Attachment 12

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19958

March 7, 2022

Attn: Mr. Chase Brockstedt

Re: Proposed EPA Consent Decree with New-Indy Catawba Mill, Lodged 12/29/21, Civ. No. 21-cv-02053-SAL

Dear Mr. Brockstedt,

This letter is a summary of my comments concerning the above-referenced Consent Decree, with a focus on modifications and additions required to prevent future noxious and toxic odor emissions from the New-Indy Catawba wastewater treatment plant (WWTP). The very limited WWTP requirements in the Consent Decree, as lodged, are simply inadequate and unreasonable to provide protection to human health and the environment. I have included a table that summarizes the needed improvements to the outdated and inadequate New-Indy WWTP, with supportive references from New-Indy's WWTP NPDES permit, EPA design criteria, and pertinent professional wastewater organization design standards.

Qualifications:
My education and my entire working career have been dedicated to wastewater and residuals treatment including treatment plant engineering and design, plant operations, treated effluent discharge, and residuals disposal and management. My Bachelor of Environmental Engineering and Master of Water Quality Engineering both came from Vanderbilt University with an emphasis on wastewater treatment.

After graduate school I worked as an Engineering Consultant evaluating wastewater treatment systems to: assess performance capability; determine reasons for failure and methods of cure; determine performance efficiency and improve treatment where possible. In 1981 I started my own Environmental Technology company and introduced new processes to the field. My 17 patents were the basis of design for over 900 WWTP's located in over 17 countries, treating many kinds of industrial wastewater, sanitary wastewater, and associated residuals.

I have personally designed and provided process and mechanical troubleshooting and problem solving for hundreds of WWTPs, including nine pulp & paper mills. I spent five years as a Vice President of Technology for two of the largest wastewater treatment companies in the world: U.S. Filter (now Evoqua), and Veolia Water. The past 20 years I have operated my own consulting firm specializing in all aspects of wastewater treatment. My CV is included in the Appendix.

Background

Virtually everything in this mill was decades old when New-Indy assumed ownership in late 2018. Satellite photos show the layout of the WWTP has been unchanged for the past 50 years. And while New-Indy spent a great deal of time and effort in 2020 to convert the mill to linerboard from white paper, they failed to make equivalent, or any, improvements to the WWTP. In fact, over the more than two years that New-Indy owned the facility prior to the linerboard conversion it is clear that New-Indy failed to perform even the minimal essential WWTP maintenance tasks that were obviously required even to a minimally skilled operator. These include:

- Failure to complete necessary maintenance and repairs on the single, *critical*, decades-old Primary Clarifier.
- Failure to remove the excessive accumulation of sludge that had been allowed to fill the Equalization basin in a half-completed cost-saving measure that got horribly out of control.
- Failure to remove the excessive sludge accumulation that had been allowed to fill the single, *critical,* Aerated Stabilization Basin (ASB) from an initial depth of 20-feet to a depth of just 3-feet or less, with shrubbery growing on islands of sludge throughout what was supposed to be a deep, liquid-filled process basin. This critical basin is where pollutants are supposed to be removed from the wastewater prior to discharge to the river.

Clearly, New-Indy avoided or deferred the millions of dollars of costs associated with these essential maintenance tasks. Unfortunately for local residents, the multiple deficiencies and failures of New-Indy's Wastewater Treatment Plant (WWTP) design, operation, and maintenance were revealed during and after the linerboard process switchover in January/February 2021. These deficiencies resulted in the total failure of the WWTP. The resultant and repeated release of malodorous and toxic emissions caused thousands of complaints from residents many miles away throughout the rest of the year. Yet, modifications/additions to the WWTP would easily have brought it up to accepted engineering standards and would have eliminated most, if not all, of these unfortunate incidents. The proposed Consent Decree between New-Indy and the EPA (Proposed CD) offers no assurance that these unsafe emissions are not continuing and will not be repeated in the future. New-Indy submissions to DHEC list the chemical additives being pumped into this outdated and undersized WWTP in an effort to prevent vast odor plumes from wafting downwind. It is suggested that these odor-neutralizing chemicals will obviate the expansion of WWTP treatment capacity to the required levels. The cost of these chemicals runs into many millions of dollars annually – it is unlikely that New-Indy will maintain this level of expenditure once the regulatory agencies have gone away. The local residents deserve to know that the deficiencies in the New-Indy WWTP will be repaired permanently, and the plant made robust, reliable, and secure without relying on vastly expensive chemical addition and the good will of New-Indy management.

The most critical flaw in the WWTP revealed by this calamity is the lack of redundancy in critical wastewater treatment process units. The extended and continuing failure of the WWTP occurred primarily because two critical processes failed or were out of service – and there were no parallel units to carry the temporary load increase. Failures at other WWTPs long ago caused engineering standards to require WWTP's to have redundancy - at least two online treatment units for each process step. This is so that ***when, not if,*** a unit fails, or must be removed from service for maintenance, the parallel unit can take up the slack for the time necessary to allow repair/maintenance/cleanup of the offline unit(s). For example, the critical, lone, Steam Stripper has already been taken out of service multiple times in the past year, and was down yet again on January 10, 2022, according to EPA meeting notes.

It is unacceptable that as of March 2022, there are still hundreds of odor complaints every month miles downwind of the New-Indy Mill that are traceable to the New-Indy Mill and WWTP. That is 13 months of noxious and dangerous levels of emissions to the community's ambient air. New-Indy should be required to make the following modifications and additions to their Catawba Mill WWTP in order to protect the community and the receiving waters from extended WWTP failures such as occurred throughout 2021 and continue today. New-Indy's National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit includes the following requirements, among many others:

1. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain in good working order and operate as efficiently as possible all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance include effective performance based on design facility removals, adequate funding, adequate operator

staffing and training and also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit. (Paragraph II.E.1)

2. Odor Control Requirements. The permit holder shall use best management practices normally associated with the proper operation and maintenance of a sludge wastewater treatment site, any sludge storage or lagoon areas, transportation of sludges, and all other related activities to ensure that an undesirable level of odor does not exist. (Paragraph V.D.3)

In short, New-Indy is required to keep the WWTP in good working order, operate as efficiently as possible, with backups as required, and emit no undesirable level of odor. However, this is virtually impossible given the age of the WWTP, its outdated technology and its lack of redundancy. Despite New-Indy's failure to meet these important permit requirements for the last 13 months, the proposed CD fails to address them at all.

