal and ammonia removal would occur. If you were to grow these ammonia-degrading bacteria in a system downstream of the secondary clarifier, it would be called tertiary nitrification. These nitrifying bacteria grow in the manner described as follows:

Biological Treatment Reaction

Ammonia-Nitrogen + Phosphorus+ Dissolved Oxygen + Alkalinity + Bacteria yields More Bacteria (reproduction and growth) + Nitrate-Nitrogen

Table 1. Comparison of Illinois Standards, 10 State Standards, and Noveon-Henry Plant Conditions for Single Stage Nitrification

Condition	Illinois Standard[a]	Ten State Standard[b]	Noveon Plant[c]
Aeration Tank Loading, lbs BOD/day per 1000 cu ft	≤15	≤15	14
Aeration Basin Mixed Liquor DO, mg/L	≥ 2	≥ 2	≥ 2
Aeration Basin Mixed Liquor pH, s.u.	7.2 to 8.4	Not Defined	6.8 to 7.2
Sludge Age, days	≥ 20	Not Defined	≥40
Aeration Basin Mixed Liquor Temperature, degrees F	≥ 50	Not Defined	≥ 80
Aeration Basin Average Hydraulic Residence Time, days	≥ 0.33	Not Defined	2.5
Aeration Basin F/M Ratio, lbs BOD/day per lb MLVSS	Not Defined	0.05 to 0.10	0.10
Return Activated Sludge Flow, % of Ave Influent Flow	15 to 100	50 to 200	100

[a] Illinois Administrative Code, Title 35, Subtitle C, Part 370, Subpart I, Title 370.920 and Subpart L, Title 370.1210. Both govern municipal (not industrial) WWTF design.

[b] Recommended Standards for Wastewater Treatment Facilities, 1997 Edition, Wastewater Committee of The Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (includes Illinois), Chapter 90. These standards are to provide guidance in the design of municipal (not industrial) WWTF design.

[c] 1999 through 2004.

Applicability of 35 ILL. Admin. Code 304.122: The provisions of Illinois Title 35, Subtitle C, Part 304, Subpart A, Section 304.122 (35 ILL. Admin. Code 304.122) is stated as follows:

a) No effluent from any source which discharges to the Illinois River, The Des Plaines River downstream of its confluence with the Chicago River System or the Calumet River System, and whose untreated waste load is 50,000 or more population equivalents shall contain more than 2.5 mg/L of total ammonia nitrogen as N during the months of April through October, or 4 mg/L at other times.

b) Sources discharging to any of the above waters and whose untreated waste load cannot be computed on a population equivalent basis comparable to that used for municipal waste treatment plants and whose total ammonia nitrogen as N discharge exceeds 45.4 kg/day(100 pounds per day) shall not discharge an effluent of more than 3.0 mg/L of total ammonia nitrogen as N.

c) In addition to the effluent standards set forth in subsections (a) and (b) of this Section, all sources are subject to Section 304.105."

Section 304.105 states "In addition to the other requirements of this Part, no effluent shall, alone or in combination with other sources, cause a violation of any applicable water quality standard."

In my professional opinion, Sections 304.122a and 304.122b do not apply to the Noveon-Henry Plant discharge for several reasons.

- The Noveon-Henry Plant untreated waste load can be "computed on a population equivalent basis comparable to that used for municipal wastewater treatment plants". Consequently, 304.122b does not apply. In my opinion, the word "comparable" merely questions whether the data exist to express an untreated waste load in population equivalents like one does when either designing or evaluating a municipal wastewater treatment plant. The data for the Noveon-Henry Plant do exist and such calculations can be and have been made. The results from such calculations allow one to put the Noveon-Henry Plant's untreated waste load in a perspective others can readily understand (population equivalents). The term "population equivalent basis" is intended to put the relative size of an untreated waste load in perspective. The term was never intended to describe how the waste load was to be treated but only the magnitude of the waste load.

- An untreated waste load can be and has been calculated by me for the Noveon-Henry Plant discharge on "a population equivalent basis comparable to that used for municipal waste treatment plants". The correct results from these calculations are stated below and clearly define the Noveon-Henry Plant discharge as having less than 50,000 population equivalents. Consequently, 304.122a does not apply.

- Since Sections 304.122a and 304.122b do not apply, the Noveon-Henry Plant is not required to provide additional effluent ammonia-nitrogen removal.

