BEFORE THE ADMINISTRATOR
U.S. ENVIRONMENTAL PROTECTION AGENCY

In the Matter of
Louisiana Department of Environmental
Quality's Proposed Operating Permit and
Prevention of Significant Deterioration Permit
for Consolidated Environmental Management,
Inc./Nucor Steel, Louisiana,
St. James Parish, Louisiana

LDEQ Agency Interest No.
157847
Activity Nos. PER20080001
and PER20080002
Permit Nos. 2560-00281-V0;
PSD-LA-740

Proposed to Nucor Steel, Louisiana
By the Louisiana Department of
Environmental Quality on
October 15, 2008

PETITION REQUESTING THAT THE ADMINISTRATOR OBJECT TO THE TITLE V OPERATING AND PREVENTION OF SIGNIFICANT DETERIORATION PERMITS PROPOSED FOR NUCOR STEEL, LOUISIANA

Pursuant to Section 505(b) of the Clean Air Act, 42 U.S.C. § 7661d(b)(2) and 40 C.F.R. §70.8(d), Zen-Noh Grain Corporation ("Zen-Noh") petitions the Administrator of the U.S. Environmental Protection Agency ("Administrator") to object to Title V Air Operating Permit (No. 2560-00281-VO) ("Operating Permit"). Zen-Noh also petitions the

Administrator to reopen or revise Prevention of Significant Deterioration Permit (No. PSD-LA-740) ("PSD Permit"). And, Zen-Noh petitions the Administrator to direct Louisiana Department of Environmental Quality ("LDEQ") to provide Zen-Noh and the public with all information necessary to the issuance or denial of the Operating Permit and PSD Permit, provide a meaningful period for public review, and reopen the public comment period.

Both the Operating Permit and PSD Permit were proposed on or about October 15, 2008 by LDEQ for issuance to Consolidated Environmental Management, Inc./Nucor Steel Louisiana ("Nucor") for a Pig Iron Manufacturing Plant in St. James Parish, Louisiana. The grounds for Zen-Noh's Petition are based on comments filed by Zen-Noh with LDEQ on November 24, 2008 during the public comment period, and expansions on those comments, as well as additional comments/objections filed with LDEQ on December 12, 2008 and January 28, 2008 ("Public Comments").

EPA Region 6 and United States Department of the Interior, Fish and Wildlife Service were unable to conduct a complete analysis of the proposed Operating Permit and PSD Permit, and both recommended to LDEQ that it provide a new public comment period to evaluate new modeling analyses to be provided LDEQ.[1] These new modeling analyses were not provided to Zen-Noh or the general public. As is more fully discussed in Zen-Noh's Public Comments, the refusal by LDEQ to follow the federal law and federally enforceable

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[1] See, letter of December 1, 2008 from EPA to LDEQ attached as Exhibit 1, and letter of November 20, 2008 from United States Department of the Interior, Fish and Wildlife Service to LDEQ attached as Exhibit 2.

SIP has deprived Zen-Noh and others of their right under the Clean Air Act to review and comment upon all of the information necessary to the issuance or denial of the Operating Permit and PSD Permit.

Zen-Noh incorporates by reference to this petition its Public Comments and attaches them here as Exhibits 3, 4 and 5.

Respectfully submitted this 30th day of January, 2009 by:

BALDWIN HASPEL BURKE & MAYER, LLC

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Attorneys for Zen-Noh Grain Corporation

CERTIFICATE OF SERVICE

I hereby certify that I have this 30th day of January, 2009 served a copy of this Petition to those listed below .

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Harold Leggett, Ph.D., Secretary *(Via Certified Mail)*
Louisiana Department of Environmental Quality
P. O. Box 4301
Baton Rouge, LA 70821-4301

Jeff Braun *(Via Certified Mail)*
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Ms. Cheryl S. Nolan
Administrator
LDEQ, Air Permits Division
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Mr. Jeffrey Robinson
Chief, Air Permits Section (6PD-R)
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Ms. Shannon Snyder
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Dallas, TX 75202-2733

original to IOA
copy to BJ Admin / B Johnston

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
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December 1, 2008 AI 157847

2008 DEC -8 AM 10:51

Mr. Bryan Johnston
Administrator
Air Permits Division
Office of Environmental Services
Louisiana Department of Environmental Quality
P.O. Box 4313
Baton Rouge, LA 70821-4313

RE: Louisiana Department of Environmental Quality's (LDEQ's) Proposed Operating Permit Number 2560-00281-V0 and Prevention of Significant Deterioration (PSD) Permit Number PSD-LA-740; Consolidated Environmental Management Inc., Nucor Steel Louisiana; Convent, St. James Parish, Louisiana

Dear Mr. Johnston:

The Environmental Protection Agency (EPA) Region 6 appreciates the opportunity to comment on the proposed operating permit and PSD permit for Nucor Steel Louisiana. The draft permits were evaluated to ensure consistency with the Louisiana State Implementation Plan and Federal Clean Air Act (CAA) requirements. We have two principal concerns: a) the application did not contain enough information to show if there will be an adverse impact on air quality in the Baton Rouge Nonattainment Area, areas that are currently in attainment, and Class I areas; and b) the applicant's Best Available Control Technology (BACT) determination did not provide enough information for EPA to evaluate the technical feasibility/infeasibility of the selected control methods. We request that LDEQ provide a more detailed analysis of the applicant's BACT determination. The company has promised to submit revised modeling to help address our first concern. Our specific comments on the permits are enclosed.

These comments are being submitted to assist LDEQ in the evaluation of the proposed permit, and this is not a final position by EPA. The public comment period for this permit closed on November 24th, 2008. Since the company will submit new modeling to amend the permit application, we recommend that LDEQ provide a new public comment period on the amended application.

Please contact me at (214) 665-6435, or Shannon Snyder of my staff at (214) 665-3134, if you have further questions. Thank you for your cooperation.

Sincerely yours,

Jeffrey Robinson
Chief
Air Permits Section

Enclosure

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Enclosure

General Comment

1) Did Nucor consider alternative manufacturing processes, employed within and outside the United States? For instance, did Nucor consider building a Direct Reduced Iron (DRI) Plant? If so, why was this type of plant eliminated from consideration? DRI plants such as the New Steel International Plant in Haverhill, OH, and the Iron Dynamics, Inc. Plant in Butler, IN, produce pig iron using this type of process and the emissions are far lower than what Nucor Louisiana has proposed using the blast furnace process. LDEQ has the discretion to require the applicant to consider alternative production processes as part of the BACT Determination.

Specific Comments

2) It is not clear from the application and the proposed permit if Startup, Shutdown, and Maintenance (SSM) emissions were included in the Potential to Emit (PTE). Please provide the BACT analysis for emissions from SSM. Additionally, it is unclear if alternate operating scenarios such as the Heat Recovery Steam Generator (HRSG) bypass operations, were included in the PTE and if BACT will apply during these operations. Emissions from all bypass scenarios are considered maintenance operations. Please clarify if emission limits apply during bypass operations and are supported by adequate monitoring and recordkeeping provisions in the PSD permit. If the limits in the permit are infeasible during SSM, the LDEQ should outline what design, control, methodology, work practice (such as a limitation on total startup and shutdown event time) or other change appropriate for inclusion in the permit to minimize excess emissions during those periods. In addition, please clarify if those emissions will be included in the annual Emissions Inventory reporting. The proposed permit also does not provide details on the number and nature of startups, shutdowns and malfunctions.

3) It was not clear from the application and the proposed permit if Particulate Matter (PM) 2.5 was evaluated. Did LDEQ consider PM 2.5 in this permitting action?

4) Based on the information provided in the PSD application, it is difficult to verify the BACT Determination provided in the Preliminary Determination Summary, specifically, the technical feasibility/infeasibilty of add-on controls for each emissions unit/pollutant evaluated. The BACT evaluation process involves reviewing not only the EPA's BACT/ Lowest Achievable Emissions Rate (LAER) Clearinghouse (RBLC), but also Federal/State/Local New Source Review (NSR) permits across the country. Please provide the State's rationale for the BACT determinations, including an analysis of the technical and economic feasibility of available control technologies.

5) The proposed permit states that for the Blast Furnace Gas, Sulfur Dioxide (SO2) BACT is no feasible control; that BACT is 0.039 BFG gr/dscf, a maximum content of 1.3% sulfur in the coal, and 2500 gr of Sulfur/MMscf of natural gas combusted. At Severstal North America, Inc. SO2 BACT for the Blast Furnace Stoves was determined to be "no controls feasible, compliance verification via Continuous Emissions Monitoring System (CEMS)." Why was the use of CEMS not regarded as BACT at Nucor? How does Nucor plan to monitor compliance without an emissions limit and the use of CEMS?

6) The proposed permit states the Volatile Organic Compound (VOC) BACT emissions limit for the Blast Furnace/Hot Blast Stove and Top Gas Boilers is 0.0054 lb/MMBtu. However, a search of the RBLC produced a 0.0026 lb/MMBTU limit at Nucor Steel in Indiana. Please explain why this lower limit or an emission limit lower than the one currently proposed is not achievable.

7) The proposed permit states the PM10 BACT emissions limit for cast house emissions is 0.003 gr/dscf. However, a search of the RBLC produced a 0.0018 gr/dscf limit at Quanex Corporation and Steelcorr, Inc. in Arkansas. Please explain why this lower limit or an emission limit lower than the one currently proposed is not achievable.

8) The proposed permits state BACT for SO2 emissions from coke oven gas is a combination of lower sulfur coal, lime dry spraying techniques, and a dry scrubber removal of no less than 90%. There is no emission limit and no use of CEMS to monitor the actual emissions. A search of RBLC, and a review of the permits issued in other states, reveals plants with 91-92% removal efficiency, emissions limits, and the use of CEMS. Please explain why these types of conditions are not being utilized or feasible at Nucor Louisiana. No emissions limit or monitoring method in the proposed permit creates an issue with practical enforceability that LDEQ should address before the final permit is issued.

9) According to the proposed PSD permit, Nitrogen Oxides (NOx) Emissions from PCI-101 – PCI Mill vent are significant. It was not apparent looking at the application whether the feasibility of controlling these emissions was addressed. Did LDEQ evaluate whether or not controlling these emissions is feasible?

10) The proposed limit for PM10 emissions from the PCI Mill is 0.031 gr/dscf, the New Source Performance Standard (NSPS) Subpart Y standard for coal preparation plants. However, a lower NSPS Subpart Y limit of 0.02 gr/dscf was proposed April 28, 2008. Please explain how LDEQ plans to address this in the proposed permit. There should be a condition in the final permit that requires Nucor to modify their permit when the new standard is finalized.

Modeling

11) The original modeling that LDEQ relied upon to publish the public notice for this proposed permit did not account for all maintenance scenarios with respect to increment and impacts on ambient air quality. On November 17, 2008, the applicant committed to providing revised Class I and II modeling to LDEQ, EPA Region 6, and U.S. Fish and Wildlife Service (FWS). The revised modeling will account for emissions from all maintenance scenarios that are being permitted and could occur up to 120 days per year in addition to normal operation with respect to increment, National Ambient Air Quality Standards (NAAQS), and Air Quality-Related Values (AQRV) compliance demonstrations. At this time, EPA Region 6 is unable to determine whether the proposed source will have an adverse impact on NAAQS or PSD Class I and II increments. We will complete our modeling review after the revised modeling has been submitted. Since the original modeling used to support the proposed permit at public comment was incomplete, EPA strongly recommends a new comment period for FWS, EPA, and the public to evaluate the new modeling analysis that will be provided to LDEQ, the revised air permit application, and the preliminary determination.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
National Wildlife Refuge System
Branch of Air Quality
7333 W. Jefferson Ave., Suite 375
Lakewood, CO 80235-2017

IN REPLY REFER TO:

FWS/ANWS-AR-AQ

November 20, 2008

Ms. Soumaya Ghosn
Public Participation Group
Louisiana Department of Environmental Quality
PO Box 4313
Baton Rouge, Louisiana 70821-4313

Subject: Consolidated Environmental Management Inc - Nucor Steel Louisiana, Agency Interest Number 157847, Permit Number 2560-00281-V0 and PSD-LA-740, and Activity Number PER20080001 and PER20080002.

Dear Ms. Ghosn:

The US Fish and Wildlife Service (FWS) has reviewed the proposed permit, statement of basis, and various revisions of the permit application submitted by Consolidated Environmental Management - Nucor Steel Louisiana (Nucor) regarding construction of a greenfield pig iron steel plant to be located in Convent, St. James Parish. The proposed facility is located 170 km west of the Breton Wilderness Area (WA), a Class I area managed by the FWS.

We have concerns regarding the bypass emissions proposed in the permits and the lack of an analysis inclusive of these emissions. We also have questions regarding analytical methods, unclear discussions, and unreferenced data used by Nucor in the Class I analysis submitted to FWS on September 11, 2008. And we have concerns with respect to the indicated Class I increment violations at the Breton WA and Nucor's analysis with respect to this increment. In summary, we believe that the Class I analysis performed by Nucor is incomplete. With the information that the FWS has at this time, we cannot determine the impact that the proposed facility will have to air quality and air quality related values (AQRV's), including visibility, at the Breton WA.

Under the Clean Air Act (CAA) the Federal Land Manager (FLM) is charged with an "affirmative responsibility to protect" the AQRV's at Class I areas, 42 U.S.C. § 7475(d)(2)(B). Due to the incomplete nature of the Class I analysis, we cannot carry out this charge. Therefore, we anticipate that a complete Class I analysis will be provided to us in advance of permit issuance and that we will be afforded an appropriate review period to consider the information

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and respond. Until the time when a complete analysis has been provided to FWS, we can not do the work necessary to make our determination. Our analysis relies on good data, and it is inappropriate for us to make unsupported assumptions as to whether or not there will be adverse impacts to AQRV's at Breton. We look forward to receiving complete information that will better inform us, as well as the public, as to the potential impacts of the proposed facility.