Hydrogen Sulfide vs. Total Reduced Sulfur Emissions Monitoring Measurements

The failures at the New-Indy Kraft mill may never have become a public issue if the company's WWTP had not produced so much malodorous and unhealthy off gas that local residents were sickened repeatedly, throughout 2021 and into 2022. Kraft mills are known to produce large amounts of noxious gases called Total Reduced Sulfides (TRS) that typically include four components: 1) Hydrogen Sulfide, 2) Methyl Mercaptan, 3) Dimethyl Sulfide, and 4) Dimethyl Disulfide. Remarkably, the CD requirements for air emissions testing require only hydrogen sulfide (H_2S) measurements. EPA's reasoning appears to be based on a conclusion that the TRS releases and toxicity at the New-Indy Mill are virtually all hydrogen sulfide and thus the other gases are irrelevant. This is clearly wrong, unscientific, and unacceptable for at least two reasons:

1) H_2S toxicity is a fraction of the documented toxicity of two of the other three TRS constituents of interest: OSHA rules allow a maximum 8-hr exposure concentration for either methyl mercaptan or dimethyl disulfide of just 0.5 mg/l, while allowing *twenty times greater* exposure to H_2S at 10 mg/l.
2) The industry-standard emissions model relied upon by New-Indy in its permit applications and in the DHEC-mandated Corrective Actions Report (CAP) calculated in Table 6-1 that the amount of H_2S would represent a minimal amount (10%) of the TRS released in the New-Indy emissions.

Therefore, monitoring only for the far less toxic and less abundant H_2S component is illogical and fails to protect residents.

New-Indy did complete several days of actual testing for TRS at the site as part of performance tests mandated by DHEC. Those few data points, taken while the plant was still mired in recovery mode, indicate that H_2S represents most of the emitted TRS load. However, that data also led to mass balance results that were clearly nonsensical, thus the data is suspect and cannot be relied upon. Of far greater reliability is vetted data collected from many similar mills over many decades, which is presented in Table 6-1 of the CAP.

In response to New-Indy's toxic emissions crisis in 2021, DHEC mandated that New-Indy "*complete an evaluation conducted in consultation with a nationally recognized organization, such as the National Council for Air and Stream Improvement (NCASI), to fully evaluate the current operations and processes at the Facility to identify all potential sources that could be contributing to the odor*s..." New-Indy responded in their Corrective Action Plan, saying: *"New-Indy consulted with NCASI in May 2021 and confirmed the emissions estimates contained in the 2019 and 2020 air permit applications were correctly applied and generally representative of the conversion from manufacturing bleached paper to brown paper. The H2S and TRS (H2S, methyl mercaptan, dimethyl disulfide and dimethyl sulfide) emissions from each area of the mill are reviewed in the following sections. A summary of the H2S and TRS emissions are provided in Table 6-1."* NCASI has represented the Pulp and Paper industry since 1943

and is the authoritative source for related technical information. NCASI's methods and data, along with New-Indy mill data, were used to generate the numbers in Table 6-1 of the Corrective Action Plan, which show H_2S (at 5.33 mg/l) to represent just 9% of Total Reduced Sulfide emissions while the TRS was calculated to total 56.18 mg/l. NCASI is clearly aware of the vastly greater toxicity of methyl mercaptan and dimethyl disulfide, which might be one reason they emphasize TRS over H_2S alone. Emissions sampling must include all constituents of TRS and other volatile organic compounds to adequately assess whether undesirable levels of odors are being generated by the New-Indy WWTP. However, the proposed CD without any explanation requires monitoring only for hydrogen sulfide.

Note that the pulp and paper industry does not consider H_2S emissions apart from being a part of or an indicator of TRS emissions. Consider a few examples below.

The data below comes from the paper "Biological Treatment of Kraft Condensates in Feedback-Controlled Packed Beds and Sequencing Batch Reactors".

Table 1. List of Compounds found in kraft condensates, and their maximum reported concentrations*

Compounds	Concentration (mg/L)
TRS: H_2S	660
CH_3SH	5,300
DMS	7,400
DMDS	4,100
BOD: methanol	12,000
ethanol	3,200
acetone	500
methyl ethyl ketone	27
terpenes	25,000
phenolics	82
Resin acids	230
Total BOD_5	13,000
Sodium	370
Suspended solids	70
pH	6 – 11.1

* *Adapted from Blackwell et al.,1979*

Note first that the data table lists the "TRS" components – not just "H_2S" - H_2S is just one of the usual four. Note also that the amount of H_2S expected in the untreated foul condensate is just a small fraction of the TRS – just 4% in this paper. Clearly it would be illogical to measure only the H_2S component of such condensate and consider that one understands the extent of TRS contamination to any degree.

It is noteworthy that the large concentrations of organic compounds that contribute to the "BOD" (biodegradable compounds) will evaporate quickly when allowed the opportunity, such as in an aerated lagoon or an open ditch as exists at the New-Indy Mill. These compounds exert a dramatic load on the ASB aeration system and can exacerbate the conditions which both release more TRS to atmosphere and generate even more TRS.

The website "Pulp and Paper Online" carries an article by a manufacturer of steam strippers that says this about "Foul Condensate Stripping":

"This treatment has been necessitated for environmental reasons as the pollution control regulations have become increasingly stringent… The condensate streams of concern include the liquor condensates of the multiple effect evaporator, the overflow of the blow heat accumulator and the underflow from the turpentine decanter. Each of these streams are contaminated by organic sulfides (TRS- Total Reduced Sulfur) and volatile organic compounds that contribute to the BOD load. The TRS gases are a result of the kraft pulping reactions. Among the TRS compounds are hydrogen sulfide, methyl mercaptan, dimethyl sulfide and dimethyl disulfide. These are noxious gases with a very low threshold of odor detectability, as shown in Table I. Thus, before any of these streams can be used in the mill or discharged to wastewater treatment, the TRS compounds must be removed at a high efficiency."

Please note the focus is on TRS, not H_2S alone: there is no mention of H_2S apart from it being just one component of the critical TRS load. This reflects the industry's interest and the ongoing reality.

New-Indy hired Weston Solutions to measure emissions at the site. Test data were collected from ambient air around the site over a week in March 2021 and included all four of the TRS factors discussed above – not just H_2S. The results showed H_2S concentrations to be generally less than 33% of TRS emissions. Samples of liquid were tested one day, and just 17% of the TRS in the influent to the Aerated Stabilization Basin (ASB) was from H_2S. The ASB has been identified as the largest source of TRS emissions generally.

Consider how the following industry references focus on TRS, *not* just H_2S. (bold emphasis added):

- The EPA publication (#450/2) which applies to this topic is titled "Kraft Pulping: Control of **TRS** Emissions", it is *not* titled "Control of H_2S Emissions".
- The EPA publication (#AP-42, "Compilation of Air Pollutant Emissions Factors") includes this statement: *"The characteristic odor of the kraft mill is caused by the emission **of reduced sulfur compounds**, the most common of which are hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, all with extremely low odor thresholds."*
- NCASI Technical Bulletin No. 1000 (used by New-Indy consultant in their performance report) is entitled: "Mechanistic Approach for Estimating Hydrogen Sulfide Emissions from Wastewater Treatment Plants", and lists the following "Related NCASI Publications":
    - Technical Bulletin No.956 (September2008). **Emissions of Reduced Sulfur Compounds** and Methane from Kraft Mill Wastewater Treatment Plants.
    - Technical Bulletin No.933 (June2007). Development and Application of a Method for **Measuring Reduced Sulfur Compounds** in Pulp and Paper Wastewaters.
    - Technical Bulletin No.849 (August2002). Compilation of Speciated **Reduced Sulfur Compounds and Total Reduced Sulfur Emission** Data for Kraft Mill Sources.