As stated above, correct calculations clearly define the Noveon-Henry Plant discharge as having less than 50,000 population equivalents. IEPA has calculated the population equivalents of the Noveon-Henry Plant for flow and BOD (based on data provided in the Baxter and Woodman-Wastewater Treatment Plant Report dated June 1994. This report did not present any data on the combined untreated wasteload. The report discussed the wasteload fed from the equalization tanks to the primary clarifier. However, this wasteload contains wastestreams that are internal to the WWTF that add flow, BOD, and TSS including primary clarifier sludge when sludge dewatering is not occurring, filtrate from sludge dewatering, and backwash water from the tertiary (secondary clarifier effluent) filter. These wastewaters and internal recirculation streams are illustrated in Figure 1 above. Even with this addition of flow and BOD from recircuclating streams,, IEPA calculated flow and BOD population equivalents of 916 and 19,412, respectively. I corrected the population equivalent calculation for TSS based on data collected by Noveon during the period of July 2002 through June 2003. The corrected value was 24,955 as illustrated below and in Figure 1. This calculation depends upon calculating the untreated waste load TSS coming to (not recycling within) the WWTF from all sources and then adding them together which is done below. The waststreams which contribute TSS to the WWTF are the PVC Lift Station Discharge which represents the waste load discharged from the PolyOne production areas, the 213 wastestream waste load before pretreatment, the PC Tank discharge, and the C-18 Tank discharge. It should be noted that the C-18 wastewater pretreatment process does not change the flow or TSS of this discharge but does increase its BOD. The TSS discharged by the combined Well No. 3 and Storm/Utility Pond discharges are less than 25 percent of the total influent wasteload as reported in the Baxter and Woodman report referenced above..

- PVC Lift Station Discharge Averages(not the PVC Tank Discharge Averages presented in Baxter and Woodman Report): 133 gpm, 1957 mg/TSS, and 3123 lbs/day TSS

- PC Tank Discharge Averages: 94 gpm, 900 mg/L TSS, and 1015 lbs/day TSS

- C-18 Tank Discharge Averages: 3.6 gpm, 300 mg/L TSS, and 13 lbs/day TSS

- 213 Averages (included in PVC Tank Discharge data presented in Baxter and Woodman Report): 35 gpm, 2000 mg/L TSS (estimate), and 840 lbs/day TSS (estimate)

- Total: 4991 lbs/day TSS (summation of above) or a population equivalent (PE) of 4991 lbs/day TSS divided by 0.20 lbs/day TSS per person(capita) or 24,955 population equivalents. This is much less than PE of 265,000 calculated by IEPA. The reason for this large discrepancy is due to recycle solids included in the IEPA calculation. These solids stay within the WWTF and are not part of the untreated waste load for which these calculations are reserved.

Even though not a part of the IEPA's definition of "population equivalent", population equivalents can also be calculated based on ammonia-nitrogen and Total Kjeldahl Nitrogen (TKN) loads that are really the thrust of 35 ILL. Admin. Code 304.122. TKN is the summation of ammonia-nitrogen and organic-nitrogen. The wasteload used to develop all effluent ammonia-nitrogen reduction options included average loadings of 385 lbs/day ammonia-nitrogen and 1038 lbs/day Total Kjeldahl Nitrogen (TKN). Based on population equivalent factors of 0.019 lbs ammonia-nitrogen/capita per day and 0.029 lbs TKN/capita per day (see Wastewater Engineering: Treatment and Reuse: Metcalf and Eddy, Inc., Fourth Edition, page 182), the Noveon-Henry Plant population equivalents would be 20,263 and 35,793, respectively.

In my professional opinion, all correct and relevant population equivalent calculations for the Noveon-Henry Plant place it under 50,000 population equivalents rendering 35 ILL. Admin. Code 304.122a and 304.122b not applicable.

Highlights of Effluent Ammonia-Nitrogen Reduction Evaluations at Noveon-Henry Plant

It is my professional opinion that 35 ILL. Admin. Code 304.122a and 304.122b do not apply. Consequently, no effluent limitations and therefore no additional effluent ammonia-nitrogen reductions are required.

The Noveon-Henry Plant currently provides effluent ammonia-nitrogen reduction through source control and removal associated with BOD removal nutrient requirements. However, in an effort to resolve disputes with the IEPA, Noveon retained Brown and Caldwell (where I serve as lead engineer) to evaluate whether there were any feasible technologies that would provide additional effluent ammonia-nitrogen reduction. Both Noveon and Brown and Caldwell have extensively evaluated a number of effluent ammonia-nitrogen reduction methods and technologies over the last 14 years.

All statements made below represent my understanding of the issues and my professional opinion regarding these issues.

1.0 Unique Characteristics of the Noveon-Henry Plant and its Associated Wastewaters:

In my professional opinion, several factors make the Noveon-Henry Plant and its associated wastewaters unique as it relates to these proceedings. These factors make the wastewaters at The Noveon-Henry Plant more technically difficult and more costly to treat than either municipal wastewaters or most other industrial wastewaters. These factors are listed below.

First, IEPA has reported that there are only three other plants in the country that generate a similar wastewater. Two of these three plants discharge to a Publicly Owned Treatment Works. Only one of these plants discharges directly to a receiving water. So, the wastewater is not commonly found.