We expect that FWS be given a full 60 day review period to evaluate the information when it is provided by the applicant.

Bypass Emissions

The proposed pig iron plant will consist of two coke oven batteries. Each battery will exhaust through a Flue Gas Desulfurization (FGD) stack via a series of five heat recovery steam generators (HRSGs). In total, there are 10 HRSGs vented through two FGD stacks during normal operation. It is our understanding that normal operation is the only scenario modeled for AQRV analysis at Breton.

However, the applicant anticipates a routine maintenance schedule that could equate to 12 days per year for each HRSG, at which time emissions would bypass the inoperative HRSG unit. Each coke oven battery would have a maximum of 60 days (12 days for each of the 5 HRSGs) in which emissions would bypass the FGD stack controls. Therefore, the maintenance schedule as described by Nucor, ranges from allowing 120 days per year that at least one HRSG will be in bypass mode, to the acute short term situation of potentially 60 days per year that two HRSGs will be bypassed simultaneously. Based upon data provided by the applicant, the hourly SO_2 emission rate for a single-HRSG-bypass scenario is more than double that of normal operations; for the two-HRSG-simultaneous bypass scenario, that normal operations SO_2 emission rate increases nearly three-and-one-half times.

The maintenance schedule, as described, results in 60 – 120 days per year that air emissions are bypassing pollution controls. In other words, for one third of the year the Breton WA will be impacted by SO_2 emissions much greater than the emission rates that were modeled. We cannot determine the impact to the Breton WA based on the modeling provided to us, as it does not represent the maximum emissions the Class I area will experience.

We request that these bypass emissions be modeled and their impact on the Class I area be predicted.

Class I Increment at Breton

The Class I analysis performed by the applicant does not adequately assess increment consumption at Breton. The Class I significant impact levels for SO_2 were exceeded for the short term, 3 hour and 24 hour averaging times. Therefore, a complete Class I increment analysis is required. No information was included in the report dated September 11, 2008, which would describe the inventories used in the increment modeling, nor did the report describe the predicted increment consumption and Nucor's contribution to increment.

No description of the inventories used by the applicant was included with the analysis. Increment evaluation must include major increment consuming and expanding sources surrounding the Breton WA. The analysis states that all SO_2 sources were modeled, but offers no additional detail or description of these inventories.

The materials forwarded to the FWS by the applicant do not indicate that the increment at Breton is consumed. However, page 94 of the State's Preliminary Determination indicates that the 3-hour and 24-hour SO_2 Class I increments are completely consumed. The assertion is also made that Nucor's contribution to that increment consumption is below the SO_2 significant impact levels. No information is included by the State or the applicant to explain this assertion. The FWS has not been provided with any modeling that demonstrates that Nucor will not contribute to the indicated increment violations at Breton for the short term SO_2 averaging periods.

Furthermore, as we have commented, emissions for operations accounting for up to one third of the year have not been modeled. Therefore, all modeling is ultimately incomplete without evaluation of the maximum emissions from the proposed project, especially as concerns the short term SO_2 increment demonstrations.

Methods Utilized by Nucor to Analyze Class I Impacts

The modeling report forwarded to FWS, dated September 11, 2008, included several modeled values represented as percentages. The FWS does not make its determinations based on single source impacts expressed as a percentage or a fraction of a total prediction. For example, modeled SO_2 concentrations at Breton receptor locations were expressed as total concentrations, Nucor concentrations, and Nucor's percentage of the total. A prediction expressed as percentages of pollutant concentration is not a value that FLM's use to determine impacts, as it does not indicate a source's direct impact on a Class I area.

In addition, we would like to see more detail with respect to unit conversions for the deposition estimates. We suggest including a worksheet showing how these conversions were calculated.

FLM Notification and Public Participation

It is our understanding that this permit action is both a Prevention of Significant Deterioration permit as well as a concurrent Title V Operating Permit. Thus, it must meet the requirements for new or modified sources impacting federal Class I areas provided in the PSD section of the State's air quality regulations (see LAC 33:III.509.P), The PSD public participation requirements (see LAC 33:III.509.Q), and various procedural requirements of the operating permit program (including those of LAC 33:III.533). We are concerned that due to the missing Class I AQRV and increment analyses addressing the true potential emissions of the facility, the package as processed thus far fails to meet these State rule requirements.

LAC 33:III.509.P.1. requires that "The administrative authority shall provide written notice of any permit application for a proposed major stationary source or major modification, the emissions from which may affect a Class I area, to the federal land manager and the federal official charged with direct responsibility for management of any lands within any such area.

Such notification shall include a copy of all information relevant to the permit application and shall be given within 30 days of receipt and at least 60 days prior to any public hearing on the application for a permit to construct. Such notification shall include an analysis of the proposed source's anticipated impacts on visibility in the federal Class I area...." We consider an analysis of the AQRV and visibility impacts predicted due to bypass operations, which in this case can occur for between 60 and 120 days, to be relevant information necessary to our evaluation of impacts at the Class I area.

LAC 33:III.509.Q.2.c. provides that the State shall, "notify the public, by advertisement in a newspaper of general circulation in each region in which the proposed source would be constructed, of the application, the preliminary determination, the degree of increment consumption that is expected from the source or modification, and the opportunity for comment at a public hearing as well as written public comment." LAC 33:III.531.A.3.b. provides that the public notice of a permit action will include "the emissions change involved...." The incomplete information provided by both the applicant and the State regarding the Class I increment analysis, including the lack of information regarding the increment consumption inventories employed in the applicant's modeling and the apparent lack of addressing short-term, ongoing, maximum emissions scenarios, has missing information that would likely be of interest to the public as to the true degree of increment consumption and AQRV impacts that this facility will cause. Furthermore, should the federal land manager find, following submission of complete analyses by the applicant or State, that an adverse impact on visibility would result, the provisions of LAC 33:III.509.P.3. would also become relevant.

LAC 33:III.533.C. provides for a 45 day review period by EPA; LAC 33:III.533.D. addresses procedures for EPA objection to a permit; and, LAC 33:III.533.E. covers public petitions to EPA should concerns raised during the public comment period not be satisfactorily addressed. The grounds for EPA Objection include: "... the permitting authority or the owner or operator has not provided information regarding the permit...;" and, "the permitting authority failed to submit any information necessary to review adequately the proposed permit...." We believe that the missing information itemized above provides grounds for EPA to object to the permit, and/or for the public to petition EPA.

For these reasons, FWS is requesting that (1) the permit application and the preliminary determination be supplemented with complete air quality, AQRV, visibility, and increment analyses that address the bypass operating scenarios; (2) the information be provided to FWS, EPA, and the public pursuant to the provisions of the State permitting regulations; (3) that appropriate opportunity for comment be afforded to the FLM as well as the public; and, (4) Louisiana Department of Environmental Quality refrain from issuing the final permit until these required steps are completed.

For further information, please contact Jill Webster of my staff at 303-914-3804. We look forward to continuing to work with you towards resolution of these concerns.

Sincerely,

Sandra V. Silva

Sandra V. Silva, Chief
Branch of Air Quality

cc:

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Mr. Bryan Johnston
Administrator, Air Permits Division
Louisiana Department of Environmental Quality
PO Box 4313
Baton Rouge, LA 70821-4313

ZGC
ZEN-NOH GRAIN CORPORATION

November 24, 2008

Louisiana Department of Environmental Quality
Attention: Ms. Soumaya Ghosn
Public Participation Group
P.O. Box 4313
Baton Rouge, Louisiana 70821

Re: AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

COMMENTS ON PROPOSED PERMITS AND EAS FOR NUCOR-STEEL, LOUISIANA

Dear Ms. Ghosn:

We are pleased to present the following comments to PSD Permit No. PSD-LA-740 (the "PSD Permit"), Part 70 Permit No. 2560-00281-VO (the "Part 70 Permit") (collectively with the PSD Permit, the "Permits"), and the environmental assessment statement ("EAS") issued to and for Consolidated Environmental Management, Inc.-Nucor Steel, Louisiana's ("Nucor") proposed new pig iron manufacturing plant in Convent, Louisiana.[1] We at Zen-Noh Grain Corporation ("Zen-Noh") look forward to a long-lasting relationship as good neighbors with the proposed Nucor facility. However, we firmly believe that being a truly good neighbor requires a solid foundation and a spirit of give-and-take from both parties. As we have discussed with Nucor and the Louisiana Department of Environmental Quality ("LDEQ"), we are deeply concerned about the possible effects that Nucor, in particular but not limited to Nucor's operations and emissions of potential grain adulterants, could have on Zen-Noh's business and the health and welfare of our employees, customers, and shareholders. We have not had enough time to fully evaluate those possible impacts and do not wish to raise any red-flags prematurely. We feel, however, that we have been boxed into a corner and are compelled to present these comments before the end of the initial public comment period. We will submit revised or additional comments as they develop. In the meantime, my door is certainly open to both LDEQ and Nucor to discuss Zen-Noh's concerns and, with luck, continue laying the foundation for a good neighborly relationship for years to come.

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[1] The Permits are found in the public record in EDMS Document No. 38131069. The EAS is found in the public record in EDMS Document No. 36847130. Both EDMS documents are incorporated herein by reference

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EXHIBIT
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Zen-Noh's Requests for 45-Day Extension of Time and Additional Information Should Have Been Granted

1. LDEQ acted arbitrarily and capriciously by denying or failing to timely approve Zen-Noh's reasonable request for a 45-day extension of time to file comments on the above referenced permits issued to Nucor and the environmental assessment statement. The permits, which were issued for public comment on October 15, 2008, incorporate hundreds of pages of information Nucor submitted to LDEQ on October 1, 2008. Zen-Noh made several immediate efforts to contact Nucor and establish a dialogue regarding Zen-Noh's concerns over the very large pig iron facility that Nucor proposes to construct adjacent to Zen-Noh's property line. Nucor initially was unable to meet with Zen-Noh. On November 10, Zen-Noh met with LDEQ to discuss Zen-Noh's concerns and to ask LDEQ for an extension of time to submit comments. LDEQ advised Zen-Noh to work it out with Nucor and to submit an extension request in writing. On November 11, Zen-Noh finally met with Nucor and advised Nucor of Zen-Noh's concerns and requests for additional information to evaluate the proposed permits. Zen-Noh advised Nucor that Zen-Noh would be requesting an extension, probably for 90-days. Nucor asked Zen-Noh not to request a definite period of time to comment. So, as agreed with Nucor, Zen-Noh submitted on November 13 a request for an indefinite extension, to be measured by Nucor's response with additional information.[2] LDEQ told Zen-Noh that LDEQ could not approve an indefinite request, so on November17, Zen-Noh submitted a request for a 45-day extension of time to submit comments. On November 19, LDEQ told Zen-Noh that requests for extended comment period would be addressed at the beginning of the public hearing to be held on November 20. Zen-Noh attended the public hearing on November 20, but there was no discussion of the extension requests. Zen-Noh called several individuals at LDEQ throughout the day on Friday, November 21, but never received a call-back or any word on the extension request. LDEQ should have granted the extension request no later than at the beginning of the public hearing. Not to have taken action on the extension request was surprising and unfair, not just to Zen-noh but to any person who may have been seeking an extension. The proposed Nucor facility is a giant, one that will have a huge and possibly detrimental environmental impact on its neighbors and the people of southern Louisiana, such that the bare minimum comment period was clearly inadequate. Zen-Noh thus requests that LDEQ consider all facts and issues Zen-Noh raises to LDEQ's attention before LDEQ issues the final permits.

2. During the meeting on November 10, Zen-Noh advised LDEQ of Zen-Noh's intention to conduct ambient air quality modeling to verify the modeling performed by Nucor and to perform certain additional modeling (such as, modeling the impact of Nucor's emissions on Zen-Noh's equipment and grain. Zen-Noh's expert, Dr. Paolo Zannetti, had previously, on November 6, requested the electronic model files by way of an e-

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[2] Zen-Noh's formal communications with LDEQ are attached hereto as Exhibit 1 and incorporated by reference, in their entirety, as comments to the issuance of the permits.

mail to LDEQ. See Affidavit of Dr. Paolo Zannetti, Q.E.P., attached hereto as Exhibit 2. Dr. Zannetti followed up his second request with an e-mail to LDEQ on November 14. Dr. Zannetti did not receive the requested electronic files until November 20, after the public hearing had started. The model input files are critical information necessary to enable Zen-Noh to evaluate the substantive merits of the air quality impact assessments upon which the proposed permits rely. LDEQ's failure timely to provide the model files and refusal to grant Zen-Noh's request for an extension deny Zen-Noh the opportunity to submit meaningful substantive comments before the end of the comment period. Dr. Zannetti reasonably needs at least two to four weeks to perform the computer modeling he advised LDEQ about on November 10. Zen-Noh requests that LDEQ allow Zen-Noh at least an additional 30-days to revise these comments and submit additional comments to LDEQ.

3. Zen-Noh also provided Nucor a written request regarding the extension request and identifying the information Zen-Noh needed to thoroughly evaluate Nucor's permit applications. Nucor responded by e-mail on November 17, promising to work on responses to Zen-Noh's specific requests and to "provide it shortly." Zen-Noh has not received any further communication, response or information from Nucor. Nucor should not be heard to object to Zen-Noh's request for additional time to submit comments.

4. During a meeting with representatives of Zen-Noh on November 10, 2008, LDEQ admitted that it had made permit decisions based on "Google searches" and other independent internet research that LDEQ conducted because Nucor did not provide sufficient technical support documentation with its BACT analyses. LDEQ admitted that it did not save or print the research and did not make it available for public review and comment. LDEQ must identify each permit decision that was based in whole or in part on information not made available for public review and comment. Each such decision should be reconsidered and all supporting information made available for proper public review and comment, before the final permits are issued. *Nat'l Wildlife Fed'n v. Marsh*, 586 F. Supp. 985 (D.D.C. 1983).