  Note that the Technical Bulletin concerning H_2S was completed only after three Technical Bulletins were written to address Total Reduced Sulfides – it is clear where NCASI's priority was focused.

In the fall of 2021, odor complaints from local residents began specifying that the rotten egg smell of previous TRS emissions had been replaced by a sickening 'sweet' smell coming from the New-Indy mill. This roughly coincided with New-Indy's installation and operation of a system to pump hydrogen peroxide directly into locations throughout the facility where they suspected TRS odors were being released. One of these systems was installed in the 'hard pipe' through which high-TRS foul condensate is pumped to the inlet of the Aerated Stabilization Basin (ASB). This was done to attempt to destroy TRS in the pipeline, and thus prevent TRS compounds from being released to atmosphere from the ASB. The addition of peroxide to the foul condensate will destroy some of the TRS, some of the time under the right conditions (the reactions depend on acidity (pH) among other things that are highly variable in condensate). Nor will chemical oxidation destroy all other volatile organic constituents in foul condensate (see note on VOC's in kraft condensate, above), which can produce odors. Also, peroxide addition can also create chemical compounds called "esters" which are used in fragrance

manufacturing and could thus contribute to a 'sweet' smell. Experienced kraft mill operators state that foul condensate itself has an odor apart from the "rotten egg" smell of hydrogen sulfide that can generally be described as "sickeningly sweet". The obvious point is that the odorous and toxic emissions emanating from the New-Indy Mill cannot be adequately monitored and assessed by measuring and placing limits on only H_2S as the proposed CD specifies.

There is simply no valid reason to ignore the most toxic components of the TRS emissions and other chemicals in the foul condensate and measure only H_2S during any emissions monitoring efforts. It is clearly not in the public's interest and fails utterly to follow the known science. This is short-sighted, counter to science, and must be changed to include all four common components of TRS. And now it must also address the "sweet smell" phenomenon that continues to sicken residents over a year after the mill conversion.

Required Actions to Prevent Future Occurrences

The following is a brief list of required improvements to the WWTP to meet the requirements of the NPDES permit and industry standards.

a. **Foul Condensate Steam Stripper.** The steam stripper is the most critical odor-prevention process in the mill. New-Indy has only one steam stripper and it is seriously undersized for even the current production rate. There must be at least two strippers and 100% of foul condensate must be treated, 100% of the time. Local residents have endured a year of emissions – it is not reasonable to conclude that a single undersized Steam Stripper is an application of "Best Management Practice" as required by the NPDES permit. Another steam stripper is clearly required per permit sections II.E.1 and V.D.3. However, the Proposed CD allows New-Indy to continue to operate with only at most 70% of foul condensate being steam stripped with the balance (approximately 300,000 gallons per day) piped directly to the ASB and no redundancy for when the steam stripper is out of service, apart from the questionable practice of chemical addition.

b. **Primary Clarification.** The clarifier removes massive amounts of sludge every day to keep it out of the ASB. This critical, lone, clarifier was offline for maintenance when the new process startup occurred and was thus a major contributor to the overall failure of the WWTP. Therefore, it clearly violates the NPDES permit requirements noted above: a 2nd, parallel, clarifier has proven to be "necessary to achieve compliance with the conditions of the permit". A second, identical clarifier would: 1) provide clarification even when one of the clarifiers is down for service; 2) provide greatly simplified and thus more reliable operation with more consistent results; 3) provide capacity to readily handle future spills, failures, and mill upsets; and 4) help greatly to ensure that the WWTP's gross failure never happens again. However, New Indy's CAP and the Proposed CD do not include any additional clarification capacity.

c. **Equalization Basin.** Two critical failures of management occurred in this basin that insured total WWTP failure. This lagoon must either be internally diked to permanently separate the influent stream from the sludge thickening process, or the sludge should be sent to and thickened in Sludge Lagoon #4 only, as was previously done for decades. The CAP and the Proposed CD do not fully address this malfunction.

d. **Aerated Stabilization Basin (ASB).** There is only one ASB – it is the basin wherein wastewater is biologically treated to meet effluent limits for discharge to the Catawba River. But this ASB failed, and thus the WWTP failed. That alone invokes the "auxiliary facility" clause in NPDES permit section II.E.1. The critical ASB process should be duplicated with a second similar lagoon in case another catastrophic failure occurs again. This would allow the operators to respect the provisions of the NPDES permit: "The permittee shall at all times properly operate and maintain in good working order and operate as efficiently as possible". The CAP and the Proposed CD do not enlarge or provide for backup operation of the ASB.

e. **#1 Holding Lagoon.** This lagoon will always generate odors because the 10,000 to 20,000 pounds of solids arriving from the ASB every day will settle out in this lagoon and produce odor and reduced sulfides (TRS). New-Indy installed a temporary band-aid solution for adding peroxide to the 1.4-billion-gallon lagoon to destroy odors. A properly engineered solution is required. Only with a real solution can New-Indy say, in accordance with the NPDES permit: "The permit holder used best management practices normally associated with the proper operation and maintenance of a … sludge storage or lagoon area… to ensure that an undesirable level of odor does not exist." (Paragraph V.D.3). The CAP and the Proposed CD do not propose a permanent fix for this holding lagoon.

f. **Secondary Clarification – Conversion to Activated Sludge Process**. The ASB process is inefficient. Greatly enhanced performance and control would be gained by adding two clarifiers between the ASB and the effluent holding lagoon #1, effectively converting the clumsy, inefficient, ASB process into a proper high efficiency activated sludge process. And this would keep the millions of pounds of organic, biodegradable solids out of #1 Holding Lagoon – and thus prevent odor generation in that 1.4-billion-gallon lagoon.

g. **Sludge Lagoon #4**. This lagoon might be leaking and releasing dioxin, furans, and other toxic chemicals into the groundwater and the Catawba River. Sampling has shown toxic contamination in soil 80-ft deep below this 37-ft deep lagoon. The entire lagoon should be assessed and made leak-proof. Further, the sludge lagoon is near capacity. The process to design, permit, and construct a replacement will take years. It should be started now. As stated in NPDES section V.D.2: *"The permittee shall apply in writing to the DHEC/Bureau of Water requesting written approval for new alternate sludge disposal locations not previously permitted."*

The above list of necessary improvements to the WWTP are offered in the public interest. These solutions are science-friendly and fully consistent with a host of professional design standards written to insure such failures as experienced at the New-Indy plant do not occur again. Reasonable, reliable WWTP assets and operation would have prevented the documented toxic releases. The local residents deserve an adequate, properly designed and operated, odor-free WWTP that simply cannot fail like the existing plant did. Critical treatment processes must have multiple, parallel, units that provide an inherent backup capability for when their service is required, because it will be.