Second, the building essential block of Noveon's main product line at the facility (rubber accelerators) is MBT (mercaptobenzothiazole). As a building block, it is present in numerous wastestreams throughout the plant sewer system. Consequently, there was not a small isolated stream that could be treated for MBT removal. Nearly all Noveon wastewaters contained MBT. It is also a well-recognized inhibitor of biological nitrification even at trace levels of 3 ppm as reported by M.L. Hockenbury and C.P.L. Grady in the Journal of the Water Pollution Control Federation in 1977 (see Exhibit B). This compound is poorly degradable which makes it ideal for a rubber-making additive. No consumer wants to buy readily degradable tires and other rubber products. Because of its poor degradability, MBT is also used as an additive to nitrogen fertilizers to inhibit biological nitrification in the soil so that more ammonia nitrogen will be available to the crops (see Exhibit B for article published in the National Corn Handbook, February 1992). However, the large use of this inhibiting compound in production at the Noveon-Henry Plant make the most widely practiced and least expensive ammonia-nitrogen removal process (single stage nitrification) technically infeasible at the Noveon-Henry Plant. MBT removal is provided in the WWTF Noveon-Henry Plant but cannot be reduced within the WWTF to the trace levels required for biological nitrification to occur. Consequently, atypical and expensive processes would be required to reduce effluent ammonia-nitrogen concentrations.

Third, the Noveon-Henry Plant and PolyOne Plant contain wastestreams that require pretreatment ahead of the onsite biological treatment plant to prevent process upsets and non-compliance with effluent BOD and TSS limits. Consequently, there is an inherent unreliability with any biological treatment process used onsite whether it is used for BOD removal or nitrification.

Fourth, the Noveon wastewater contains several degradable organic nitrogen compounds such as tertiary butyl amine. When these compounds are degraded, they release ammonia-nitrogen. Consequently, effluent ammonia-nitrogen concentrations increase as the presence of these compounds increase in the influent wastewater and as these compounds are more thoroughly biodegraded. This explains why the influent ammonia-nitrogen concentration at the Noveon-Henry Plant is much less than the effluent concentration (less than 40 mg/L versus greater than 80 mg/L). This means that the majority of the effluent ammonia-nitrogen at the Noveon-Henry Plant is due to thorough biological treatment of organic compounds.

Fifth, the compounds present in the Noveon-Henry Plant wastewater make oxygen transfer into this wastewater about half as efficient as municipal wastewater as measured by a parameter known as "alpha". Alpha is the ratio of oxygen transfer in wastewater divided by the oxygen transfer in tapwater. In municipal wastewater this alpha value for fine bubble diffused aeration is typically 0.60 versus the 0.35 measured in the Noveon-Henry Plant wastewater in 1987 by Gerry Shell. Consequently, the Noveon-Henry Plant has to use blowers with about twice the horsepower to transfer the same amount of oxygen used at municipal wastewater treatment plants. Furthermore, this increased power has to be accompanied by increased aeration tankage to keep operating power levels in a reasonable range.

Sixth, the Noveon-Henry Plant wastewater is lightly buffered. Consequently, if biological nitrification could be implemented with inhibitor control, the majority of alkalinity would have to be chemically added whereas in biological nitrification of municipal wastewater the majority (if not all) of the alkalinity required is present in the wastewater. This further makes the Noveon-Henry Plant wastewater technically challenging and expensive to treat for effluent ammonia-nitrogen reduction.

Eighth, the Noveon-Henry Plant does not have any additional appreciable electrical power available at the WWTF. Any significant additional power required at the WWTF would require installation of a new motor control center and installation of a new power line to a substation located approximately 0.5 miles away. Consequently, any WWTF upgrade (regardless of magnitude) to address effluent ammonia-nitrogen reduction will require a significant increase in power delivery and this too leads to greater treatment costs.

2.0 History of Effluent Ammonia-Nitrogen Reduction Evaluations at the Noveon-Henry Plant

During the last 14 years, Noveon and Brown and Caldwell have extensively evaluated whether there are any feasible technologies that would provide additional effluent ammonia-nitrogen reduction at the Noveon-Henry Plant. These evaluations have consisted of literature review, consultation with additional experts, laboratory-scale treatment investigations, full-scale operations and capital enhancements, and full-scale plant trial investigations. Many of these evaluations were based on results of prior evaluations in an attempt to continue to build on findings of prior evaluations. In my professional opinion, there have been "no relevant stones left unturned". The significant evaluations in which I have participated are summarized below.

2.1 Single Stage Nitrification, Powdered Activated Carbon Addition, Effluent Ion Exchange and Tertiary (Effluent) Nitrification