5. In issuing a permit, LDEQ "is required to make basic findings supported by evidence and ultimate findings which flow rationally from the basic findings" and to detail the connection between the evidence and the ultimate decision to issue the permit. *Save Ourselves, Inc. v. Louisiana Envtl. Control Comm.*, 452 So. 2d 1152, 1159 (La. 1984). Failing to do so is an abuse of LDEQ's discretion and position as public trustee. *In re E.I. du Pont de Nemours & Co.*, 674 So. 2d 1007, 1011 (La. App. 1996).As the public trustee, LDEQ must balance the interests of the environment and public -- including Zen-Noh -- before issuing the Permits. *Save Ourselves, Inc. v. Louisiana Envtl. Control Comm.*, 452 So. 2d 1152 (La. 1984).

6. LDEQ's failure to consider Zen-Noh's interests could result in an inverse condemnation of Zen-Noh's facility, a property right protected under Article I of the Louisiana Constitution and the Fifth Amendment of the United States Constitution.

Among other things, LDEQ has not considered the effect Nucor's emissions and operations -- on property to be acquired with public funds -- would have on the wholesomeness and marketability of Zen-Noh's grain and business.

7. By failing to consider the effects Nucor's emissions and operations would have on Zen-Noh, LDEQ has not addressed all potential and real adverse environmental effects of Nucor's proposed operations, and has not demonstrated that the social and economic benefits of Nucor's activities outweigh the environmental impact costs. *See* L.R.S. 30:II.2018(B). LDEQ also has not articulated a reasonable consideration of alternatives that would offer more protection to the environment, *id.*, including among other things alternate sites and alternative processes for the manufacture of pig iron.

Emissions of All Toxic or Deadly Pollutants Must Be Quantified and Evaluated

8. Stack testing at the Haverhill North Coke heat recovery coke plant demonstrated that hydrogen chloride ("HCl") and sulfuric acid mist ("H2SO4") emissions from heat recovery coke oven FGD units and HRSG bypass vents are much higher than the emission factors reported in AP-42. These higher emission rates are reflected in the permits for Haverhill North Coke, Indiana Harbor Coke, and Gateway Energy, and the draft permits for Middletown Coke and FDS Coke, but they are not reflected in the Nucor Permits. HCl and H2SO4 are Toxic Air Pollutants ("TAP") regulated under LAC 33:III Chapter 51. Ambient impacts must be evaluated if HCl emissions exceed the Minimum Emission Rate of 500 pounds/year or H2SO4 emissions exceed 1,200 pounds/year. LAC 33:III.5112. Based on the more realistic emission estimates used at every other heat recovery coke plant, Nucor's coke battery FGD units will emit more than 10 tons/year of both HCl and H2SO4. LDEQ should quantify emissions of HCl and H2SO4 from the coke ovens and assess the ambient impact of these emissions.

9. Iron ore sinter plants are a major source of dioxin emissions..[3] Dioxins and furans are extremely toxic carcinogens and hormone disruptors, even at very low concentrations. They are also bioaccumulative, which means that they become concentrated in body fat. Dioxin contamination may cause rivers and streams to become unfishable. Dioxin concentrations in sinter plant exhausts have been measured as high as 43

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[3] *See* "The Shell Dioxin Destruction System," H. Tang et al., presented at the Solid and Hazardous Waste Management Conference, Feb. 2003, attached hereto as Exhibit 3; Sinter Plants in the Iron Industry; Development Document for Final Effluent Limitations Guidelines and Standards for the Iron and Steel Manufacturing Point Source Category, EPA-821-R-02-004, pp. 9-7 – 9-9 (April 2002) (dioxins and furans in wastewater from sinter plants that use wet scrubbing).

TEQ/m^3.[4] LDEQ and Nucor should quantify dioxin or furan emissions from the sinter plant and evaluate the ambient impact of these emissions.

10. Water cooling during slag processing has been demonstrated to result in emissions of hydrogen sulfide ("H2S"), a noxious compound that smells like rotten eggs or raw sewage and is immediately dangerous to life and health at concentrations as low as 100 ppm. H2S is a TAP with a Minimum Emission Rate, which requires ambient impacts to be evaluated, of 800 pounds/year. LAC 33:III.5112. H2S emissions from slag processing have been measured at rates of up to 0.704 pounds per ton of pig iron produced.[5] Based on Nucor's projected production of pig iron, H2S emissions will be significant. LDEQ should quantify and evaluate the ambient impact of H2S emissions from slag processing.

11. LDEQ should quantify the PM10 emissions from the proposed rail loading/unloading processes and truck loading/unloading processes.

BACT Determinations for the Blast Furnace/Hot Blast Stoves Are Improper

12. The blast furnace/hot blast stoves are major sources of criteria air pollutants. The hot blast stoves will emit a combined 442.6 tons/year CO, 132.5 tons/year NOx, 55.2 tons/year PM10, 122.1 tons/year SO2, and 29.0 tons/year VOC, through two common stacks (STV-101 and STV-201). Given the magnitude of the emissions from the hot blast stoves, LDEQ should evaluate every technology potentially applicable to emissions similar to the hot blast stove emissions, including alternative and innovative process, collateral environmental benefits, and cost-effectiveness.

13. LDEQ improperly ruled out a fabric filter/baghouse for control of PM10 emissions from the blast furnace and hot blast stoves because "blast furnace gas has a high moisture content." LDEQ and Nucor did not provide any technical documentation supporting this statement. Fabric filters are the most efficient (99 – 99.9%)[6] control technology for removal of PM10 from iron and steel production and industrial boilers. The Indian Central Pollution Control Board reports that fabric filters have been demonstrated to achieve 99+% reduction efficiency for particulate matter in blast furnace emissions.[7] If fabric filters are technically feasible for the blast furnace and hot blast stove emissions, they will likely be the top selection for BACT. Fabric filters are not affected by the absolute moisture content in the gas stream; rather, the relative humidity, which is a function of water content and temperature, determines the technical feasibility of fabric filters. LDEQ's analysis does not provide any technical

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[4] "Emissions of Dioxins and Furans from Metallurgical Processes: Iron Ore Sintering and Secondary Zinc Production," U. Quass, attached as Exhibit 4. TEQ stands for "Toxicity Equivalent" and is a measure of how deadly or toxic one form of dioxin is compared to another.

[5] BAT Reference Document, pp. 187-88, attached hereto as Exhibit 5.

[6] *See* Air Pollution Technology Fact Sheet, Fabric Filters, attached as Exhibit 6.

[7] *See* newsletter on Preventative & Control Measures of Cadmium Contamination to Environment, attached as Exhibit 7.

basis -- such as the relative humidity, water content or temperature *at the point of control* -- for its determination that fabric filters are technically infeasible due to the moisture content of blast furnace gas. LDEQ should provide technical support for its determination, including engineering calculations and literature, or should evaluate the control efficiency and cost-effectiveness of fabric filters as BACT for the control of PM10 from the hot blast stoves.

14. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that a cyclone-wet scrubber combination is BACT for the control of PM10 emissions from the hot blast stoves.

15. LDEQ improperly deemed selective catalytic reduction ("SCR") to be technically infeasible for the control of NOx emissions from the hot blast stoves because "control [of NOx emissions] has not been demonstrated beyond [30 ppmv] at any efficiency." LDEQ and Nucor did not provide any technical documentation supporting this statement. Duke Power Cliffside Steam Station has reported, in the engineering literature, that it achieves 93% NOx removal efficiency, down to concentrations of 9-12 ppm, using SCR reactors furnished by Riley Power, Inc.[8] Applications of SCR in the electric utility industry are relevant to and should be considered in the determination of BACT for the hot gas stoves. Based on parameters stated by Nucor in the Emission Inventory Questionnaire ("EIQ") for the hot blast stoves, the concentration of NOx in the hot blast stoves common stacks is 39.5 ppmv (average) to 66.3 ppmv (maximum). Control of NOx to a level 9-12 ppm will result in a 73% -- or 236.7 ton/yr -- reduction in NOx emissions. LDEQ should provide technical support for its determination, including engineering calculations and literature, or should evaluate the control efficiency and cost-effectiveness of SCR as BACT for the control of NOx from the hot blast stoves.

16. LDEQ improperly deemed the EMx (SCONOx) technology to be technically infeasible for the control of NOx emissions from the hot blast stoves because the stoves "will experience regular temperature swings between 180-400°C (356-752°F)" and "large temperature swings during operation can render the system ineffective as pass-through leaks develop within the catalyst modules." PSD Permit, p. 17. LDEQ and Nucor did not provide any technical documentation supporting this statement. According to Nucor, there will be three hot blast stoves for each blast furnace. Application, p. 1-11. The hot blast stoves will be operated in a cyclical fashion, with one producing hot blast, one being heated, and one in transition, and with the three exhausts vented to a common stack. *Id.* Therefore, the temperature in the hot blast stove common stack will not be variable to the same degree as the temperature in each individual hot blast stove exhaust. According to the EIQ for the hot blast stoves, the

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[8] *See* "Increasing SCR NOx removal from 85% to 93% at the Duke Power Cliffside Steam Station," Terence R. Ake, et al., ASME Power Division Special Section (April 2006), attached as Exhibit 8.

temperature in the hot blast stove common stacks will be 375°F. According to the EMx catalyst manufacturer, the EMx technology will have a 90+% reduction efficiency at temperatures between 350°F and 700°F and has a maximum temperature of 1,200°F.[9] The catalyst capacity -- not the NOx reduction efficiency -- varies from 10% to 75% over the same temperature range. In other words, more catalyst is necessary to remove the same amount of NOx. This goes to the cost-effectiveness of the EMx technology, not its technical feasibility. Assuming a reduction efficiency of 75%, the EMx technology will reduce NOx emissions from the hot blast stoves by 176.3 tons/year.[10] LDEQ should provide technical support for its determination, including engineering calculations and literature, or should evaluate the control efficiency and cost-effectiveness of EMx as BACT for the control of NOx from the hot blast stoves.

17. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that low NOx fuel combustion is BACT for the control of NOx emissions from the hot blast stoves.

18. LDEQ improperly deemed the EMx technology to be technically infeasible for the control of CO and VOC emissions from the hot blast stoves because the stoves "will experience regular temperature swings between 180-400°C (356-752°F)" and "large temperature swings during operation can render the system ineffective as pass-through leaks develop within the catalyst modules." PSD Permit, p. 24. LDEQ and Nucor did not provide any technical documentation supporting this statement. According to Nucor, there will be three hot blast stoves for each blast furnace. Nucor PSD Permit Application ("Application"), EDMS Doc. No. 36847130, p. 1-11. The hot blast stoves will be operated in a cyclical fashion, with one producing hot blast, one being heated, and in transition, and their exhausts will be vented to a common stack. *Id.* Therefore, the temperature in the hot blast stove common stack will not be variable to the same degree as the temperature in each individual hot blast stove exhaust. According to the EIQ for the hot blast stoves, the temperature in the hot blast stove common stacks will be 375°F. According to the EMx catalyst manufacturer, the EMx technology will reduce CO and VOC concentrations from about 50 ppm to about 2.5 ppm, and the catalyst has a maximum temperature of 1,200°F.[11] The EMx technology will reduce the CO emissions from the hot blast stove from 50.5 ppm to about 2.5 ppm, a 95% reduction, or 420.5 tons/year.[12] LDEQ should provide technical support for its determination, including engineering calculations and literature, or should evaluate the

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[9] *See* EMx Catalyst Technical Specification, EmeraChem, attached as Exhibit 9.

[10] It should be noted that this level of emissions reductions implicitly incorporates the BACT selected by LDEQ, low NOx fuel combustion, which is reflected in the EIQ for hot blast stoves.

[11] *See* EMx Catalyst Technical Specification, EmeraChem, attached as Exhibit 9.

[12] It should be noted that this level of emissions reductions implicitly incorporates the BACT selected by LDEQ, good combustion practices, which is reflected in the EIQ for hot blast stoves.

control efficiency and cost-effectiveness of EMx as BACT for the control of CO and VOC from the hot blast stoves.

19. LDEQ's analysis of the EMx technology as BACT for control of NOx emissions, CO emissions, and VOC emissions from the hot blast stoves, including the analysis of the cost-effectiveness of this technology, should consider the collateral environmental benefit that NOx, CO and VOCs are all reduced by the EMx technology.

BACT Determinations for the Cast House Are Improper

20. LDEQ correctly determined that wet scrubbers and cyclones individually are technically feasible for control of PM10 emissions from the cast house. LDEQ determined that a cyclone-wet scrubber combination is BACT for control of PM10 emissions from the hot blast stoves and top gas boilers, but LDEQ and Nucor did not evaluate the technical feasibility of cost-effectiveness of a cyclone-wet scrubber combination as BACT for control of PM10 emissions from the cast house. LDEQ reports that cyclones have an 80% control efficiency and wet scrubbers a 98% control efficiency for PM10; in combination, then, the cyclone and wet scrubber should have a 99.6% control efficiency for PM10. LDEQ determined that the fabric filter employed by Nucor would have a control efficiency of only 99%. LDEQ should evaluate the control efficiency and cost-effectiveness of a cyclone-wet scrubber combination as BACT for control of PM10 emissions from the cast house.

21. Providing a nitrogen blanket in the blast furnace prevents molten iron from reacting with oxygen and forming "brown fume." This technique has been employed by (at least) the Stahlwerke Bremen blast furnaces since 1991 and demonstrated to achieve 97-99% PM reduction efficiency. Exh. 5, pp. 203-4. LDEQ should evaluate the cost-effectiveness of a nitrogen blanket as part of the BACT for control of PM10 emissions from the cast house.

22. LDEQ determined BACT for PM10 emissions from the cast house to be local collection hoods and baghouse filter at 0.013 lbs of PM per ton of hot metal. LDEQ and Nucor did not provide sufficient technical documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, to justify this selection of BACT, the substitution of PM for PM10, or to verify that this BACT selection is less than 0.003 gr/dscf, the applicable NESHAP Subpart FFFFF emission limit. Typical new baghouse design efficiencies are 99-99.9%.[13] BACT for PM10 emissions from the cast house at the Quanex Corporation-MacSteel facility was determined to be 99.5% control. PSD Permit, p. 26. BACT for PM10 emissions from the cast house should be at least as stringent as 99.5% control efficiency *and* less than 0.003 gr/dscf.