Please let me know if you have any questions concerning the above.

Kenneth L. Norcross
President, Wastewater Experts

Attachment

Appendix

1. References List
2. Recommended Actions - Details
3. Norcross CV

	Referenced Justification for Required Improvements to New-Indy WWTP				
Required Improvement to WWTP	New-Indy NPDES Discharge Permit	American Society of Civil Engineers (ASCE) Manual of Practice #76	Industrial Water Quality	U.S. EPA - Design Criteria for WWTP Reliability	10 States' Recommended Standards for Wastewater Treatment Facilities
Add a 2nd Steam Stripper of equal or greater capacity to Existing Stripper	"This provision requires the operation of back-up or auxiliary facilities … when the operation is necessary to achieve compliance with the conditions of the permit." (II.E.1)	"Multiple Units are Required for All Critical Components of the treatment plant." (Ch 3, para. #4.6)	n/a	Minimum of two operating units, each able to pass peak flow rate with one unit out of service (para. #212)	n/a
Add a 2nd Primary Clarifier of Equal Size or greater	"This provision requires the operation of back-up or auxiliary facilities…when the operation is necessary to achieve compliance with the conditions of the permit". (II.E.1)	"Multiple Units are Required for All Critical Components of the treatment plant." (Ch 3, para. #4.6) Two or more Clarifiers are Required for Redundancy (Ch. 12, Section 2.1.2.11)	n/a	Minimum of two operating units, each able to pass peak flow rate with one unit out of service (para. #212)	Multiple settling units capable of independent operation are desirable and shall be provided in all plants. (para. #71.1)
Eliminate Accumulated Sludge, Sludge Dewatering, and Sludge Erosion in Equalization Basin	"The permittee shall at all times properly operate and maintain in good working order and operate as efficiently as possible all facilities and systems of treatment." (II.E.1)	n/a	"There should be a spill pond to retain slugs of concentrated wastes that could upset the downstream processes" (#2.1)	n/a	n/a
Add a Second Aerated Stabilization Basin (ASB), dredge solids to minimum 8 ft; add dikes to prevent short-circuiting	"The permittee shall at all times properly operate and maintain in good working order and operate as efficiently as possible all facilities and systems of treatment." "This provision requires the operation of back-up or auxiliary facilities … when the operation is necessary to achieve compliance with the conditions of the permit." (II.E.1)	"Multiple Units are Required for All Critical Components of the treatment plant." (Ch 3, para. #4.6)	"Lagoons in series will produce a superior effluent" "Lagoons should be 8 ft to 16 ft deep" (#2.2)	Requires a minimum of two operating units, each able to pass peak flow rate with one unit out of service (para. #212)	At a minimum, a wastewater treatment pond system should consist of three cells designed to facilitate both series and parallel Operations. (para. #93.35)

Prepare for Closure of Sludge Lagoon #4 and Initiate Replacement Procedure	"The permittee shall apply in writing to DHEC requesting a written approval for new alternate sludge disposal locations not previously permitted. (V.D.2)	n/a	n/a	n/a	n/a
Test All Lagoons for Leakage and Reline if necessary	"The permittee shall at all times properly operate and maintain in good working order and operate as efficiently as possible all facilities and systems of treatment." (II.E.1)	n/a	"Acceptable liner needed" (#2.2)	n/a	n/a
Reference Details	South Carolina Department of Health and Environmental Control Permit No.: SC0001015	American Society of Civil Engineers, Manual of WWTP Engineering Practice, 5th edition.	Industrial Water Quality – 4th Edition	US EPA, Document # EPA-430-99-74-001	Recommended Standards for Wastewater Facilities: Policies for the Design, Review, and Approval of Plans and Specifications for Wastewater Collection and Treatment Facilities. 2014 Edition.
Several of these reference manuals primarily address municipal wastewater treatment. However, as noted by Dr. Wesley Eckenfelder in his seminal manual Industrial Water Quality: *"These processes are basically the same in an industrial plant (WWTP) as in a publicly owned treatment works."*					

The following list adds some explanatory detail to the multiple required modifications necessary to insure the malodorous and toxic releases of 2021 do not happen again. (A similar list of these items was previously submitted under separate cover.)

Required Actions to Prevent Future Occurrences

1. **Current and Future Effluent Quality.** New-Indy's NPDES discharge permit was issued in 2009 and expired in 2014 and has been administratively extended by DHEC for the past seven years without proposing a new permit. The outdated permit should be updated promptly to account for New-Indy's new production process and additional information and data collected as discussed above to assess performance and the need for upgrades. For example, New-Indy should be required to add "Total Reduced Sulfides" to its monitoring requirements for both air and water due to its toxic nature. Further, it is not clear why New-Indy is allowed to discharge many times the pollutants allowed for most municipal WWTPs. New-Indy is allowed, for example, to discharge some 100 mg/l (parts per million) of BOD (organic contaminants) and approximately 200 mg/l of TSS (total suspended solids). Municipal wastewater dischargers are typically required to discharge less than 30 mg/l of BOD or TSS. The city of Rock Hill, S.C. discharges into the Catawba River upstream from New-Indy and has a permit for 20 million gallons per day (similar to New-Indy) at a BOD of 20 mg/l and solids of 30 mg/l TSS. It is unclear why Rock Hill must meet standards 5 to 6 times more strict than New-Indy. The New-Indy WWTP can readily be modified to meet similar standards.

2. **Wastewater Treatment Plant Units:** The many deficiencies and failures of New-Indy's WWTP were starkly revealed during and after the linerboard process switchover in January/February 2021. These deficiencies resulted in the total failure of the WWTP and repeated emissions that caused misery for residents many miles away, for the rest of the year. Yet a few modifications/additions to the WWTP would bring it up to accepted engineering standards and would have eliminated most, if not all, of these unfortunate incidents. There is no insurance that this event will not be repeated in the future, and the local residents deserve to know that the deficiencies in the New-Indy WWTP have been repaired and is now robust, reliable, and secure.