When I first got involved at the Noveon-Henry Plant in 1989, the focus was on developing a strategy for achieving consistent effluent BOD compliance. Brown and Caldwell conducted continuous flow treatability testing that I designed and oversaw which indicated consistent compliance could be achieved with pretreatment of one major wastestream (C-18). During the course of the treatability studies, we noticed that the WWTF would discharge elevated concentrations of ammonia-nitrogen while providing excellent BOD removal. Despite carefully controlled conditions of F/M (approximately 0.10 lbs BOD/day/lb MLVSS), MCRT, pH, temperature and DO that should prompt biological nitrification, none was observed. This likely indicated that bio-inhibitors were present in the influent at sufficient levels to prevent biological nitrification. It was eventually determined following significant research and testing efforts that MBT was a prime inhibitor of nitrification at the Noveon-Henry Plant. Batch testing was conducted in early 1989 to determine if powdered activated carbon (PAC) could be added to remove these inhibitors and allow single stage biological nitrification. Furthermore, batch testing also evaluated selective ion exchange treatment (clinoptilolite) of the effluent, and tertiary (effluent) nitrification of the effluent. This work indicated that an untenable, large dose of PAC would be required to allow single stage nitrification (5000 mg/L or 17 tons/day). Because of this finding (untenable carbon usage) and the certainty of fouling problems, no further consideration was given to carbon treatment. This work also indicated that even the most appropriate ion exchange media was not selective for ammonia-nitrogen removal due to the other competing cations in the wastewater (approximately 100 pounds resin required to remove 1 pound of ammonia-nitrogen). Lastly, this work suggested that the effluent could be biologically nitrified with yet another treatment unit (known as tertiary treatment). Consequently, subsequent evaluations considered more thoroughly tertiary nitrification.

2.2 Further Evaluation of Tertiary Nitrification and Pretreatment with Single Stage Nitrification

Based on these results, Noveon's corporate Research and Development group initiated a laboratory-scale, continuous flow treatability study that focused on tertiary nitrification with alkalinity addition. This work was conducted over about a 6 month period using fixed film biological nitrification and secondary clarifier effluent samples that were collected monthly. The work preliminarily indicated that tertiary nitrification could be accomplished and low discharge ammonia-nitrogen concentrations (less than 6 mg/L) could be achieved with alkalinity addition and effective performance of upstream treatment processes. There were, however, legitimate concerns about how reliably this process would have performed under the daily variability of secondary clarifier effluent quality. The same bio-inhibiting compounds that prevented nitrification in the current WWTF would be expected to be present in the WWTF effluent, on occasions, in concentrations that would either prevent or greatly slow ammonia-nitrogen removal in the tertiary process.

Brown and Caldwell also initiated a series of batch treatability tests that I designed and oversaw. This testing was to identify if available technologies could be used to remove the bio-inhibitors present in the influent wastewater to the extent that the most widely practiced ammonia-nitrogen removal process (single stage nitrification) could be employed. These treatability tests evaluated hydrogen peroxide treatment, clay absorption, and precipitation. However, the rate of biological nitrification was slower than would be expected for an uninhibited system indicating that bio-inhibitors were still present in the effluent from the treatment plant. This work indicated that precipitation and filtration of the Noveon wastewater at pH 2 would allow single stage nitrification to proceed. However, this pretreatment would require significant acid addition to lower the wastewater pH from pH 10 to pH 2 and then significant alkali addition to increase the pH from Ph 2 to pH 7 for biological treatment. The precipitant from the pH 2 pretreatment was analyzed and found to be predominantly MBT (a known nitrification inhibitor). Implementation of this pretreatment process and subsequent single stage nitrification would suffer from reliability issues as the nitrification achieved would only be as successful as the pretreatment process was in removing all bio-inhibiting substances. It was uncertain whether MBT was the only bio-inhibitor of concern.

2.3 Further Evaluation of Pretreatment (pH 2 Precipitation and Solvent Extraction) and Single Stage Nitrification

Based on results of the work described above, Brown and Caldwell conducted a continuous flow treatability study, which I designed and oversaw, to evaluate pH 2 pretreatment of the PC wastewater and single stage nitrification. This study indicated that single stage nitrification could be achieved with this pretreatment. The rate of nitrification was inhibited indicating that some bio-inhibitors still remained in the combined influent. Effluent ammonia-nitrogen concentrations from this process varied from 1 mg/L to 20 mg/L, indicating a variation in remaining influent bio-inhibitor concentrations. It was concluded that this pretreatment process would support single stage nitrification to an extent. The extent was unknown due to the short lived demonstration period and the potential for other bio-inhibitors being present that would not be affected by this pretreatment. It was certain that effluent ammonia-nitrogen concentrations from this treatment process would not consistently achieve those limited by 35 ILL. Admin. Code 304.122a or 304.122b.

During this same period of time, Noveon investigated a process used in Germany for MBT recovery. This process used solvent extraction. It is my understanding that results of this investigation indicated that the process would pose safety concerns (potential for explosions) and would also be cost prohibitive to implement at the Henry Plant (greater than $10 million in capital cost alone).

2.4 Assessment of WWTF for Compliance with Conventional Design for Single Stage Nitrification [35 ILL. Admin. Code 370.1210 and 370.920]

Noveon retained Baxter and Woodman in 1994 to review the WWTF for compliance with the Illinois design standards for single stage nitrification of municipal wastewaters. These standards are conservative to allow a significant margin of error in waste load determinations and operating conditions based on my experience. There are no Illinois design standards for single stage nitrification facilities for industrial wastewaters. It should be noted though that the Noveon-Henry Plant does provide the equipment and treatment conditions needed to establish and maintain single stage nitrification.