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[13] *See* Exh. 6.

23. LDEQ and Nucor should provide technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, to justify the selection of local collection hoods and fabric filters at 0.013 lbs of PM per ton of hot metal as BACT for PM10 emissions from the cast house.

BACT Determinations for the Coke Ovens Are Improper

24. LDEQ and Nucor did not consider and account for emissions from the coke oven batteries when one of the coke battery flue gas desulfurization ("FGD") units is down for maintenance. The Middletown Coke Company, which is constructing a SunCoke heat recovery coke oven, requested a 5-day period for annual maintenance of its FGD baghouse based on the recommendations of the FGD vendor. It is reasonable to expect that Nucor's FGD units will also be shut down periodically. During periods when one of Nucor's coke oven FGDs is shut down, that coke battery will emit a combined 388.7 pounds /hour PM10 and 3,762.5 pounds/hour SO2 and an unknown amount of HCl and H2SO4. Over the course of a 5-day shutdown, the coke battery would emit 23.3 tons of PM10 and 225.8 tons of SO2. These potential emissions should have been included in LDEQ's analyses of BACT and ambient air quality impacts.

25. The Permits should be revised to explicitly prohibit coke charging operations in a coke battery when the coke battery FGD system is shut down or otherwise is not functioning in compliance with the applicable BACT limits.

26. LDEQ should have explicitly evaluated BACT for control of emissions during Heat Recovery Steam Generating ("HRSG") unit maintenance downtime. HRSG units generate steam from the excess heat in coke oven gas, which in turn is used by Nucor to generate electric power. Nucor's preliminary design includes five HRSG units for each coke battery – a total of ten HRSG units. Nucor estimates that each HRSG unit will be down for maintenance a total of 12 days per year, which appears to be a low estimate -- by two days per unit -- considering the experience at the Haverhill North Coke Company plant and the recommendations of the coke plant vendor, Uhde. Maintenance downtimes for HRSG units are lengthy because it takes several days to cool an HRSG unit down to a safe temperature and then to reheat it to operating temperature. When an HRSG unit is down, the coke ovens that normally vent to the FGD unit through that HRSG instead vent uncontrolled through the HRSG bypass vent stack. Nucor estimates that each of the ten HRSG bypass vent stacks will emit 74.7 pounds/hour PM10, 752.5 pounds/hour SO2, 30.74 pounds/hour NOx, and various other pollutants when venting. Together, the HRSG bypass vents will emit a total of 489.2 tons/year PM10, 1,083.2 tons/year SO2, and 201.2 tons/year NOx. During its initial review of Nucor's permit application, LDEQ requested Nucor to evaluate the feasibility of eliminating the HRSG bypass emissions. On October 1, 2008, Nucor submitted a report prepared by Uhde, titled "Study to Evaluate Means to

Prevent Venting of Hot Waste Gas during Annual HRSG Inspection," in which Uhde unequivocally reported that providing spare HRSG units to eliminate bypass venting "is feasible and represents a practical solution." Nucor did not present a top-down BACT evaluation demonstrating the cost-effectiveness of this proposal (as it had not done for any other emission source). However, Uhde's report demonstrates that by maintaining a peak steam generating capacity, a system with spare HRSG units would generate as much as $6,720,000 per year in electric power (at $0.20/kWh). The cost-effectiveness and collateral environmental and energy benefits of spare HRSG units, as proposed by Uhde, should be properly evaluated and supported with technical documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties.

27. The Haverhill North Coke plant has equipped all HRSG bypass vent stacks with sensors that detect when the bypass stacks are open or partially opened. The sensors transmit an alarm to the control room when there is stack gas flow to any of the bypass vent stacks. Haverhill's operating permit requires the plant to record and maintain daily records for each bypass vent stack, including the time that there was any flow through the bypass vent stack. Similar monitoring, alarming and recordkeeping requirements, and a requirement to respond immediately to any unplanned venting, should be required for the Nucor HSRG bypass vent stacks and should be incorporated into the Permits.

28. The Part 70 Permit should be revised to include SO2, PM10, NOx, lead, mercury and sulfuric acid mist emission testing requirements for the HRSG bypass vents.

29. During a meeting with Zen-Noh on November 10, 2008, LDEQ stated that LDEQ had eliminated spare HRSG units from consideration because, based on LDEQ's interpretation of a site map provided by Nucor, there will not be enough room for spare HRSG units. This is improper for several reasons. First, LDEQ did not make any drawing with sufficient detail and scale necessary to make such a determination available for public review. More important, the Nucor plant, none of which has been constructed, will occupy a small fraction of the 4,000+ acre site acquired by the State for Nucor's use. In the opinion of Dr. Michael Jennings, Nucor easily can and should reconfigure the plant layout to accommodate spare HRSG units. *See* Affidavit of Dr. Michael Jennings, and opinion attached thereto, attached as Exhibit 10 hereto.

30. Dr. Jennings is of the opinion that two alternate configurations can eliminate both the HRSG bypass venting and the completely uncontrolled venting when the coke battery FGD units are down for maintenance. *See* Exhibit 10. The first solution utilizes 25% larger HRSG units so that four HRSG units can handle the load of five, and spare FGD units. The second solution utilizes one spare HRSG unit and a spare FGS unit.[14] Both

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[14] It should be noted that neither of Dr. Jennings' proposed solutions is the same as the options Nucor discussed in its response to LDEQ's request for additional information. Those options included venting coke ovens from one battery all the way over to the HSRG units in the other battery, and providing a complete set of spare HRSG units. It is small wonder Nucor found those options to be too expensive.

solutions eliminate the need to send untreated releases through the bypass stacks during maintenance. Both employ the same technology as the current design, and both provide redundancy that will result in additional levels of operating reliability ad flexibility. The cost-effectiveness and collateral environmental and energy benefits of both options proposed by Dr. Jennings should be evaluated, with support by technical documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties.

31. LDEQ and Nucor should have considered alternative and innovative technologies for the control of emissions from the coke ovens, including the direct reduction iron ("DRI") and COREX® processes, which manufacture pig iron without the use of coke -- and hence eliminate coke oven, coke charging and coke pushing emissions entirely.

32. SCR was found to be technically feasible, and almost cost-effective, for control of NOx emissions from the heat recovery coke ovens at Haverhill North Coke. The Haverhill coke ovens are similar to the Nucor coke ovens but emit less NOx. Therefore, SCR might be cost-effective for the control of NOx emissions from the Nucor coke ovens. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that SCR is technically infeasible or cost prohibitive for the control of NOx emissions from the coke ovens.

33. BACT for control of SO2 emissions from heat recovery coke ovens has previously been determined to be 92%, particularly at the Haverhill North Coke plant. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that the coke battery FGD units cannot reliably achieve an SO2 control efficiency of 92%, or at least 91%, when the six-month rolling average sulfur content of the charge material is less than 1.0%. LDEQ and Nucor also did not demonstrate that the coke battery FGD units cannot reliably achieve an SO2 control efficiency of at least 92% when the six-month rolling average sulfur content of the charge material is equal to or greater than 1.0%.

34. Together, the coke oven batteries will emit 0.22 tons/year of mercury through the coke oven FGD units. Mercury is a toxic heavy metal that is routinely analyzed for by Zen-Noh's clients and the Federal Grain Inspection Service ("FGIS") inspectors at the Zen-Noh facility. Mercury contamination may result in seizure of the load of grain by the Food and Drug Administration ("FDA"). The PSD permit for the Granite City non-recovery coke oven requires the installation of an activated carbon injection system upstream of the flue gas desulfurization unit, and to obtain 90% reduction of mercury emissions. This control technology is technically feasible and should be required as MACT for the control of mercury emissions from the coke ovens.

35. LDEQ improperly deemed wet scrubbers to be technically infeasible for the reduction of SO2 emissions from the coke batteries. To support its decision, LDEQ cited the size, capital cost, energy requirements, staffing requirements, and waste disposal requirements for wet scrubber flue gas desulfurization. None of these considerations renders wet scrubbers, which have been used to remove SO2 from a variety of sources for many years, technically infeasible for application in a coke oven flue.

36. LDEQ admits that wet scrubbers may achieve 95% SO removal, compared to 90% removal provided by a lime spray dryer. The coke batteries will emit 2,685.3 tons/year SO2 through the FGD stacks, even after 90% reduction by the FGD units. A wet scrubber would reduce SO2 emissions by 1,342.7 tons/year. LDEQ and Nucor should have analyzed the cost-effectiveness of the wet scrubber system as BACT. LDEQ should provide LDEQ did not do so. LDEQ should provide technical supporting documentation justifying its decision not to require a west scrubber as BACT for the coke oven exhaust.

37. Nucor did not evaluate control technologies for the emission of H2SO4 or HCl from the coke ovens. As described above, non-recovery coke ovens have been found to be significant sources of H2SO4 and HCl. Emissions of these compounds should be quantified and available control technologies should be evaluated.

BACT Determinations for Coke Charging and Pushing Are Improper

38. In regard to the BACT determinations for coke charging and pushing operations, we incorporate by reference and adopt as our own the Comments on Determination of NESHAP Compliance, set forth in a letter from Kevin D. Parr, P.E. to Bryan Johnston, dated September 29, 2008, EDMS Doc. No. 38593694. Specifically, LDEQ should require the use of collection hoods and fabric filters to control PM10 emissions during coke charging and pushing operations. As Mr. Parr noted, other non-recovery coke oven operations incorporate collection hoods and fabric filters to control PM10 emissions during coke charging and pushing operations, including the Indiana Harbor Coke Company facility in East Chicago, Indiana, the Gateway Energy and Coke Company facility in East Chicago, Indiana, and the Haverhill North Coke Company facility in Haverhill, Ohio.

BACT Determination for the Quench Towers Is Improper

39. Combined, the quench towers will emit 565.5 tons/year PM and 108.4 tons/year PM10. Given that Nucor will draw make-up cooling water from the Mississippi River, a limit of less than 500 ppm TDS in the cooling water is technically feasible. Nucor admits that a level of 500 ppm TDS can be met by using once through quench water, but rejected very low TDS quench water as BACT because Nucor intends to operate with minimal wastewater discharge. Nucor's concern may relate to certain collateral environmental impacts, e.g. wastewater discharges, but it does not relate to

the technical feasibility of using once through quench water or other collateral environmental impacts, e.g. potential contamination of Zen-Noh's equipment and grain. Limiting quench water TDS to 500 ppm would reduce PM emissions from quench towers by 308 tons/year. LDEQ and Nucor did not provide any technical documentation comparing a 500 ppm TDS limit to the 1,100 ppm TDS limit selected as part of BACT. PM emissions from the quench towers will be large-diameter, cool, wet and released at a relatively low elevation, and therefore more likely to deposit on and adhere to Zen-Noh's equipment and grain. LDEQ should consider ultra-low TDS quench water, including an evaluation of the cost-effectiveness of using ultra-low TDS quench water and the collateral environmental benefit of reducing the deposition of wet solids on Zen-Noh's equipment, and grain, and should provide technical documentation supporting its decision.

40. LDEQ's BACT decision requires the quench towers to have internal baffles. This BACT standard is less stringent than the MACT standard in 40 CFR 63.7295(b), which requires: (1) baffles such that no more than 5% of the cross sectional area of the tower is uncovered or open to the sky; (2) baffles must be washed daily unless the highest ambient temperature for the day is below 30°C; and (3) baffles must be inspected monthly and repaired or replaced within 30 days. These requirements should be incorporated in the BACT determination for quench towers at the Nucor facility.

BACT Determinations for Slag Processing Are Improper

41. LDEQ improperly deemed a wet scrubber to be technically infeasible for control of emissions from the slag granulation and processing processes because a wet scrubber would require a wastewater treatment system and a wastewater discharge. The generation of wastewater that requires treatment and discharge does not render a control technology "technically infeasible," nor does requiring control technologies to be installed in series (e.g., cyclone and wet scrubber). Moreover, LDEQ selected "water suppression" to be BACT for the control of PM10 emissions from the slag granulation and processing processes. This process, in which molten slag is cooled and granulated by high pressure water jets while falling from the end of the blast furnace slag runner, already requires water treatment, at least in the form of solids removal with a dewatering wheel. *Id.*, pp. 54, 57. As noted above, the water suppression process results in a significant collateral environmental adverse impact, the emission of large quantities of hydrogen sulfide, an extremely odorous TAP that is immediately dangerous to life and health at concentrations as low as 100 ppm. Several slag granulation plants in Germany are equipped with technically feasible wet scrubbers (called "fume condensation") systems to remove H2S from slag processing fumesExhibit 5, p. 210. The wet scrubber can be an integral part of the granulator tank/stack system. *Id.* With this technology, H2S emissions can be reduced below 0.002 pounds/ton of pig iron produced, *id.*, or 95+% H2S reduction efficiency. LDEQ

should evaluate the cost-effectiveness of a wet scrubber as BACT in conjunction with water suppression for the control of PM10 emissions and the associated collateral environmental impact, H2S, from the slag granulation and processing processes.

42. Although it appears from LDEQ's description of Nucor's slag granulation and processing process that the process will be totally enclosed and have limited drop heights, with the only emission point being the stack above the granulation tank (as described above, the wet scrubber stack), LDEQ should revise the BACT determination for this process to make this clear.

43. LDEQ should revise the BACT determination for the slag milling processes to require, in addition to fabric filters, enclosures and limited drop heights. By reducing the dust loading to the fabric filters, these technologies will improve the PM10 reduction efficiency of the control system and will reduce PM10 emissions in the event of a fabric filter malfunction.

44. LDEQ should specify a minimum control efficiencies and maximum emission rates for its determination that collection and control by fabric filters is BACT for PM10 emissions from the slag milling processes.