   The most critical flaw in the WWTP revealed by this calamity is the lack of redundancy in critical wastewater process units. This extended failure occurred because two critical processes failed or were out of service – and there was no parallel unit to carry the temporary load increase. This WWTP must not be allowed to continue to operate with only a single train of wastewater treatment units. A long history of other WWTP failures long ago caused Engineering standards to require WWTP's to have redundancy - at least two online treatment units for each process step. This is so that *when, **not if,*** a unit fails, or must be removed from service for maintenance, the parallel unit can take up the slack for a significant length of time to allow repair/maintenance/cleanup of the offline unit(s). New-Indy must be required to make the following modifications and additions to their Catawba Mill WWTP in order to protect the community and/or the receiving waters from extended WWTP failures such as occurred throughout 2021.

   a. **Steam Stripper.** DHEC has reported this stripper could treat about half of the foul condensate. The decision to remove the steam stripper from service contributed significantly to the release of malodorous and dangerous chemicals. A second, parallel, steam stripper is required. This would also allow a stripper to be removed from service for maintenance without the likelihood of additional malodorous and toxic chemicals being emitted from the WWTP. New-Indy's status reports to DHEC indicate that the existing stripper has already been removed from service twice for maintenance in the past few months. The Proposed CD and New-Indy's Corrective Action Plan make no mention of increasing steam

stripper capacity which is an essential improvement needed to prevent the ongoing and future H2S and TRS emissions to the surrounding communities.

b. **Primary Clarification.** The decision to take the clarifier offline for service was apparently necessary; the decision to commence full-scale production without a functioning clarifier was a major contributor to the overall failure of the WWTP. As stated in New-Indy's O&M Manual, operation of the single Clarifier requires "maintaining a fine balance" in order to have satisfactory performance. This is an accident waiting to happen given the amount of fiber and other solids in the wastewater generated by the mill. A second, and perhaps a third (depending on size) clarifier would: 1) provide greatly simplified and thus more reliable operation with more consistent results; 2) provide capacity to readily handle future spills, failures, and mill upsets; and 3) help greatly to ensure that the WWTP's gross failure never happens again. Primary Clarification is the process that protects the entire rest of the treatment process – it absolutely must be robust. Right now, this plant is one accident, one major equipment failure or maintenance event away from another crippled WWTP. New-Indy should be required to install at least a second 275-ft diameter Primary Clarifier, and really should have a third primary clarifier due to the potential for another massive and sustained loss of pulp. Primary Clarification has proven to be critical to the successful operation of the WWTP. It is essential to have industry standard spare capacity for unexpected events and for maintenance. This will contribute greatly to the success of future operation. However, neither the Proposed CD nor New Indy's Corrective Action Plan requires any additional clarification capacity.

c. **Equalization (EQ) Basin.** New-Indy should separate the influent wastewater flow from the thickening of Clarifier sludge. There can be no path back into the WWTP for the wasted Clarifier sludge. This lagoon must either be internally diked to permanently separate the two streams, or the sludge should be sent to and thickened in Sludge Lagoon #4 as was previously done. Further, this lagoon must be brought up to current standards by being properly dredged and then lined with a leak-proof geo-polymer liner to prevent contamination of the groundwater. New-Indy stated in its Corrective Action Plan that it will continue to remove sludge from the basin but has not indicated it will cease sending sludge from the clarifier or line the Equalization Basin. The Proposed CD does not require any improvements to the EQ Basin.

d. **Aerated Stabilization Basin.** The ASB must be restored to working condition and all aerators placed back into operation. This includes replacing the former "curtains" (that attempted to for a 3-cell serpentine flow pattern to reduce short-circuiting) with actual dikes that will be permanent. The ASB must be dredged of sludge until the minimum liquid depth meets typical recommendations of at least 6-ft or more – nearly double its current state. New-Indy and its contractors and consultants have begun this process but are merely seeking to return the WWTP to a functional state. Much more is required to make this WWTP robust and stable in the long term and prevent future failures. The ASB failure was caused by 1) the failure of the single Primary Clarifier, 2) New-Indy's mistake of filling the Equalization Basin with sludge and allowing it to wash into the ASB, 3) the fact that there was no spare capacity, no standby or parallel clarifier or aeration basin to rely upon. The critical ASB process should be duplicated. The Temporary Wastewater Holding Lagoon (Lagoon #5) is adjacent to and already overflow-connected to the ASB. It holds 400 million gallons and the ASB holds 375 million gallons once it is cleaned of sludge. It would be logical and relatively simple to add aeration to Lagoon #5 and then have a 100% standby capacity. This would also help produce an effluent to the Catawba River that was much higher quality than in the past.

It is critical that both lagoons be brought to modern standards and sealed and lined with a geo-polymer liner. This will stop the leaking of pollutants to the groundwater which flows to the Catawba River. Lagoon #5 should be dredged and cleaned and lined (if not already), then equipped with aerators and any necessary flow baffles. Then the raw wastewater can be directed to the new ASB #2 while the existing ASB is drained, fully dredged, cleaned, and then lined and sealed. New-Indy and its contractors reportedly have removed much sludge, repaired and

replaced some of the aerators, and begun adding chemicals to try and neutralize some of the odors. However, there is no indication in the Proposed CD or New-Indy's Corrective Action Plan when the current remediation of the ASB will be completed. Nor does the CAP indicate that New-Indy intends to line the existing ASB or add a second ASB to provide backup capacity and improve the effluent being discharged to the Catawba River.

e. Conversion to Activated Sludge Process. The Aerated Stabilization Basin (ASB) process has been used to treat mill wastewater successfully throughout the pulp and paper industry. It has apparently worked effectively for over 50 years at the New-Indy Catawba mill site. However, the process failed to protect local residents from the powerful odors released throughout the past year of operation with the new mill process introduced by New-Indy. As noted above, there were many causes of this failure – and it is clear that New-Indy failed to maintain appropriate Operation and Maintenance procedures. Conversion of the lone ASB to a highly efficient Activated Sludge Process would require: 1) addition of a second, parallel aeration basin for redundancy, and 2) the addition of Secondary Clarifiers to prevent the millions of pounds of solid particles from reaching the #1 Holding Lagoon and settling therein to gradually decompose and generate more odors. Final effluent water discharged to the river will be much cleaner, and odors greatly reduced.

f. **#1 Holding Lagoon.** This lagoon will always generate odors because the 10,000 to 20,000 pounds of solids arriving from the ASB every day will settle out in this lagoon and start to produce odor and reduced sulfides (TRS). That is why over 2 mg/l of Sulfide was being measured in the lagoon many months after startup of the new process, and New-Indy installed aerators and started paying to have sulfide-neutralizing chemicals pumped into the vast lagoon. Even if the odors are normally minimal, they will be excessive whenever septic settled sludge is dredged and removed. The WWTP requires significant diking of this lagoon to separate the ASB effluent solids-settling function from the effluent flow equalization function. Alternatively, installation of two Secondary Clarifiers between the ASB and the Holding Lagoon would provide vastly improved process control ability and would ensure that ASB solids (which include the microbes responsible for removing pollutants) are removed and kept out of the Holding Lagoons entirely. These solids can then be either returned to the ASB to increase efficiency and reliability or be sent to Sludge Lagoon #4 for dewatering and disposal. This capability would give New-Indy WWTP operators the ability to manage and have a measure of control over the WWTP process. They could, when appropriate, decide to increase or decrease the concentration of active and beneficial microbes in the ASB for which they have no such control now. This will guarantee a much cleaner effluent going to the Catawba River, provide much improved operational stability, and virtually eliminate the production of odors from various Holding Lagoons once they are all properly dredged, cleaned, and lined to current standards. New-Indy reports that it is adding oxidizing chemicals to neutralize odors as a temporary measure. However, neither the Proposed CD nor the Corrective Action Plan indicates any other plans to improve performance.