The review by Baxter and Woodman indicated the WWTF would comply with the municipal wastewater standards with the addition of about 65 percent more aeration tankage. Noveon expanded the aeration tankage in 1998 by 100 percent to provide greater aeration capacity and greater treatment plant flexibility. This addition put the WWTF in full compliance with 35 ILL. Admin. Code 370.1210 and 370.920 and Ten State Standards (which includes Illinois) for single stage nitrification and yet the WWTF did not exhibit any nitrification. The reason nitrification was not achieved was not due to a lack of equipment, but rather the presence of bio-inhibition.

2.5 Alternative Bacteria

IEPA had conducted a literature search and found an article that seemed to imply that special bacteria could be grown in the Noveon-Henry Plant that would both degrade the difficult compounds (such as morpholine) and remove ammonia-nitrogen at the same time. I explained to IEPA that these were not the findings of this article. However, IEPA was persistent that these bacteria could achieve both types of degradation (morpholine and ammonia-nitrogen). Consequently, Noveon brought in the author of this article from England (Dr. Jeremy Knapp). Dr. Knapp reviewed the Noveon-Henry Plant operation with me; Gardner, Carton and Douglas; Noveon and IEPA. He then explained to all that the bacteria that he wrote about were already present in the Noveon-Henry Plant based on morpholine removal data he had reviewed and that the conditions present in the Noveon-Henry Plant were suitable for maintaining a culture of these bacteria. He further explained that these bacteria do not provide nitrification. He also explained that the Noveon-Henry Plant provided all the right conditions for single stage nitrification if bio-inhibiting compounds were not present.

Noveon on several occasions has tried adding specialty bacteria to remove difficult to degrade compounds. During these same periods, Noveon has added nitrifying bacteria from the Peoria POTW. In no instance has Noveon been able to initiate nitrification. This once again indicates that the lack of nitrification is due to inhibitors that are not degraded within the confines of the Noveon-Henry Plant even with special bacteria addition. Furthermore, this Plant offers the biological treatment opportunity that is required by Ten State Standards and 35 ILL. Admin. Code 370.1210 and 370.920 for single stage nitrification.

2.6 Numerous Occasions of Seeding Plant with Nitrifying Bacteria

The Noveon-Henry Plant is in compliance with Ten State Standards and 35 ILL. Admin. Code 370.1210 and 370.920 for single stage nitrification. Noveon has added on numerous occasions bacteria from other WWTF that are actively nitrifying. These additions were intended to improve the Noveon-Henry Plant WWTF performance in removing ammonia-nitrogen. Yet, in no case has nitrification occurred at the Noveon-Henry Plant despite optimum conditions of MCRT (greater than 30 days), temperature (28 to 32 degrees C), pH (6.8 to 7.5), DO (greater than 2 mg/L). Again, it is my professional opinion that this is due to the presence of bio-inhibiting compounds in the influent.

2.7 Full-Scale Plant Trial of Alkaline Air Stripping to Achieve Effluent Ammonia-Nitrogen Reduction

The Noveon-Henry Plant conducted a full-scale trial of alkaline air stripping of the combined influent to quantify the effluent ammonia-nitrogen removal that would be achieved. This required Noveon to set up an interim pumping system, caustic addition system, and acid addition system. This interim system diverted all primary clarifier effluent (approximately 560 gallons per minute) to an aeration basin that had been set aside for this testing. Caustic was added to the aeration basin to maintain a target pH value of 10.5. A surface aerator was placed in this basin and operated to assist in air stripping. Effluent from this tank was diverted to a blend tank where the pH was lowered. The blend tank contents were then pumped to the other three aeration basins for biological treatment. This treatment did demonstrate some reduction in effluent ammonia-nitrogen (less than 20 percent). This reduction was low, in my opinion, due primarily to the fact that the majority of the effluent ammonia-nitrogen is formed during biological treatment. Secondly, the pH control method was unable to consistently keep the tank contents at or above pH 10.5. This treatment process is not a viable method for achieving significant effluent ammonia-nitrogen removal.

2.8 Full-Scale Trial of Pretreatment and Single Stage Nitrification

Noveon environmental staff conducted a literature search and found an article that indicated that MBT could be co-precipitated with ferric hydroxide at an elevated pH (see Exhibit B). The article indicated that significant removal could be accomplished at pH 4.5 versus the pH 2 pretreatment evaluated by Brown and Caldwell. Noveon conducted a full-scale trial of this pretreatment system in hopes of achieving single stage nitrification. I reviewed the article, believed there was a likelihood of success in this trial, helped design the trial, reviewed data from the trial and witnessed this trial in progress. The trial involved Noveon installing an interim precipitation system and separate sludge dewatering system to treat and segregate pretreatment byproducts (sludge and filtrate from sludge dewatering). The entire PC wastewater discharge (120 gpm) was routed through this system involving ferric chloride addition to lower the PC Tank wastewater to pH 4.5. The pH adjusted water was allowed to separate in interim clarifiers. The treated wastewater was transferred using an interim pumping system to the existing primary treatment system. The precipitated sludge was dewatered using an interim filter press with precoat addition system. The filtrate from sludge dewatering was routed back to the pretreatment system. The pretreatment system was operated for months and did demonstrate significant MBT removal (greater than 50 percent). At the end of this operating period, Noveon brought in a tanker load (5000 gallons) of bacteria from a plant in Indiana that had a high population of active nitrifying bacteria. The bacteria were added to the aeration basins. The pretreatment system continued to operate while Noveon checked for signs of nitrification in the activated sludge system. The activated sludge system was operated under adequate DO, pH, MCRT and alkalinity control to prompt nitrification. Yet, despite greater than 50 percent MBT removal, no nitrification occurred with this large investment of resources (greater than