45. LDEQ and Nucor should provide technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, to justify the selection of collection and fabric filters as BACT for PM10 emissions from the slag milling processes.

BACT Determinations for the Topgas-Fired Boilers Are Improper

46. The topgas-fired boilers are major sources of criteria air pollutants. The topgas-fired boilers will emit a combined 1,259.9 tons/year CO, 1,402.5 tons/year NOx, 156.3 tons/year PM10, 342.0 tons/year SO2, and 82.5 tons/year VOC, through eight stacks (PWR-101 through PWR-108). Given the magnitude of the emissions from the topgas-fired boilers, LDEQ should evaluate every technology potentially applicable to emissions similar to the topgas-fired boiler emissions, including alternative and innovative process, collateral environmental benefits, and cost-effectiveness.

47. LDEQ improperly ruled out a fabric filter/baghouse for control of PM10 emissions from the topgas-fired boilers because "blast furnace gas has a high moisture content." LDEQ and Nucor did not provide any technical documentation supporting this statement. Fabric filters are the most efficient (99 – 99.9%)[15] control technology for removal of PM10 from iron and steel production and industrial boilers. The Indian Central Pollution Control Board reports that fabric filters have been demonstrated to achieve 99+% reduction efficiency for particulate matter in blast furnace emissions.[16] If fabric filters are technically feasible for the topgas-fired boiler emissions, they will

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[15] *See* Exhibit 6.

[16] *See* Exhibit 7.

likely be the top selection for BACT. Fabric filters are not affected by the absolute moisture content in the gas stream; rather, the relative humidity, which is a function of water content and temperature, determines the technical feasibility of fabric filters. LDEQ's analysis does not provide any technical basis -- such as the relative humidity, water content or temperature *at the point of control* -- for its determination that fabric filters are technically infeasible due to the moisture content of blast furnace gas. LDEQ should provide technical support, including engineering calculations and literature, for its determination that fabric filters are technically infeasible, or should evaluate the control efficiency and cost-effectiveness of fabric filters as BACT for the control of PM10 from the topgas-fired boilers.

48. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that a cyclone-wet scrubber combination is BACT for the control of PM10 emissions from the topgas-fired boilers.

49. LDEQ improperly deemed SCR to be technically infeasible for the control of NOx emissions from the topgas-fired boilers because "NOx control has not been demonstrated at high efficiency at this level of NOx concentration." PSD Permit, pp. 64-65. LDEQ and Nucor did not provide any technical documentation supporting this statement. The ultimate NOx reduction efficiency and possible need for flue gas reheating relate to the cost-effectiveness of SCR, not technical feasibility. Given the magnitude of NOx emissions from the topgas-fired boilers, even a relatively low level of NOx reduction could be cost-effective. Duke Power Cliffside Steam Station has reported, in the engineering literature, that it achieves 93% NOx removal efficiency, down to concentrations of 9-12 ppm, using SCR reactors furnished by Riley Power, Inc.[17] Applications of SCR in the electric utility industry are relevant to and should be considered in the determination of BACT for the hot gas stoves. Based on parameters stated by Nucor in the EIQ for the topgas-fired boilers, the concentration of NOx in the topgas-fired boilers stacks is 50-75.9 ppmv. Control of NOx to a level 9-12 ppm will result in up to 80% -- or 1,108.0 ton/yr -- reduction in NOx emissions. LDEQ should provide technical support for its determination, including engineering calculations and literature, or should evaluate the control efficiency and cost-effectiveness of SCR as BACT for the control of NOx from the topgas-fired boilers.

50. LDEQ improperly deemed the EMx technology to be technically infeasible for the control of NOx emissions from the topgas-fired boilers because "the hot blast stoves will operate in a cyclic fashion, such that the flue gas leaving the stoves will experience regular temperature swings between 180-400°C (356-752°F)" and "large temperature swings during operation can render the system ineffective as pass-through leaks develop within the catalyst modules." PSD Permit, p. 65. LDEQ and Nucor did not provide any technical documentation supporting this statement, which appears to

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[17] *See* Exhibit 8.

have been cut-and-pasted from the BACT determination for the hot blast stoves, and thus has no relevance to the applicability of EMx for the topgas-fired boilers. Indeed, as described above, it is not even an accurate statement with respect to the applicability of EMx for control of NOx emissions from the hot blast stoves. According to the EIQ for the topgas-fired boilers, the temperature in the topgas-fired boiler common stacks will be 375°F. According to the EMx catalyst manufacturer, the EMx technology will have a 90+% reduction efficiency at temperatures between 350°F and 700°F and has a maximum temperature of 1,200°F.[18] Assuming a conservative NOx reduction efficiency of only 75%, the EMx technology will reduce NOx emissions from the topgas-fired boilers by 1,051.9 tons/year.[19] LDEQ should provide technical support for its determination, including engineering calculations and literature, or should evaluate the control efficiency and cost-effectiveness of EMx as BACT for the control of NOx from the topgas-fired boilers.

51. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that low NOx fuel combustion or an emission rate of 0.092 lbs/MMBTU is BACT for the control of NOx emissions from the topgas-fired boilers.

52. LDEQ should evaluate the EMx technology as BACT for the control of CO and VOC emissions from the topgas-fired boilers. According to representations in the EIQ, the CO concentration in the topgas-fired boiler stack is about 55 ppm. According to the EMx catalyst manufacturer, the EMx technology will reduce CO and VOC concentrations to about 2.5 ppm, and the catalyst has a maximum temperature of 1,200°F.[20] The EMx technology will reduce the CO emissions from the topgas-fired boiler from about 55 ppm to about 2.5 ppm, a 95+% reduction, or 1,196.0 tons/year.[21] LDEQ should evaluate EMx as BACT for the control of CO and VOC from the topgas-fired boilers.

53. LDEQ's analysis of the EMx technology as BACT for control of NOx emissions, CO emissions, and VOC emissions from the topgas-fired boilers, including the analysis of the cost-effectiveness of this technology, should consider the collateral environmental benefit that NOx, CO and VOCs are all reduced by the EMx technology.

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[18] *See* Exhibit 9.

[19] It should be noted that this level of emissions reductions implicitly incorporates the BACT selected by LDEQ, low NOx fuel combustion, which is reflected in the EIQ for hot blast stoves.

[20] *See* EMx Catalyst Technical Specification, EmeraChem, attached as Exhibit 9.

[21] It should be noted that this level of emissions reductions implicitly incorporates the BACT selected by LDEQ, good combustion practices, which is reflected in the EIQ for hot blast stoves.

BACT Determinations for the Sinter Plant Are Improper

54. LDEQ improperly deemed ESPs to be technically infeasible for the reduction of PM10 emissions from the sintering process because the dust emissions would be electromagnetically bound to the ESP collection plates. LDEQ and Nucor did not provide technical documentation to support this reason. In fact, an ESP is an integral part of the Siemens VAI MEROS® sintering process, which Nucor proposes to use. LDEQ should evaluate the cost-effectiveness of an ESP as BACT for the reduction of PM10 emissions from the sintering process.

55. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that the fabric filter proposed by Nucor will achieve the BACT emission limit of <= 0.005 gr/dscf.

56. LDEQ's evaluation of SCR for the reduction of NOx emissions from the sintering process improperly considers only a configuration with the SCR unit upstream of the sulfur control technology. In the MEROS process, SO2 is contacted with calcium hydroxide and/or sodium hydroxide (and converted to calcium sulfate or sodium sulfate) upstream of a fabric filter that must be designed to achieve 99+% control efficiency and a PM emission rate <= 0.005 gr/dscf. An SCR unit located downstream of the fabric filter would not be subject to the fouling discussed by LDEQ. An SCR system located downstream of the fabric filter would likely require a supplemental heat source, e.g. an in-line burner, to raise the temperature of the flue gas. This does not render SCR technically infeasible, although it may reduce the cost-effectiveness of the SCR system. The MEROS system vent stack will emit 749.9 tons per year of NOx. Even an 80% reduction in NOx emissions would justify a significant expenditure. LDEQ should evaluate post-MEROS SCR as BACT for the reduction of NOx emissions from the sintering process. In addition, as noted above, sinter plants are significant sources of dioxin emissions. A study of sinter plant emissions found that those with SCR had lower concentrations of dioxins and furans (0.995-2.06 TEQ/Nm^3) in the stack gas than did a sinter plant that did not employ SCR for control of NOx emissions (3.10 TEQ/Nm^3).[22] LDEQ's evaluation of SCR as BACT for reduction of NOx emissions from the sintering process should consider the important collateral benefit of reducing dioxin emissions.

57. As noted above, Nucor's sintering process will be a major source of dioxins and furans, which are extremely toxic and bioaccumulative carcinogens. LDEQ should evaluate the Shell Dioxin Destruction System ("SDDS") as BACT for the reduction of NOx emissions. SDDS can achieve over 99.9% destruction of dioxins and has been

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[22] *See* "Sinter plants in the iron industry," coordinated by P. Finley (April 2004), attached as Exhibit 11, p. 10.

offered with performance guarantees of less than 0.01 ng [TEQ]/Nm^3.[23] When used with ammonia injection, SDDS removes both dioxins and NOx. SDDS operates at relatively low temperatures (as low as 160°C), but for use in the MEROS system vent, the exhaust gas will likely require supplemental heating, e.g., an in-line burner. The catalytic reaction generates heat that can be recovered to pre-heat the exhaust gas. The need to pre-heat the exhaust gas may affect the cost-effectiveness of the SDDS system but does not render it technically infeasible. The SDDS has been used in a great number of facilities for dioxins and NOx reduction since 1996. The SDDS has been demonstrated to achieve 80-99% NOx reduction in a variety of industrial processes. The MEROS system vent stack will emit 749.9 tons per year of NOx. Even an 80% reduction in NOx emissions, i.e. 600 tons/year, will justify a significant expenditure. LDEQ's evaluation should also consider the very important collateral environmental benefit that the SDDS system will reduce the significant dioxin emissions by over 99.9%.

58. Siemens is constructing a new sinter plant for Dragon Steel Corporation in Taiwan, with scheduled start-up in December 2009. The new plant will utilize waste gas recirculation and integrated SO2, NOx and dioxin control facilities. LDEQ should consider this technology for applicability as BACT for the removal of SO2 and NOx from the sintering process, with the important collateral environmental benefit of reducing dioxin emissions.

59. LDEQ eliminated a thermal oxidizer from consideration as BACT for reduction of CO and VOC emissions from the sintering process because "it has unacceptable energy and environmental impacts. The sintering process will emit 27,193 tons/year of CO, so it is not implicitly clear that the increase in NOx emissions will outweigh the reduction of CO emissions provided by a thermal oxidizer. LDEQ and Nucor did not -- but should -- calculate the amount of natural gas required to operate the thermal oxidizer or the resulting NOx emissions. LDEQ and Nucor also did not -- but should -- evaluate the cost-effectiveness of a thermal oxidizer for reduction of CO and VOC emissions from the sintering process.

60. LDEQ should re-evaluate SCR, SNCR, NSCR, EMx and SDDS as BACT for control of NOx emissions assuming that a thermal oxidizer is used to control CO and VOC emissions from the sintering process and the NOx control technology is placed downstream of the oxidizer. LDEQ eliminated each of these processes (except SDDS, which LDEQ did not evaluate) from consideration in part because of the temperature of the MEROS system exhaust gas, and eliminated the thermal oxidizer from consideration due to the generation of additional NOx. A thermal oxidizer will increase the temperature of the exhaust gas to at least the minimum required for each of these processes. If the thermal oxidizer exhaust is too hot for any of these

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[23] *See* Exhibit 4; "The Shell Dioxin Destruction System (SDDS) for the Catalytic Destruction of Dioxins/Furans in Flue Gas from Waste Incineration Plants," O.L. Maaskant et al., ADEME Seminar on Dioxins and POPs, March 2004, attached hereto as Exhibit 12.

technologies, the excess heat can be used to pre-heat the MEROS system exhaust gas and thereby reduce the amount of natural gas required to operate the oxidizer. The NOx control system will, in turn, treat the NOx generated by the oxidizer. LDEQ and Nucor should provide sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, to support the determination of BACT. In addition to technical considerations, the evaluations should include cost-benefit analyses and consideration of the important collateral environmental benefit of reducing dioxin emissions (at least for SCR and SDDS).

61. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that the MEROS system will not achieve an SO2 removal efficiency greater than 90% and an SO2 emission rate below 1.0573 pounds/ton of finished sinter. BACT should be established as the most stringent level of control achievable by a MEROS system, but no less than 90% removal efficiency and no more than 1.0573 pounds/ton of finished sinter. LDEQ and Nucor should provide technical documentation justifying the selection of BACT for reduction of SO2 emissions from the sintering process.

BACT Determination for the Cooling Towers Are Improper

62. Combined, the cooling towers will emit more than 17 tons/year PM10. According to AP-42, cooling water containing less than 500 ppm TDS is feasible. Given that Nucor will draw make-up cooling water from the Mississippi River, a limit of less than 500 ppm TDS in the cooling water is technically feasible. LDEQ and Nucor did not provide any technical documentation comparing a 500 ppm TDS limit to the 1,100 ppm TDS limit selected as part of BACT. PM10 emissions from the cooling towers will be cool, wet and released at a low elevation, and therefore more likely to deposit on and adhere to Zen-Noh's equipment and grain. LDEQ should consider ultra-low TDS cooling water together with high efficiency drift eliminators, including an evaluation of the cost-effectiveness of using ultra-low TDS cooling water and the collateral environmental benefit of reducing the deposition of wet solids on Zen-Noh's equipment, and grain, and should provide technical documentation supporting its decision.