g. **Post-Aeration Basin**. New-Indy has emphasized the importance of this basin for removing odor. Therefore, there should be a second, identical basin with similar equipment. Further, each basin should be equipped with a sulfide monitoring system that controls both the aerators and chemical feed pumps to add oxygen and sulfide-destroying oxidant as necessary. As a temporary measure, New-Indy has covered the basin with a tarpaulin and is scrubbing the off-gas in an attempt to remove at least some of the malodorous TRS. However, neither the Corrective Action Plan nor the Proposed CD indicate any intent to provide any spare capacity or install a sulfide monitoring system.

h. **Sludge Lagoon #4.** It is not clear from the documents reviewed at this time whether this lagoon is leaking. This is especially critical with the presence of dioxin, furans, and other toxic chemicals likely present in the sludge. Sampling has shown toxic contamination as low as 80-ft deep in this 37-ft deep lagoon. There are liners visible in some zones, but their coverage and integrity apparently have not been determined. The entire

lagoon should be assessed and made leak-proof. The river should be protected with a groundwater barrier such as a leachate pump-and-treat system if it is not already. New-Indy previously advised DHEC that it would increase the sludge removal rate and cap the sludge lagoon. However, New-Indy recently stated its intent to continue to use the lagoon until it is at full capacity. The Proposed CD does not address Sludge Lagoon #4 at all.

i. **Reduce Load to Match Treatment Capability.** As noted above, New-Indy should not be allowed to continue to run the mill above the capacity of its WWTP to adequately treat the quantity of wastewater produced and without releasing malodorous and toxic levels of TRS and other pollutants to the surrounding communities. Wastewater volume and quality is directly related to production rates. Until New-Indy can implement the improvements described above, it should reduce pulp production to limit TRS emissions and achieve a higher quality effluent. New-Indy's Corrective Action Plan and the Proposed CD make no mention of this obvious method to immediately reduce odors in the community.

CURRICULUM VITAE

Kenneth L. Norcross, B.Eng., M.Sc.

Areas of Experience and Expertise

Technical Experience: Wastewater Treatment, Biosolids Stabilization, and Sludge Reduction

- Wastewater Treatment Plants - Design, Operation, Analysis and Troubleshooting of Processes and Equipment
- Design, Operation, Analysis, and Troubleshooting of Processes and Equipment, including:
  - Municipal Wastewater Treatment Systems
  - Industrial Wastewater Treatment Systems
  - Activated Sludge Systems
  - Sequencing Batch Reactors (SBR)
  - Biological Nutrient Removal Systems (BNR)
  - Membrane Biological Reactors (MBR)
  - Biosolids Reduction and Stabilization
  - Thermophilic Waste Treatment and Sludge Stabilization (ATAD)
  - High-Strength Industrial Waste - Low Sludge-Yield Systems
  - Dissolved Air Flotation (DAF)
- Activated Sludge Biomass Issues – Bulking, Dispersed Solids, Turbidity, Poor Settling, Effect of Salinity on Biomass Flocculation, Filtration Breakthrough
- Water/Wastewater Disinfection
- Aeration and/or Mixing Systems - Design, Testing, and Analysis
- Automated Process Controls

Legal and Litigation Experience

- Expert Witness in Warranty and Liability Claims and Litigations
- Forensic Expert in Litigations in Europe, North America, and China
- Contracts: Writing, Review, and Negotiation
- Process and Equipment Warranty or Performance Claims and Negotiations

Sales & Marketing

- Technical Sales Support and Presentations
- Evaluation of New Processes or Equipment, or of Existing Products Failing to Meet Sales Expectations
- Market Entry Strategy for New Companies, Processes, or Products

Business

- Small Business Startups
- Patent Claims and Patent Writing
- Evaluation of Technologies and Companies for Potential Investors or Corporate Acquisitions

Professional Experience

- **Wastewater Experts, Div. of SynergisTech, Inc: Founder and President, 2002 to present**, (www.WasteWaterExperts.com) provides consulting services to the wastewater treatment industry with clients in the following areas:
  - ***Forensic and Expert Witness*** services for the inevitable litigations that arise in the business of wastewater treatment including: contractual disagreements; warranty claims; performance failures; and related forensic analyses.
  - ***Consulting Services*** emphasizing wastewater treatment process and equipment troubleshooting, cost reduction (Value Engineering), efficiency verification, Warranty Claims and Negotiations
  - ***New Product Development Consulting***: Many new products are introduced each year which fail to perform as expected. We help protect investors' interests by insuring the product is properly analyzed, performance-optimized, and the real marketability accurately evaluated.
  - ***New Product Marketing.*** The wastewater market is large and complex – introduction of a new product, process, or business into this market is difficult, and many good ideas have failed due to a lack of market knowledge. SynergisTech knows the industry, the players, the sales channels and paths to market to quicken the growth curve.

Litigation and Related Projects

- Forensic Expert for a national dairy company facing litigation over potential WWTP issues
- Forensic Expert in litigation over WWTP failure at a poultry processing facility.
- Court-Appointed Custodian of failing Resource Recovery Equipment Manufacturer
- Forensic Expert - Analysis and Negotiation of Construction Insurance Claim, Moffett Air Force Base, Nebraska
- Forensic Expert - Analysis of Wastewater Treatment Process Failure and Warranty Liabilities at the City of Dublin WWTP, Ireland.
- Forensic Expert - Witness and Analysis of Wastewater Treatment Process Failure and Warranty – Yorkshire, UK.
- Forensic Expert - Analysis of a Failed Wastewater Treatment System at a Small Municipality.
- Forensic Expert - Analysis of a Failed Anaerobic Wastewater Treatment System at a Large Dairy
- Forensic Expert Witness – Analysis and Defense of a Patent Position on an Industrial Mixing Device
- Consulting Expert - Neutralization of Toxicity in the Wastewater Plant – Fujian, China
- Consulting Expert - Doubling Performance Capacity of an Existing Activated Sludge Plant in a Small Municipality
- Consulting Expert - Improved Process Operation with a High COD:BOD Wastewater - Yunnan, China
- Consulting Expert – Restoring Proper Function to a Very Lightly-Loaded Activated Sludge Plant
- Consulting Expert – Analysis of Failure and Restoration of a Thermophilic Sludge Stabilization Process (ATAD)

- **Consulting Expert - Analysis of Failure and Restoration of a Failed Anaerobic/Aerobic Treatment Process Treating Beverage Wastewater**

New Product or Business Startup Projects

- **Consulting Expert – Analysis of an Innovative Wastewater Treatment Process: Efficacy, Marketability, Economic Viability as Due Diligence Prior to a Corporate Acquisition – Denver, Colorado**
- **Consulting Expert - Development, Patenting, Demonstration, and Market Entry of an Innovative Process for Sludge Reduction in Wastewater Treatment – Las Vegas, Nevada.**
- **Consulting Expert – Development and Training of Engineering Design Protocol for Implementation of Sequencing Batch Reactor Technology Deployed in Portugal and Africa – Lisbon, Portugal**

- **Evoqua Water Technologies. Senior Process Consultant, April 2015 to present.**
  - **Consultant for Sequencing Batch Reactor (SBR) and other process technologies**
  - **Operations Optimization, Process Troubleshooting, and Process Startup and Training**
  - **Technical Sales Support**
  - **Patented Technology Innovations**

Sandhu Consultants, Inc. Board of Directors, Technology Adviser, 2010 to 2013. SCI is an international environmental consulting business. Mr. Norcross helped qualify and select certain American Green Technologies for export. He then participated in successful effort to go to and open markets in the Middle East through strategic partnerships and authorized agents. Mr. Norcross also made technical presentations and wrote and negotiated the agreements and contracts involved.