$100,000) and time (greater than 4 months). It is my opinion that nitrification did not occur because of the continued presence of bio-inhibiting compounds in the influent (MBT and likely others).

2.9 Consideration of Other Lesser Known Technologies

Another consultant (Ecology and Environment, Inc) was retained to review the work of Brown and Caldwell for Noveon. It is my understanding that this consultant believed that all feasible technologies had been considered for effluent ammonia-nitrogen reduction excluding ozonation. A conceptual level design and cost estimate was developed for this treatment process. The process would presumably achieve a 98 percent reduction in effluent ammonia-nitrogen but at a present worth cost of $20.32 million (almost twice the cost of any other process considered). This process would also significantly increase the effluent total dissolved salt concentration due to the caustic addition required to neutralize the acid generated from this process. Additionally, a significant substation upgrade would be required to deliver the additional power consumed (equivalent to approximately 3500 hp demand).

I discovered in 2003 a company in Memphis, Tennessee that had a patented membrane that selectively separated ammonia-nitrogen from wastewater containing little other constituents besides ammonia-nitrogen. This membrane was tested to remove ammonia-nitrogen from a landfill leachate and groundwater stream that was less concentrated in other constituents than the Noveon wastewater. The company concluded after actual testing that the membrane would not be suitable for treating the leachate and groundwater stream due to interference caused by other compounds present in the wastestream. Consequently, I did not further pursue use of this membrane at the Noveon-Henry Plant for effluent ammonia-nitrogen reduction.

2.10 Comparative Performance and Costs of all Proven Effluent Ammonia-Nitrogen Reduction Processes

After approximately 14 years of extensive evaluations by Noveon and Brown and Caldwell, all applicable treatment processes, in my professional opinion, have been considered for effluent ammonia-nitrogen removal. Treatment processes considered went beyond those included in the USEPA Process Design Manual: Nitrogen Control (EPA 625R93010). No stone has gone unturned.

The proven treatment processes described in this testimony have been developed by me and support staff well enough to accomplish the following:

- predict potential effluent ammonia-nitrogen reduction,
- understand the pros and cons,
- develop conceptual level designs for their application, and
- develop conceptual level design cost estimates (capital, annual, and present worth costs) for these treatment alternatives to within 30 percent accuracy using available influent waste load data.

The proven treatment processes that were evaluated are listed below.

- Alkaline air stripping (air stripping at pH 10.5) of PC Tank contents with off-gas collection and treatment. Noveon believed this off-gas collection and treatment would be required to comply with air quality regulations. At high pH ammonia-nitrogen exists as a gas dissolved in liquid and can be removed from the liquid by air stripping.
- Alkaline air stripping of PVC Tank contents.
- Alkaline air stripping of secondary clarifier effluent.
- Struvite precipitation of combined influent prior to primary clarification. Ammonia-nitrogen can be precipitated as $NH_4MgPO_4(H_2O)_6$.
- Breakpoint chlorination of secondary clarifier effluent. The addition of chlorine converts ammonia-nitrogen to nitrogen gas that exits the liquid to the atmosphere without the need for air stripping.

- Nitrification of PVC Tank wastewater (non-PC wastewaters). Nitrification is a process by which bacteria convert ammonia-nitrogen to nitrate-nitrogen. The bacteria consume large amounts of oxygen (4.6 lbs oxygen/lb ammonia-nitrogen removed) and alkalinity (7.14 lbs alkalinity/lb ammonia-nitrogen removed).

- Nitrification of the combined wastewater. This process would require pretreatment of the PC wastewater to remove bio-inhibitors.

- Nitrification of secondary clarifier effluent (tertiary nitrification).

- Ion exchange treatment of the final effluent. Ion exchange is a process where another cation (e.g., sodium (Na^+) or hydrogen (H^+) is released from a resin into the water so another cation (NH_4^+) can be removed from the water.