BACT Determination for the Storage Areas Are Improper

63. Nucor proposes to store granulated slag, sinter, coke breeze, mill scale, coal, iron ore, limestone, dolomite, electric arc furnace slag, flux, and pig iron in storage piles, mostly located near the southwestern boundary of Nucor's property and therefore near Zen-Noh. Even with the use of wet suppression, which LDEQ proposes as BACT for PM emissions from (some of) these emission units, the storage piles will be a major

source of PM emissions -- over 434 tons/year. Most of these particulates will be large and therefore more likely to deposit onto Zen-Noh's equipment and grain, just across the shared fence-line. LDEQ should evaluate the use of silos instead of piles, for each material that can be stored in a silo, and enclosures or buildings vented to fabric filters, in addition to wet suppression, for each material that cannot be stored in a silo. Most coal and coke storage and handling at the Gateway Energy & Coke Company facility in Granite City, Illinois, is contained in an enclosure of sorts. *See* PSD Approval No. 06070020. On June 21, 2007, the FDS Coke, LLC facility in Toledo, Ohio resubmitted a PTI application, in part to "fully enclose the coal and coke piles inside an open span building to be constructed on the western side of the new straight-line battery configuration." The modification will also allow FDS Coke to locate the railcar loading and unloading operations inside buildings with baghouse controls. Storing these materials in silos with PM controls or inside open span buildings with PM controls is technically feasible and will reduce PM emissions above and beyond wet suppression alone, particularly if used in conjunction with wet suppression. BACT for PM emissions from material storage at Nucor should include storage in silos with fabric filters or wet suppression in conjunction with storage inside buildings that vent to fabric filters. *See* 33 LAC III.305(3).

64. Nucor proposed -- and LDEQ accepted -- that BACT for roadways is to be pave roadways "where practicable," reduce speed limits and spray roadways. This standard is impractical and unascertainable in that there is no identification of who decides whether a roadway may practicably be paved and upon what standards the decision is based. Even assuming that reduced speed limits and spraying reduce fugitive PM emissions by 50%, unpaved roads at the Nucor plant will emit 554.9 tons/year of PM. Given the proposed layout of the plant, most of those PM emissions will likely occur on or very near the shared fence-line between Nucor and Zen-Noh. If that is the case, these fugitive PM emissions will likely deposit on Zen-Noh's equipment, property and grain. 33 LAC III.1305 provides, in pertinent part, "[a]ll reasonable precautions shall be taken to prevent particulate matter from becoming airborne. These precautions shall include but not be limited to the following: . . . (6) paving roadways and maintaining the roadways in a clean condition. . . ." BACT for fugitive dust emissions from roadways at Nucor should not be less stringent than Louisiana emission standards. All roadways at Nucor should be paved and routinely cleaned. *See* 33 LAC III.1305(6)-(7).

BACT Determinations for Material Handling and Transfer Are Improper

65. The material handling and transfer operations at Nucor will all be located on or very close to the shared fence-line between Nucor and Zen-Noh. The conveyors will emit 54.3 tons/year of PM, even with a 90% control efficiency. The fugitive particulate emissions from the conveyors will be primarily larger than 10m and will be emitted at a low elevation and temperature; therefore, they will likely deposit onto Zen-Noh's

equipment, property and grain. LDEQ selected BACT to be enclosed conveyors, but will allow water sprays and partial enclosures to be utilized at drop points and transfer areas. Under the circumstances, partial enclosures are not sufficient to be BACT. All conveyors should be fully enclosed, and all drop points and transfer areas should be located inside enclosures or buildings. Each conveyor should also be equipped with a dust collection system such as a fabric filter with induced draft. Water sprays should also be employed at drop points and transfer areas.

66. BACT for the various unloading and unloading operations was selected to be collection and control by fabric filters. Even with these controls, PM emissions from the gantry cranes will be 209.8 tons/year. The fugitive particulate emissions from the dock 1 and dock 2 gantry cranes will be primarily larger than 10m and will be emitted at a low elevation and temperature and very near Zen-Noh's barge unloading and ship loading dock operations. Depending on the material being loaded or unloaded, the PM emissions may contain significant quantities of heavy metals, dioxins or other contaminants. In addition, the prevailing wind blows from Nucor directly toward Zen-Noh's dock. The holds are generally open on ships and barges spotted at Zen-Noh's dock for loading or unloading, some for as long as 36 hours. PM emissions from Nucor's dock gantry crane operations will likely deposit into and onto the open holds of, or grain contained in, ships and barges spotted at Zen-Noh's dock. This could lead to rejection of vessels or loads of grain by the FGIS inspectors stationed at Zen-Noh, or impoundment of grain by the FDA. LDEQ and Nucor did not demonstrate with sufficient technical supporting documentation, including design parameters, engineering drawings and calculations, engineering literature, and vendor literature and performance warranties, that the collection and fabric filter systems for the dock gantry crane operations will in fact achieve BACT. The collection and fabric filter systems for these emission units should be designed and operated to provide the maximum control achievable and consistent with the goal to minimize adverse collateral environmental and economic impacts at Zen-Noh. LDEQ should provide technical documentation necessary to support its decision of BACT for these sources.

67. BACT for the various unloading and unloading operations was selected to be collection and control by fabric filters. Nucor apparently plans to ship and received some materials by truck and rail, but Nucor did not estimate emissions from or determine BACT for truck or rail loading/unloading operations. BACT for truck and rail loading/unloading operations at the Gateway Energy and Coke Company facility in Granite City, Illinois and the FDS Coke plant in Toledo, Ohio include an enclosure inside a building that vents to a fabric filter. BACT for loading/unloading operations at the Mesabi Nugget, LLC facility in Minnesota is also an enclosure inside a building that vents to a fabric filter and meets the standard of 40 CFR Subpart RRRRR. BACT for truck and rail loading/unloading operations at Nucor should be enclosure inside a building that vents to a fabric filter that achieves at least 99% PM reduction efficiency and complies with the 0.005 gr/dscf requirement in 63 CFR Subpart RRRRR, the NESHAP for taconite ore handling.

Ambient Impact Analyses Are Improper and Pre-Construction Ambient Air Monitoring Should Be Required

68. LDEQ and Nucor did not include emissions from the HRSG bypass vents and unpaved roads in their analysis of air quality impacts from the Nucor plant. Each of the ten HRSG bypass vents will operate 12 days per year. In other words, one or another HRSG bypass vent will emit 74.7 pounds/hour PM10, 752.5 pounds/hour SO2, and 30.74 pounds/hour NOx fully 120 days per year -- one third of the time. These sources should have been included in the air quality impact modeling.

69. If the HRSG bypass vents are included in the air quality impact modeling, the air quality impact of the Nucor facility will exceed the de minimis levels for PM10 and SO2, *see* Exhibit 3, which are 10 $\mu g/m^3$ (24-hour) and 13 $\mu g/m^3$ (24-hour), respectively. 40 C.F.R. § 52.21(i)(8)(i). LDEQ must but did not require continuous pre-construction ambient air quality monitoring at the proposed site for PM10 and sulfur dioxide for the year preceding receipt of Nucor's application. 40 C.F.R. § 52.21(m)(1)(iii). The PSD Permit may not be issued in final form until one year of ambient air quality monitoring is completed, before submission of a revised permit application and an opportunity for public comment.

70. Even if the HRSG bypass vents are not included in the air quality impact modeling, the predicted air quality impact of the Nucor facility will exceed the de minimis level for PM10 and SO2. *See* Exhibit 3. LDEQ must but did not require continuous pre-construction ambient air quality monitoring at the proposed site for PM10 and sulfur dioxide for the year preceding receipt of Nucor's application. The PSD Permit may not be issued in final form until one year of ambient air quality monitoring is completed, before submission of a revised permit application and an opportunity for public comment.

71. LDEQ has not made a determination that the existing air quality data used by Nucor in its air quality modeling are representative of the air quality at the proposed site. Even if LDEQ had made such a determination, it would have been arbitrary and improper. The existing data used by Nucor was gathered between 2001 and 2005 in Baton Rouge, LA, approximately 40 miles from the proposed site. This data is not representative of the proposed site. LDEQ must require continuous air quality monitoring at the proposed site.

72. Nucor expects to create thousands of jobs and hundreds of millions of dollars in new household earnings in St. James Parish. Surely this growth in residential and commercial, not to mention associated industrial growth, will result in increased emissions of air pollutants in the area through motor vehicles, heaters and fire places, lawn mowers, solvent usage for various activities such as painting, etc. Nucor did not provide an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial or other growth associated with the proposed Nucor facility. An appropriate analysis must be conducted and presented for

public review and comment before the final permit may be issued. 40 C.F.R. § 52.21(o)(2).

73. Nucor has not guaranteed that all jobs at the proposed pig iron mill will be taken by people currently living in St. James Parish. Indeed, insofar as Nucor publicly claims that its processes will be "state of the art," it is expected that Nucor jobs will require a high degree of education and experience or a recognized trade skill. The evaluation of associated emission increases required under 40 C.F.R. § 52.21(o)(2) should include an evaluation of the number of Nucor jobs expected to be taken by individuals who do not presently live in St. James Parish.

74. LDEQ and Nucor improperly utilized the "adjusted background concentration" in their PSD increment and NAAQS modeling. *See* Exhibit 2.

75. LDEQ and Nucor improperly did not evaluate the ambient impact of lead emissions from the coke oven HRSG bypass vents and coke battery FGD stacks, which the largest sources of lead emissions. *See* Exhibit 2. Lead is a TAP, a hazardous air pollutant and a criteria air pollutant subject to a revised NAAQS. During the November 10 meeting with LDEQ, LDEQ stated that it would require a demonstration that Nucor will not cause an exceedance of the new NAAQS for lead. This has not been achieved, given the failure to model lead emissions from the coke ovens. It should be noted that at least one or another of the HRSG bypass vents will operate 120 days of the year.

76. The meteorological files supplied by Nucor contain roughly 20% calm wind hours. *See* Exhibit 2. Calm wind hours are not calculated by AERMOD. The meterological data might not be suitable.

77. The modeling conducted by Nucor and evaluated by LDEQ utilizes erroneously high exit velocities for several emission sources from neighboring facilities. *See* Exhibit 2. This has the effect of underestimating impacts from those sources.

78. The modeling conducted by Nucor and evaluated by LDEQ utilizes erroneously high exit velocities for several emission sources at Nucor. *See* Exhibit 2. This has the effect of underestimating impacts from Nucor.

79. The modeling conducted by Nucor and evaluated by LDEQ did not account for fugitive emission releases from all material storage and transport sources at Nucor. *See* Exhibit 2. This has the effect of underestimating PM10 impacts from Nucor.

80. The air dispersion modeling for TAPs and criteria pollutants emitted by Nucor should have considered elevated receptors on Zen-Noh's property.

81. The air quality impact analysis of emissions from Nucor is unreasonable, even compared to similar but smaller sources, and should be redone in its entirety. *See* Exhibit 2.

Environmental Assessment Statement Is Inadequate and Unreasonable

82. Nucor's search for, and analysis of, alternate sites for the proposed facility was woefully inadequate and prevents LDEQ from performing its constitutional duties as public trustee of the environment. CITE CONS; SAVE OURSELVES Nucor allegedly looked throughout the southeast and was able to find only three other possible sites for the pig iron mill, one 88 acres, one 200 acres, and one 400 acres. Nucor rejected all three sites as too small. It strains the imagination to accept that these were the only three sites where Nucor could put together even 400 acres. Developers routinely put together thousand acre properties for planned unit developments and mega-malls. Nucor does not plan to have any discharge of wastewater and does not actually need direct access to a deep river port. Coke ovens and iron mills can be constructed to rely on rail transportation, and to the extent shipping is necessary, the material can be transported to the port by rail. Nucor does not explain how much property is really necessary, but it is clear that Nucor is not planning to use most of the property south of S.R. 3125 or any of the property north of the highway. To perform its duties as public trustee of the environment, LDEQ should require Nucor to make a more genuine effort to identify and evaluate alternate locations.

83. During a meeting on November 11, 2008, Nucor agreed to consider alternative configurations that would move Nucor's docks, conveyors, storage piles and coke ovens to the east side of the Nucor site, away from the shared fence-line between Nucor and Zen-Noh. As proposed in the preliminary design, these emission units, in particular the docks, conveyors and storage piles, would be located very close to the shared-property line between Nucor and Zen-Noh and, hence, would be very close to exposed grain at Zen-Noh's dock and in Zen-Noh's conveyors and elevators. The purpose of moving these emissions units to the north and east would be to prevent or materially reduce any risk of contamination to Zen-Noh's equipment, ships and barges moored to Zen-Noh's dock, and grain that is exposed during the loading and unloading processes. This is not in any way an unusual or unreasonable request. In fact, the Haverhill North Coke, Middletown Coke, and FDS Coke plants were all reconfigured, between the submission of the application and the issuance of a permit, in response to requests to lessen impacts at sensitive receptors. The Middletown Coke plant coke ovens were moved almost one mile, from one end of the site to the other, in order to minimize the impact of its coke conveyors on a sensitive neighbor. Zen-Noh appreciates Nucor's professed willingness and agreement to evaluate options to reconfigure its plant. Zen-Noh has not yet received the results of Nucor's evaluation, and Zen-Noh will perform its own evaluation. It is possible that Nucor will be required to modify its ambient impact analysis as a result of this exercise, but insofar as the prevailing winds blow from Nucor to Zen-Noh, a reconfiguration is likely to reduce ambient impacts.

84. Nucor's evaluation of alternative processes, in particular the DRI process, places Nucor's economic return on a pedestal well above the protection of the environment.

There is no question that, by eliminating coke ovens and blast furnaces, the DRI process is significantly more environmentally friendly than the old-school pig iron manufacturing process proposed by Nucor. Nucor operates a large DRI iron facility on Trinidad and can easily prepare an objective analysis of the cost-effectiveness of the DRI process compared to the emissions from the blast furnace process. There is a good chance that the DRI process will result in orders of magnitude lower emissions at little to no increased cost. To perform its duties as public trustee of the environment, LDEQ should require Nucor to perform this evaluation before LDEQ issues the final permit (and Nucor starts to construct an unreasonably dirty facility).