- **PMC BioTec, Inc. Founder and Executive Vice President, 2003 to 2011.** PMCB was formed to offer a sustainable, patented, thermophilic biosolids destruction technology with special efficacy for hazardous industrial wastes and sludges.
  - The technology was successfully commercialized with installations in Europe, North America, and Asia achieving the destruction of tens of millions of kilograms of hazardous waste and sludge onsite where it was generated, at a fraction of Incineration costs.
  - The core technology was ultimately modified, patented, and applied to destruction of municipal sludge while enhancing the efficiency of sludge-to-energy conversion. Company name was then changed to ***Bioconversion Solutions, Inc.***

  Mr. Norcross co-founded and funded the growth of the company, developed Sales and Marketing materials, established a national Sales Rep network, did direct Technical Sales, conducted Contract Reviews and Contract Negotiations, and made Technical Sales Presentations.

- **Western Water Group of China. Co-Founder, Board of Directors, Technology Consultant, 2004 – 2011.** The explosion of the Chinese industrial economy led to the much-publicized water pollution challenges facing China. WWC was formed to utilize American environmental technology for Water and Wastewater Treatment Plants within China. The result was:
  - 14 water and wastewater projects are installed and operating.

- These projects were sold as financed, 25-year BOOT projects (Build/Own/Operate/Turnover).
- The 14 Installations are spread over five (5) Chinese provinces.
- At full build-out, the installations will produce a total of 375,000 metric tons per day of treated water.

Mr. Norcross is a co-founder and co-funder of the company. He directed or participated in Sales and Marketing Training, Concept Sales with Provincial and Municipal Authorities, Customer Relations, Project Development, Technology Selection and Plant Design, Contract Negotiations, Plant Startups, Operator Training, Operations Troubleshooting, and Warranty Claim Forensics and Resolution Negotiations. He also was responsible for Developing and Writing several of the Company's Patents.

- **Hans Technologies, Inc. Board Member, Principal, Technology Adviser, 2002 to 2011.** Han's Technologies, Inc. (HTI) is an engineering and management firm providing environmental planning and project supervision to municipalities, industry, and private developers, and is the parent company of Western Water Group of China. HTI selected and exported the American Water and Wastewater Treatment Technologies installed in Western Water Group's 14 Chinese installations.
  Mr. Norcross directed or participated in Concept Sales, Customer Relations, Project Development, Technology Selection and Plant Design, Contract Negotiations, Plant Startups, Operations Troubleshooting, and Warranty Claim Forensics and Negotiations. He also Developed and Wrote several of the Company's Patents.

- **Veolia Water Company. 1996 to 2001, Vice President of Technology**
  Process and Equipment Design, Technical Sales Support, Operator Training, Process Troubleshooting, Patent Development, Warranty Claim Forensics and Negotiations, and Technology Acquisition Evaluations. He also served on the International Biological Treatment Steering Committee of the $15 Billion French parent company - Veolia Water - at a time of growth and transition.

- **US Filter Corporation. Vice President of Technology, 1995 to 1999.** Mr. Norcross had responsibilities for Process and Equipment Design, Technical Sales Support, Operator Training, Process Troubleshooting, Technical Papers and Presentations, Patent Development, Technology Acquisition Evaluation, and. He also served as Director, US Filter Product Rationalization from 1996 to 1999, when US Filter was acquired by Veolia Water.

- **Jet Tech Incorporated. Co-Founder, Vice President of Technology, 1981 to 1996.** Mr. Norcross had responsibility for Research and Development, Process and Equipment Design, Field Testing, Pilot Plants, Technical Sales Support, Operator Training, Process Troubleshooting, Technical Papers and Presentations, Warranty Claims, and Patent Development. He authored or co-authored 14 patents in that time. In 1995, Jet Tech Inc. was acquired by the US Filter Corporation.

- **Pentech Division of Houdaille Industries. Research and Development Engineer and Process Troubleshooting Engineer, 1979 to 1981.**
  Designed aeration, mixing, and biological processes; conducted equipment testing and evaluation both in the factory and in the field; wrote technical reports; wrote/presented technical papers and sales presentations; did field evaluations/solutions for Warranty claims.

- **GS Environmental Engineers, Inc., Chief Project Engineer, 1977 to 1979.** Conducted equipment testing and evaluation both in the factory and in the field, wrote technical reports, designed systems for biological treatment and for Chemical Processes.

Educational Background

Vanderbilt University, Nashville, Tennessee
M.E., 1978, Masters of Science in Water Quality Engineering
B.E., 1976, Environmental and Water Resources Engineering

Patents

Nineteen (19) Patents in the area of Water/Wastewater Treatment

Inventor or Co-Inventor – 14 patents in wastewater treatment processes and/or equipment
Inventor - one patent in Hazardous Waste Remediation
Inventor - two patents for Autothermal Thermophilic Sludge Digestion (ATAD) Process and Equipment
Inventor – two Patents for SBR Equipment in China

Technical Papers and Presentations

"Biosolids Destruction Alternatives: Approaching Zero Residuals" – Seminar to the Korean EPA, Seoul, South Korea, October, 2009.

"Application of AFC^{sm} Technology for Sludge Minimization for Municipal Wastewater Treatment Plants – Bench Pilot Test and Concept Design," Kenneth L Norcross, Alan F. Rozich, Ph.D., P.E., DEE, Philippe Maltais, presented at PNCWA Conference, 2009.

"Wastewater Treatment – The Next Generation of Technology" – Presented at 5th Annual Chinese Investment Conference, Xiamen, China, 2008.

"Zero-Sludge Treatment of High-Strength or Hazardous Industrial Wastewater" – Presented at 2005

"Reduce Sludge Handling Costs by Destroying Sludge Onsite – Case Study", White Paper written for PMC BioTec, Inc.. 2005

"Consideration of an Innovative Low Sludge Yield Process" – Patent, Process Development, and White Paper prepared for private equity firm, 2007.

"SBR Systems: Effective Biological Nutrient Removal for Small and Medium Sized WWTP's" - 1st WEF Plant Operations Specialty Conference, Milwaukee, Wisconsin, June, 1999. K. L. Norcross and R. Shamskhorzan.