The treatment process evaluation described above is briefly summarized in Exhibits C, D, and E. This evaluation established that the process offering the lowest present worth cost for reducing effluent ammonia-nitrogen was alkaline stripping of the PC Tank contents ($2.31 million). This alternative, however, would only provide at most a 27 percent reduction in effluent ammonia-nitrogen. If reductions in effluent ammonia-nitrogen were required at the Noveon-Henry Plant to meet, 35 ILL. Admin. Code 304.122b, the average effluent ammonia-nitrogen would have to be reduced by 98 percent (135 mg/L reduced to 3 mg/L). Under peak effluent conditions, the effluent ammonia nitrogen reduction would have to exceed 98 percent. The process offering the lowest present worth cost that would be capable of meeting the 98 percent reduction requirement was ion exchange ($5.07 million). However, this process would be complicated to operate, would generate a waste byproduct (liquid ammonium chloride) requiring offsite disposal and would be prone to fouling by scaling and bacterial growth. This treatment process would be difficult to operate and maintain and, consequently, would pose reliability issues. Secondly, it could cause effluent toxicity problems due to an ionic imbalance. The next least expensive process capable of achieving 98 percent reduction was breakpoint chlorination ($9.73 million). However, this process poses significant safety and site security concerns (chlorine gas is extremely hazardous), would significantly increase effluent total dissolved salt (TDS) concentrations, may generate chlorinated organics, would increase effluent aquatic toxicity due to the elevated TDS and likely presence of chlorinated organics. Lastly, the next least expensive process capable of achieving 98 percent reduction was nitrification of the combined wastestream as a single stage process ($11.71 million) or as a tertiary process ($11.41 million). Both processes would result in an increase in effluent TDS and both processes would provide unreliable performance based on the variability of influent bio-inhibiting compounds. At times, neither process would comply with the requirements of 35 ILL. Admin. Code 304.122a and 304.122b.

2.11 Evaluation of Alternative Methods of Effluent Ammonia-Nitrogen Measurement

Given the concentrations of ammonia-nitrogen and the difficulty in treating it made me question whether there could be a fundamental error in the measurement of effluent ammonia-nitrogen. The method used by the IEPA laboratory and the outside laboratory used by the Noveon-Henry Plant for effluent compliance monitoring were the same. Both laboratories used the ion selective probe method. This method is recognized by USEPA as registering artificially elevated values in the presence of organic nitrogen compounds. These compounds are likely to be present in the Noveon-Henry Plant effluent. Noveon, at my suggestion, conducted a testing program where the secondary clarifier effluent was analyzed using the historical method without distillation, the historical method with distillation, and the phenate method with distillation. All three methods are approved by USEPA. The last method mentioned was the method least prone to interference by organic nitrogen. Results of this test method indicated a slightly lower value for effluent ammonia-nitrogen with distillation and with the phenate method. However, the average of all values was within 15 percent regardless of the method selected. This finding indicated the historical effluent ammonia-nitrogen concentrations were reasonably accurate and that the historical method could continue to be used with reasonable accuracy to monitor effluent ammonia-nitrogen concentrations. The effluent concentrations measured throughout all treatment evaluations could be considered reasonably accurate. Effluent ammonia-nitrogen reduction had indeed been as difficult to achieve as measured.

3.0 OTHER ISSUES

3.1 Source Reduction Measures implemented by Noveon-Henry Plant

Noveon has installed in-plant recovery devices and instituted pollution prevention plans to minimize the discharge of organic nitrogen (such as tertiary butyl amine) to the WWTF which would have been converted to ammonia-nitrogen through biological treatment had such recovery not been provided. Further, Noveon has even been recognized by the State of Illinois for progress in pollution prevention (Annual Governor's Award for Pollution Prevention in 1999, 2002, and 2003 with Governor's Citation Award for Pollution Prevention in 1998). Second, the Noveon-Henry Plant has consistently removed ammonia-nitrogen through its WWTF as a nutrient required for BOD removal (approximately 0.04 lbs ammonia-nitrogen removed/lb BOD removed). BOD-removing bacteria are more tolerant of inhibitors than are nitrifying bacteria. Without this BOD removal, Noveon would discharge approximately an additional 20 mg/L ammonia-nitrogen in the final effluent. The Noveon wastewater just contains more ammonia-nitrogen than required as a nutrient for BOD removal. Lastly, it should be noted that Noveon has exerted significant effort in conducting two full-scale trials in an attempt to demonstrate a WWTF modification that would provide effluent ammonia-nitrogen reduction. One trial provided less than a 20 percent reduction and the other trial provided no reduction.

3.2 Comparative Cost of Ammonia-Nitrogen Removal for Noveon and Others

As described in 1 above, the Noveon-Henry Plant has several unique features that render its cost of providing ammonia-nitrogen removal more expensive than others. The comparisons made by the IEPA considered only the capital costs of single stage nitrification. Operations and maintenance (annual) costs were not included in the comparison. However, as noted in **Exhibit C**, these annual costs for Noveon would be significant. The facilities used in the comparisons by the IEPA were likely required to add little or no chemicals to achieve nitrification whereas the Noveon-Henry Plant would be required to spend $788,000 annually on chemicals alone. This high chemical cost is due to chemicals required for the pH 2 pretreatment process (acid to lower the pH and caustic to raise the pH for biological treatment) and caustic required providing the alkalinity consumed in nitrification.