85. Nucor's traffic analysis did not make any evaluation of the impact that Nucor's docks -- including barges and ships entering, leaving or holding for the docks -- will have on river traffic in general and traffic at Zen-Noh's docks in particular. And, although road traffic was evaluated by LDEQ, LDEQ also provides no analysis of the suitability of Nucor's docks. Nucor must obtain a permit from the Army Corps of Engineers before constructing the dock. Part of the review process for that permit will include an evaluation of the effect of the dock and dock operations on river traffic and nearby dock operations. If given time to perform an analysis, Zen-Noh will provide comments to LDEQ and the Army Corps of Engineers with expert opinion to assist in the evaluation of the location and construction of docks and dock operations LDEQ should refrain from issuing these air permits to Nucor until the suitability of the proposed dock design and location is properly evaluated.

86. The Nucor facility will result in significant emissions of CO2. These emissions must be evaluated. CO2 emissions must, in particular, be evaluated as part of Nucor's re-evaluation of the cost-effectiveness of the DRI process, which will have much lower CO2 emissions because it does not involve coke ovens.

87. Last, the analysis of Nucor's economic impact on the community is flawed because it does not consider the potential catastrophic impact Nucor's operations could have on Zen-Noh. Coal dust, coke breeze, and sinter dust all contain heavy metals and other toxic compounds that could, if deposited on Zen-Noh's grain in large enough quantities, cause the grain to be declared adulterated by FGIS and seized by FDA or food safety inspectors at Zen-Noh's foreign customer ports. For example, FGIS inspectors are trained to inspect empty holds for coal dust, among other things, and will reject a ship with any visible coal dust contamination. This could result in demurrage charges, which were as high as $100,000 per day earlier this year, while the ship is cleaned. There is no tolerance level on grain for coal dust or virtually any of the other pollutant emitted by Nucor; therefore, any measureable amount of those compounds on grain, such as a visible coal dust, could result in the entire load being impounded. The cost to Zen-Noh should that occur would be astronomical, easily in the millions of dollars, but far less than the human cost should adulterated grain find its way into the food chain. However, it may be that an affirmative resolution of the issues raised in these comments, including, but not limited to, reconfiguring the iron plant to move the potentially dusty material storage, conveyance and loading

operations away from the shared fence-line between Nucor and Zen-Noh; eliminating the HRSG bypass venting and FGD bypass venting, and utilizing the SDDS technology to reduce dioxin emissions from the sinter plant or, alternatively, using the DRI process, will minimize or even eliminate the economic risk to Zen-Noh and its 140 plus employees.

Thank you for this opportunity to provide comments. We will forward additional comments as they develop.

Please feel free to contact me should you have any questions.

Sincerely,

John Williams

John Williams
President, Zen-Noh Grain Corporation

cc: Kermit Wittenburg, LDEQ
Steven Rowland, Nuc

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY (LDEQ)
CONSOLIDATED ENVIRONMENTAL MANAGEMENT, INC.
NUCOR STEEL LOUISIANA

PUBLIC HEARING AND REQUEST FOR PUBLIC COMMENTS ON PROPOSED INITIAL PART 70 AIR OPERATING AND PREVENTION OF SIGNIFICANT DETERIORATION (PSD) PERMITS AND ENVIRONMENTAL ASSESSMENT STATEMENT (EAS)

AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

Zen-Noh Grain Corporation's Request to Extend Deadline for Public Comments

Zen-Noh Grain Corporation ("Zen-Noh") respectfully asks that the November 24, 2008, public comment period on proposed air permits 2560-00281-VO and PSD-LA-740 and the environmental assessment statement for the Consolidated Environmental Management, Inc.-Nucor Steel Louisiana ("Nucor") pig iron mill, be extended, for an indefinite period to be determined after Nucor submits, for public review and comment, all the supporting documentation necessary to thoroughly evaluate the potential impacts of the proposed pig iron mill on the environment and Zen-Noh.

Zen-Noh is one of the largest and most efficient grain elevators in the world, annually shipping in excess of 11,000,000 tons of American grain overseas. Zen-Noh thus provides food and animal feed to people around the world. The grain passing through Zen-Noh's facility is exposed to the ambient air during most of the process.

The Nucor plant would be located immediately adjacent to, and upwind from, Zen-Noh and would, according to the draft permit, emit millions of pounds of air pollutants each year. Zen-Noh is extremely concerned that proposed emissions from the Nucor plant could

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contaminate its grain and could adversely affect, or even destroy, Zen-Noh's business. Zen-Noh is just as concerned about the possible adverse effects that Nucor's emissions could have on Zen-Noh's 140+ employees who would be forced to work in the shadow of Nucor stacks.

Zen-Noh and Nucor have begun a constructive dialogue that Zen-Noh hopes will answer Zen-Noh's ultimate question whether a massive pig-iron manufacturing operation (a business notorious for its adverse environmental impacts) should be located immediately adjacent to a world-class and vitally-important food and feed operation.[1] Much conversation must follow, many questions remain to be answered, and volumes of data remain to be reviewed. At a minimum, more time is needed to adequately study and understand the potential adverse effects that the proposed Nucor plant could have on the existing Zen-Noh operation and its employees. To underscore this, please consider the following, more detailed description of Zen-Noh and its concerns:

1. Zen-Noh Is a Critical Food and Animal Feed Export Facility and Must Protect Against Potential Contamination from the Pig Iron Mill

Situated on the left descending bank of the Mississippi River at mile 163.8 AHP, the Zen-Noh Convent elevator is the largest and most efficient grain export elevator in the world. Built and placed in operation by Zen-Noh in 1982, on the former Rapidan Plantation, the elevator has 72 silos with a total storage capacity of 4.0 million bushels of grain and grain by-products (collectively "Grain"). The facility also has an open storage pad of 16 acres with a capacity of

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[1] Zen-Noh notes that this was not Zen-Noh's first attempt to begin this dialogue with Nucor. Zen-Noh scheduled meetings with Nucor on September 25, October 14, and October 22, but Nucor was unable to keep those scheduled meetings. Zen-Noh and Nucor held an abbreviated conference on November 4, which lead to the more detailed dialogue on November 11. Zen-Noh looks forward to continuing this dialogue with Nucor.

240,000 metric tons of bulk material. This storage pad is equipped with mechanical "stackers" and "reclaimers", which are interfaced with the conveyor system of the elevator.

Zen-Noh is a subsidiary of ZENNOH (National Federation of Agricultural Cooperative Associations), the largest agricultural cooperative in the world, and the second largest compound feed manufacturer in the world. Grain, including corn, soybeans and sorghum, is grown and harvested domestically here in the U.S., and shipped by Zen-Noh, primarily for export overseas. On an annual basis, the elevator receives approximately six thousand hopper barges and fourteen thousand rail cars from the grain belt of the Midwest, as well as approximately six thousand grain trucks totaling 150,000 tons of grain that Zen-Noh buys from local cooperatives and grain dealers. Each load or lot of grain is carefully weighed and inspected before entering the complex conveyor system and storage silos of the elevator where the grain is processed, blended, dried and made ready for shipment to the international market.

The elevator is the fastest loading grain elevator in North America and, on an average, loads eleven million metric tons of grain into approximately 220 ships on an annual basis. Prior to shipment, the grain is weighed, inspected and tested by representatives of the Federal Grain Inspection Service ("FGIS"), an agency of the U.S. Department of Agriculture ("USDA") which maintains and staffs a laboratory at the elevator on a 24 and 7 schedule. In most cases, the grain is also inspected, sampled and tested by a third-party representative of buyers and/or sellers and the samples are subject to further laboratory analysis by independent chemists. As mandated by the United States Grain Standards Act and the Food Drug and Cosmetic Act, purity of the grain is of the utmost importance. In addition, many of Zen-Noh's purchase orders require potential contaminants to be measured not only in parts per million but parts per billion.

Grain is offloaded from barges, rail cars and trucks and transferred to the silos by partially enclosed conveyors, during which the grain is exposed to the ambient air. During the offloading of a barge by the marine leg (barge unloader), the open hopper of the barge is only partially protected by a rain shield, and the hopper compartment remains open to the environment for 1.5 hours or more during the offloading process. During the complete cycle of receiving and shipping the grain, the product is first transferred from the barge unloader to the conveyor system and transported to the silos, moved by conveyor system to the shipping bins and the head house, and then to the four ship loading towers. The grain is transported over 6,500 feet of conveyor and over seventeen transfer points. Throughout this process, the grain would be exposed to coke dust, fly ash and other particulates, vapors and toxic air pollutants emitted by the proposed Nucor steel plant.

Prior to loading grain aboard an ocean going carrier at Zen-Noh's dock, the holds of the vessel are carefully cleaned, and then inspected by a surveyor from National Cargo Bureau, a representative of the buyer and an inspector from FGIS, to ensure that there are no impurities in the vessel holds that could contaminate the product. If the vessel fails to pass this inspection, she is placed offhire and returned to anchorage for further cleaning.

The normal grain capacity of vessels loading at Zen-Noh is 55,000-60,000 metric tons. This size vessel is a Panamax class vessel.[2] During loading of a Panamax vessel, all seven watertight hatches covering the cargo holds of the vessel are opened and usually remain open to the atmosphere for periods up to 36 hours while 55,000-60,000 tons of grain is loaded. The cargo holds generally must remain open to allow for even weight distribution across the vessel

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[2] Zen-Noh loads smaller vessels of 25,000 tons capacity, and larger vessels with capacities in excess of 80,000 tons.

during the loading process. We mention these factors because the total cost of a single vessel shipment of 55,000 tons of grain, depending on the price of the commodity and the prevailing shipping rates, could exceed $33,000,000.

In addition to meeting US standards for quality and purity, Grain loaded and shipped into export markets must meet international standards for food safety. These international standards and the standards of Zen-Noh's customers are often more stringent than U.S. standards. If the Grain were to become contaminated during the loading process, it would not only fail to meet specific contract requirements, but may also become subject to seizure by the Food and Drug Administration ("FDA") and rejection by the foreign country. In either case Zen-Noh would face severe financial exposure and risk its credibility as a world class grain exporter if its Grain were contaminated by the emissions from the proposed Nucor pig iron facility.

2. The Magnitude of the Proposed Pig Iron Mill Warrants Detailed Review and Additional Time for Public Comment

Zen-Noh has not had enough time to thoroughly review the permit file, which includes thousands of pages of information, much of which has been revised more than once. A preliminary read of the permits and application documents reveals a number of potential and substantial unresolved problems, some of which are discussed below.

The proposed permits themselves are 107 pages (PSD-LA-740) and 154 pages (2560-0028-VO), and come with a 38 page statement of basis. The most recent sets of emission calculations and emission inventories submitted by Nucor spans 324 pages and 122 pages respectively, representing at least 104 emission points -- assuming Nucor identified and reported each potential source of emissions. The total number of emission calculations that must be thoroughly reviewed and confirmed is staggering. For example, the calculation for a single emission source, STC-101, includes 57 input parameters and 76 individual calculations, and this is a source of only dust emissions. Collectively, Nucor's 104 emission points will emit *major source* quantities of five pollutants (PM_{10}, SO_2, NOx, CO and VOC) and fifty Toxic Air Pollutants ("TAPs") regulated under LAC 33:III. Given the potential catastrophic effects on Zen-Noh's business, customers and employees, each calculation for each of these pollutants at each emission point must be verified, which will take more than the thirty days allowed if the public comment period is closed November 24.

Federal and state regulations regarding the prevention of significant deterioration of air quality ("PSD") and permitting of major sources of air pollutants ("Part 70") require analyses of many other factors before a new major source, like Nucor's pig iron facility, may be constructed. For example, all applicable air pollution control requirements must be identified in the permit. In this case, the Part 70 permit identifies 845 specific requirements -- including three complex federal emission standards for hazardous air pollutants -- 117 monitoring requirements for 55 sources, and 42 citations to applicable requirements that Nucor claims are inapplicable or exempt. As another example, Nucor submitted at least 35 best available control technology ("BACT") analyses for pollutants from 17 sources (some sources emit more than one pollutant). Zen-Noh needs more time to evaluate whether the permits accurately reflect *all* requirements applicable to Nucor's operations.

3. More Time Must Be Allowed to Identify and Evaluate Nucor's Analyses of Control Technologies and Impacts of the Pig Iron Mill

Although Zen-Noh requests additional time in which to evaluate the thousands of data points and pages in the permit file, a number of questions are readily apparent. For example, LDEQ requested Nucor to reconsider several of the BACT analyses, including evaluating spare

HRSG units, which could reduce air pollution emissions from the coke ovens by an estimated 720 tons per year. Nucor's design engineer determined that "[t]his solution is feasible and represents a practical solution," *see* HRSG Bypass Capture Study, p. 3, but Nucor recommended a "do nothing" approach as BACT. The permits appear to have adopted this approach. Given the likely impact of Nucor's emissions proposed in the permits, it is imperative that true "top-down" BACT analyses be conducted and documented for each of Nucor's emission sources.

As another example, Nucor submitted several iterations of air pollution dispersion modeling to support its contention that the thousands of tons of annual emissions would not adversely impact ambient air quality. Zen-Noh needs additional time to review and evaluate the air quality modeling, but several significant issues are obvious. First, Nucor did *not* model the largest single source of particulate matter emissions, FUG-101, dust from unpaved roads. Presumably these roads will collect and emit coke, coal and iron dust, in addition to limestone and dirt. By themselves the unpaved roads are a *major source* of particulate matter emissions, and it appears from Nucor's site plan that many of the unpaved roads will be located on or near the Zen-Noh property line. This source should have been included in the air quality model. In addition, Nucor should be required to pave *all* of its roads unless it can prove -- in a proper top-down BACT analysis -- that a particular segment of road cannot be paved due to technical -- not financial -- concerns.

Nucor's emission estimates and dispersion modeling do not account for all pollutants that will be emitted in quantities large enough to potentially impact Zen-Noh's operations. For example, Nucor apparently did not account for or model chloride emissions from the coke ovens and the HRSG bypass vents. Coal typically contains a significant concentration of chloride compounds, which can be converted to chloride emissions in the coke manufacturing process.