"Innovative ATAD Design Saves Costs at Franklin, Tennessee", Water Environment Federation Conference, Chicago, Illinois, October, 1997.

"Successful Conversion from Anaerobic to Aerobic Treatment of a High Strength Dairy Wastewater", Food Industry Environmental Conference, Proceedings, Pp. 409-422, November, 1994.

"Solving Activated Sludge Process Problems", Oklahoma Water and Pollution Control Association Conference, October, 1994.

"High Efficiency Biological Wastewater Treatment Design", Wastewater Treatment Seminar, Poly Technical Institute of Mexico, Mexico City, June, 1994.

"Selection of Batch Reactor Design Parameters for Varying Influent and Effluent Characteristics", Federal Engineering and Technology Center, Mexico City, June, 1994.

"Expansion and Retrofit of a Four Tank SBR for Treatment of Poultry Processing Wastewater", 1994 Industrial Pollution Control Conference, Atlanta, Georgia, February, 1994.

Papers and Presentations (Continued)

"Nutrient Removal from Municipal Wastewaters", 1993 Conference of the Pennsylvania Water Pollution Control Federation, Harrisburg, Pennsylvania, October, 1993.

"Biological Nutrient Removal in SBR's - Theory, Practice, and Results", June, 1993, New England Water Pollution Control Conference, Boston, Massachusetts, June, 1993.

"Biological Nutrient Removal from Potato Processing Wastewater", Food Industry Environmental Conference, November, 1992.

"Nutrient Removal", Pacific Northwest Pollution Control Association, Boise, Idaho, October, 1992.

"An Overview of SBR Technology", 16th Biennial Conference of the International Association of Water Pollution Research and Control, Washington, DC., published in Water Science Technology, Vol. 26, No. 9-11; pp 2523-2526, May 1992 (London England).

"Biological Treatment Process Selection - Guidelines for the Selection of Batch Reactors", 24th Annual Wastewater Design and Operations meeting, Des Moines, Iowa, May, 1992.

"Biological Treatment - Process Alternatives", Iowa Environmental Engineering Conference, Des Moines, Iowa, April, 1992.

"Performance and Design Considerations for Treatment of food Processing Wastewaters", 1990 Food Industry Environmental Conference, November, 1990.

"SBR Treatment of Food Processing Wastewater - 5 Case Studies", 1988 Food Processing Waste Conference, November, 1988.

"Process Performance Parameters for Three Full-Scale SBRs Treating Meat, Dairy, and Industrial Park Wastewaters", 60th Annual Water Pollution Control Federation Conference, October, 1987.

"Treatment of Meat Processing Wastes with a Sequencing Batch Reactor", Annual Purdue Industrial Waste Conference, May 1987.

"Upgrading Treatment Plants to Reduce Operating Costs", 5th Annual Pacific Northwest Pollution Control Association Conference, November 1986.

"Potential Operation and Maintenance Reductions with SBR Technology", Kentucky Water Pollution Control Association Conference, March 1986.

Papers and Presentations (Continued)

"SBR Treatment of Hazardous Wastewaters - Full-Scale Results", International Conference on Innovative Biological Treatment of Toxic Wastewaters, Pp 275 - 295, June UPS. Environmental Protection Agency, June 1986.

"Mass Transfer and Process Characteristics of Hazardous Waste Treatment in a Sequencing Batch Reactor", Norcross, K. L., Irvine, R. L., Herzbrun, P. E., Water Pollution Control Federation Annual Conference, October 1985.

"A Full-Scale Evaluation of Thermal Efficiency for a Mechanical Surface and a Submerged Jet Aeration System", 58th Annual Water Pollution Control Federation Conference, October 1985.

"Biological Degradation of Hazardous Wastewater", 52nd Annual Conference of the Northwest Water Pollution Control Federation, November 5, 1985.
"Economical Retrofit for Expansion of Existing Package Process Treatment Plants", Kansas Water Pollution Control Federation, March 1984, Norcross, K. L., Bailey, J., Schomaker, M., May, 1984

"The Effect of Aeration Device Shear Characteristics on Apparent Alpha Factor", WEMA Annual Conference, Houston, Texas, 1981.

"Process Efficiency of Submerged Jet Aeration", Wastewater Equipment Manufacturers Association Annual Conference, June 15, 1980

"Improved Efficiency of High-Speed Mechanical Surface Aerators", Purdue Industrial Waste Conference, May 12, 1978, Shell, G. L., and Norcross. K. L.

**** Sole author unless noted.***

Major Research and Development Projects

Evaluation of an Innovative Process for Minimizing Sludge Yield in Activated Sludge Processes, PWI Corporation, 2006.

Evaluation of a High-Intensity Shearing on MBR Membrane Flux and Permeability Rates, PWI Corporation, 2007.

MBR (Membrane Bioreactor) Process Development for Veolia Water, 1999.

Improved Efficiency and Reliability for the Autothermal Thermophilic Aerobic Sludge Digestion Process (ATAD), February through March, 1994.

Assessment of Alpha Factor Variation as a Function of Aerator Device and Dissolved Solids Content, 1993.

Major Research and Development Projects (continued)

Efficiency Enhancement of Submerged Jet Diffusers Through Augmented Horizontal Momentum, June through August, 1987.

Control of Microbial Population Distribution Through Substrate Feed Rate Variation, July through December, 1987.

Enhancement of Biological Phosphorus Removal in an SBR Through Reduction of Apparent Sludge Age, June through December, 1987.

Examination of Oxygen Transfer Rate Enhancement Through Rapid Uptake and Utilization, January, 1986 through March, 1988.

Optimization of Liquid/solid Separation Mechanisms for Batch Reactor Applications, January, 1985 through October, 1987.

Reduction of Nozzle Blockage Through Simplified Reversed Hydraulics, August, 1984 through August, 1986.

Analysis of Hydraulic Efficiency of Large-Diameter, Low-Speed Horizontal Propeller Mixers, July through September, 1985.

Effect of Bulk Liquid Velocity Termination on the Settling Behavior of Mixed Liquor Solids, May, 1986 through October, 1986.

Effect of Compound Nozzle Configuration Upon Two-Phase Transfer Performance, April 1982 through June, 1983.

Low Head Surface Aeration Using Free Jet Discharge, June through August, 1980.

Impact of Ohnesorge Number-Based Design on Dissolved Air Flotation Efficiency, August through December, 1978.

Effect of Discharge Trajectory on Surface Aeration Efficiency, April through July, 1978

Nozzle Distribution Hydraulic Considerations for Granular Media Filters, May through September, 1978.

Impact of Pore Geometry on Elastomeric Diffusion Transfer Efficiency, February through June, 1978.

Induced Air Flotation of Liquids Containing High MBAS-Quantified Constituents, May, 1977 through September, 1977.

Professional Societies

International Water Association
Environmental Engineering Division of the ASCE
American Society of Chemical Engineers
American Society of Chemical Engineers Product Review Panel
Water Environment Federation
United States Environmental Technology Export Council - Advisory Board