This yields a present worth chemical only cost of $5.29 million excluded from the cost comparisons made by IEPA (based on a 10 year project life). In some cases, a 20 year project life is considered more representative. Under this project life, the present worth cost of chemicals would increase to $7.73 million. Either way, this is a significant omission in cost comparisons. In addition, this does not include the added operating cost that Noveon would have related to pretreatment system operations and increased aeration horsepower. Only present worth cost comparisons are meaningful when there is a significant difference in operating costs as is the case here. In my professional opinion, there is no doubt that single stage nitrification at the Noveon-Henry Plant would be far more expensive on a present worth basis than most facilities(principally POTWs) envisioned by the Illinois Water Pollution Control Board in developing 35 ILL. Admin. Code 304.122 .

It is likely that a present worth cost comparison of these facilities would reveal that the cost of ammonia-nitrogen removal is less than $0.20/lb (the surcharge cost imposed by the Knoxville Utility Board on ammonia-nitrogen is $0.12/pound of ammonia-nitrogen) for the POTWs. The present worth cost for Noveon to implement single stage nitrification is $3.60/lb to $2.32/lb (depending on whether a 10 year or 20 year project life is assumed, respectively) of ammonia-nitrogen reduced or 18 to 12 times the cost for other facilities.

4.0 INCREMENTAL COST OF PROVIDING EFFLUENT AMMONIA-NITROGEN REDUCTION

It should be recognized that the Noveon-Henry Plant already provides effluent ammonia-nitrogen reduction through source control practices and ammonia-nitrogen removal accomplished in BOD removal. Noveon requested that Brown and Caldwell calculate the cost of incrementally providing additional effluent ammonia-nitrogen reduction. I personally developed the basis for this cost analysis and reviewed and approved the process by which they were calculated. In some cases incremental effluent ammonia-nitrogen would be accomplished by treating only a portion of the wastewater. In other cases, it would be accomplished by sizing the treatment vessel to only provide partial treatment. The results of this exercise are summarized in **Exhibit D.**

These results indicated that even a 25 percent reduction in effluent ammonia-nitrogen would have a present worth cost of $1.8 million to $ 3.9 million depending upon the treatment process selected. More importantly, the 25 percent reduction would not achieve compliance with 35 ILL. Admin. Code 304.122b assuming it applied (and it does not apply).

5.0 SUMMARY

The Noveon-Henry Plant currently provides effluent ammonia-nitrogen reduction through source control and removal associated with BOD removal nutrient requirements. In my professional opinion, any further reduction in effluent ammonia-nitrogen is not required by 35 ILL. Admin. Code 304.122a or 304.122b. Both 304.122a and 304.122b do not apply because the Noveon-Henry Plant clearly has an untreated wasteload with a population equivalent less than 50,000 based on all relevant calculations.

Extensive efforts have been made by Noveon and its consultants over the last 14 years in examining effluent ammonia-nitrogen reductions. They have been undertaken in a good faith attempt to resolve a dispute with the IEPA and to evaluate whether there were any feasible technologies that would provide additional effluent ammonia-nitrogen reduction.

The findings of effluent ammonia-nitrogen reduction efforts have been shared with IEPA and are summarized in **Exhibits C, D, and E**. These findings show the following:

- The Noveon-Henry Plant has at least eight unique characteristics that render it unusually difficult and expensive to achieve any further ammonia-nitrogen removal.

- Every proven treatment process for effluent ammonia-nitrogen reduction has been considered by the Noveon-Henry Plant, even one that was in the developmental stages.

- Noveon has had several consultants evaluate effluent ammonia-nitrogen removal. These have included a well-respected Illinois firm, a nationally-recognized engineering firm, and a research professor from England.

- No treatment technology was found by IEPA or any of these consultants that could provide significant effluent ammonia-nitrogen reduction (greater than 50 percent) for a present worth cost of less than $5.0 million. Even a 25 percent effluent ammonia-nitrogen reduction had a present worth cost of at least $1.8 million.

- The present worth cost of installing single stage nitrification, like facilities IEPA used in cost comparisons, was $11.7 million. This cost when compared to the surcharge cost imposed by a POTW on ammonia-nitrogen indicated that the Noveon-Henry Plant costs for ammonia-nitrogen removal would be 18 times greater than that for a POTW. This cost difference was not revealed in IEPA analysis due a lack of consideration given to disproportionate operating costs.

In my professional opinion, Noveon has gone far beyond that which Illinois regulations require in evaluating effluent ammonia-nitrogen removal. Good faith and a willingness to work with IEPA have been demonstrated. Fourteen years and considerable resources have been applied in an effort to find a technically feasible and economically reasonable method to reduce effluent ammonia-nitrogen at the Noveon-Henry Plant. An agreeable position with IEPA has been sought through these efforts. Such an agreement was not reached. If 304.122 is determined to be applicable, Noveon's Petition for Adjusted Standard is reasonable and should be supported by the Board in conformity with Illinois regulations.