At this point, Zen-Noh is evaluating what other air pollutants were omitted or under-reported in Nucor's emission inventories and impact assessments.

Nucor also did not include any elevated off-site receptors in the dispersion models. Zen-Noh's dock facilities, silos and conveyors, and the ships receiving the grain, are not located at ground level. In most instances, the grain exposure point is located at 10-meters or higher. Nucor's emission sources are located so close to Zen-Noh that the plumes might not have reached ground-level at the point they impact Zen-Noh's grain. In addition, some of the elevated exposure points at Zen-Noh, in particular the silos and the conveyor system, are operated under a strong negative pressure induced by Zen-Noh's dust collectors. A significant portion of the collected dust is reintroduced into the product grain. The remainder is captured and used to manufacture animal feed pellets. This will have the effect of drawing Nucor's air emissions into the grain. The elevated receptors should have been included in Nucor's air pollution dispersion modeling.

In addition, Nucor's emission calculations and emission inventories do not include a discussion and quantification of the adverse effects of unplanned emissions under non-routine operating conditions, such as upsets, maintenance, malfunctions, fires and/or explosions. These unplanned emissions may not occur frequently but, nevertheless, are of extreme importance in our case where a very sensitive receptor area (Zen-Noh) is in close proximity to the Nucor's plant and often downwind. Also, we believe that the calculations of maximum short-term concentrations in the permit application (e.g., 1-hr CO and 3-hr SO2) should include unplanned excess emission scenarios that on a yearly basis are likely to occur.

Zen-Noh plans to conduct a thorough review of the air pollution dispersion modeling submitted by Nucor and to evaluate critical issues not considered by Nucor. Experts will determine whether the pig iron mill will cause an exceedance of allowable PSD increments and NAAQS standards (including the new standard for lead) based on the conditions modeled by Nucor, and also considering the elevated receptors in Zen-Noh's facility. These analyses will also consider emissions of pollutants Nucor omitted or under-reported in its emission calculations. Zen-Noh also plans to perform a preliminary modeling simulation of a few reasonably foreseeable excess emission scenarios to assess the impact of peak and accidental releases on Grain at the Convent elevator. The simulations will include deposition and grain absorption/adsorption of chemicals and retention calculations, thus providing further insight into the risk and consequences of Grain contamination.

4. A Fair Opportunity for Public Comment Demands that Nucor First Provide All Necessary and Required Supporting Documentation

As indicated above, Nucor's permit application, including additional information submitted by Nucor to date, does not provide sufficient information for Zen-Noh to thoroughly evaluate the proposed permits. Much of the missing information is also required by EPA and LDEQ rules, regulations and guidance documents. Although the expedited permit process has not allowed enough time for Zen-Noh to generate a comprehensive list of all missing necessary information, Zen-Noh has identified the following missing information:[3]

- For each control technology deemed to be technically infeasible for any emission unit (as part of the BACT analysis), design parameters, engineering calculations, vendor literature and other supporting documentation from which Nucor's claim of technical infeasibility may be verified, based on physical, chemical and engineering principals.

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[3] Zen-Noh's air pollution dispersion modeling expert, Dr. Paolo Zannetti, requested the electronic model input files by e-mail to publicrecords@la.gov dated November 6, 2008.

- For each emissions unit, documentation verifying appropriate consideration of alternative manufacturing processes, systems and techniques, including technologies employed outside the United States (e.g. the Uhde processes and technologies employed at the ThyssenKrupp coke plant Schwelgern, Germany), innovative control technologies, and technologies required under lowest achievable emission rate determinations. In addition, for each alternative or innovative process of technology to be employed, vendor or user contact information should also be provided.
- Cost-benefit analyses for each control technology that is technically feasible, including, for each, design parameters, engineering calculations, vendor literature, performance guaranties, and other supporting documentation from which the capture and control efficiencies, operability, reliability, installed capital cost and annualized control cost may be verified.
- In addition to the above, for each marine or rail loading or unloading point, a specific identification of the proposed control technologies; for each raw material, product or byproduct conveyance system, a specific identification of the proposed control technologies; for each segment of unpaved road, the specific location and documentation supporting Nucor's contention that the road should not be paved; for the HRSG bypass vents, documentation demonstrating the installed capital cost to provide stand-alone or shared "spare" HRSG units, and accounting for the incremental power generated and emissions reductions afforded by the spare units; and for the coke quenching units, a cost-benefit analysis considering the use of once-through quench water or quench-water TDS removal technology, such as reverse osmosis.

- An evaluation of alternative physical layouts for the proposed pig iron mill, including moving the docks, storage areas, conveyors and coke ovens so that they are not immediately adjacent or proximate to the Zen-Noh facility.
- An accounting of every pollutant that could be emitted from each emissions unit in quantifiable quantities or concentrations.

5. Conclusion

Until Zen-Noh can be assured that any and all emissions from the proposed pig iron processing plant will not compromise the health and safety of Zen-Noh's personnel and subcontractors, contaminate or adulterate the Grain processed through the Convent elevator, nor adversely impact barge, ship and rail traffic entering and exiting Zen-Noh, it must oppose the issuance of any permit. Zen-Noh met with Nucor officials on November 11, 2008, to discuss Zen-Noh's concerns and the above documentation gaps, which Zen-Noh needs to adequately evaluate the potential impacts of the pig iron mill (and which EPA and LDEQ regulations require Nucor to submit). Zen-Noh would characterize the conversation as constructive and focused on a positive result for both parties. We believe Nucor is in general agreement to provide the type of information Zen-Noh requested; however, it is unknown when Nucor can gather and provide the requested information or how long it will take Zen-Noh to review the additional information. What is certain, though, is that the Notice that was published on October 14 gives little if any time to evaluate any of the issues and deficiencies described above, much less review the permits and applications in detail.

LDEQ has discretion to extend the time allowed for public comment and even to hold additional hearings. *In re: Belle Co.*, 809 So. 2d 225, 228 (La. App. 2001). Such extensions and additional public hearings are important because all reasonably ascertainable issues and reasonably available evidence must be submitted to LDEQ before LDEQ issues the final permit, so that evidence is preserved for judicial review, La. Rev. Stat. 30:2014.3, or a petition that EPA object to the permit. L.A.C. 33:III.533(E). It seems only reasonable here that the public be given sufficient time to review the calculations, analyses and decisions reflected in the pig iron mill permit applications and permits and the additional information to be submitted by Nucor.

Zen-Noh estimates that at least an additional 90 days will be necessary just to complete its evaluation of the information already made a part of the record. The additional information requested of Nucor -- all of which Nucor is required to place in the public record under LDEQ and EPA rules and regulations -- may require even more time to review, depending on when Nucor submits the information. Given the expedited nature of the permit review to date, allowing an additional 90 days for public comment will not cause the total permit review time to exceed 300 days.

Accordingly, Zen Noh formally requests an enlargement of time for an indefinite period, to be determined after Nucor submits the requested information, in which to submit its Public Comment to the Notice on permits 2560-00281-VO and PSD-LA-740 and the environmental assessment statement.

ZEN-NOH GRAIN CORPORATION

By: John Williams
John Williams, President
1127 East Service Road, Highway 190
Covington, LA 70433
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Mandeville, LA 70470
985.867.3511
John.Williams@zgcusa.com

November 17, 2008

Ms. Soumaya Ghosn
Louisiana Department of Environmental Quality
Public Participation Group
P.O. Box 4313
Baton Rouge, Louisiana 70821

Re: **Request for 45-Day Extension of Time for Public Comment on Permit Nos. 2560-00281-VO and PSD-LA-740, and Environmental Assessment Statement (EAS), Nucor Steel-Louisiana**

AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

Dear Ms. Ghosn:

This letter follows-up on Zen-Noh Grain Corporation's ("Zen-Noh") November 13, 2008 written request for an indefinite extension of time in which to respond to the above-referenced permits and EAS, for the proposed Consolidated Environmental Management, Inc. Nucor Steel-Louisiana ("Nucor") facility in Convent, Louisiana. I have since been informed that LDEQ will approve extensions only for definite periods of time. By way of this letter, Zen-Noh incorporates and revises the November 13 request and now requests a **45-day extension** of time for public comment.

As became clear during our November 11 meeting with Kermit Wittenburg and other members of LDEQ's staff, Nucor's permit application omitted a significant number of documents necessary to support certain analyses required under EPA and LDEQ rules and regulations. Without those documents, Zen-Noh cannot evaluate whether air emissions from the Nucor facility will be controlled to a level necessary to prevent adulteration of Zen-Noh's grain. Zen-Noh met with Nucor on November 12, during which Nucor agreed to provide information to Zen-Noh. I have attached Zen-Noh's specific information request for your convenience. Generally, Zen-Noh requested:

- Documents supporting Nucor's BACT determinations;
- An inventory of the pollutants that could contaminate Zen-Noh's grain;
- Air dispersion modeling electronic input files;
- Nucor's application for a permit from the Unites States Army Corps of Engineers;
- Nucor's evaluation of alternate site configurations that would relocate the docks, conveyors and material storage areas to the lower (east) end of the batture, which Nucor agreed to consider during our meeting last week; and
- Documents supporting Nucor's environmental assessment statement.

We believe 45 days is a reasonable request for this initial extension of time. It is unlikely that Nucor will be able to even begin compiling the requested information until after the public hearing scheduled for November 20, and the following week is Thanksgiving. Even if Nucor diligently compiles the necessary information, it is unlikely to be available for public review until December. Extending the public comment period for 45 days should provide the public 30 days to review the additional information, with time off for Christmas and New Years, if Nucor provides the information by December 2. Zen-Noh therefore requests the public comment period be extended for **45 days**, until **January 8, 2009**.

We appreciate your prompt consideration of this request. Please do not hesitate to call me if you have any questions or concerns. Thank you.

Sincerely,

John D Williams

John Williams
President, Zen-Noh Grain Corporation

Enc.

cc: Mr. Kermit Wittenburg, LDEQ
Ms. Cheryl Nolan, LDEQ
Mr. Beau Brock, LDEQ

Mr. Steven Rowlan - Nucor

November 17, 2008

Mr. Steven Rowlan
Director of Environmental Affairs
Nucor Corporation
1915 Rexford Road
Charlotte, North Carolina 28211

Re: **Part 70 and PSD Permits and Environmental Assessment Statement**
Nucor Steel-Louisiana
Request for Supporting and Background Documentation

Dear Steve:

Thank you for visiting with us on Tuesday, November 11, 2008, to discuss Zen-Noh Grain Corporation's concerns regarding the proposed Consolidated Environmental Management, Inc.-Nucor Steel Louisiana pig iron mill in Convent, Louisiana. It was certainly a pleasure meeting you and your team, and we appreciate the mutual spirit of cooperation exhibited by all involved. Your willingness to share technical information for our review is appreciated. Following is our first-blush identification of data gaps in the permit applications and additional information Nucor submitted to LDEQ, most of which we discussed at length last Tuesday.

- **Supporting documentation for Nucor's BACT analyses.** This should include design parameters, engineering drawings and calculations, vendor literature and performance warranties.
- Identify **alternative and innovative technology**, including processes and technologies used outside the United States, evaluated by Nucor, and include the results of those evaluations;
- Documentation supporting Nucor's determination that any control technology is **technically infeasible.**[1]
    - Please also provide any reports and/or results of the **NOx emission control pilot projects** implemented by Nucor pursuant to the EPA Consent Decree.
- **Cost-benefit analyses** for each control technology identified as technically feasible, including (at least):
    - **"spare" HRSG units** to eliminate coke oven bypass vent emissions;
    - **once-through quench water** to further reduce quench tower

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[1] For example, the determination that selective catalytic reduction is not feasible for control of NOx in the topgas boiler flue gas should be supported by vendor or engineering literature identifying the required temperature range for use of this technology, the level of NOx emissions (in ppm) that may be achieved with this technology, and the specific conditions that prevent SCR from being used by Nucor.

emissions;

  - **Cyclone and wet scrubber combination** to reduce cast house emissions;
  - **Wet scrubber** to control coke oven emissions;[2]
  - **Fabric filter** or **cyclone** (in addition to flat-car pushing) to reduce coke pushing emissions;
  - **Cyclone and wet scrubber flue gas desulfurization combination** to reduce sinter plant emissions;[3]
  - **Cyclone and wet scrubber flue gas desulfurization combination** to reduce coke oven emissions;
  - **Enclosures** to further reduce slag processing and storage emissions;
  - **Thermal oxidizer** to reduce sinter plant emissions;
  - **Very low (< 500 ppm) TDS cooling water** to further reduce emissions from cooling towers; and
  - **Enclosed storage piles** to reduce dust emissions.
- For emissions units that are treated as groups in the BACT analysis, identify the specific control technology to be implemented at each **individual emissions unit**, including:
  - each proposed segment of **unpaved road** (and document why the segment cannot be paved);
  - each **marine or rail loading or unloading** point; and
  - each **conveyance system** for raw materials, products or byproducts.
- A **material balance** for each potential air pollutant[4] that will be present in quantities above 25 pounds per year, in Nucor's raw materials, including:
  - proposed **water treatment chemicals**;
  - **impurities** commonly found in coal, iron ore, and lime, including

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[2] The BACT Analysis provides a number of cost issues associated with wet scrubbers and states that "[a] wet scrubbing system is not known to have been used for coke ovens," but there is no indication of any physical, chemical and engineering principal that would prevent use of wet scrubbers in this application.

[3] The BACT analysis indicates that wet scrubbers were rejected because used alone wet scrubbers provide 98% removal of particulate matter. This analysis does not account for the facts that 99+% control can be achieved by a cyclone/wet scrubber combination and the particulate matter loading to the fabric filter in a spray dryer system is greatly increased by the injection of lime.

[4] When it comes to food and feed grain, there is no list of contaminants of concern. Rather, in accordance with FDA and USDA rules and regulations and the requirements of our international customers, *any* detectable quantity of industrial pollutants -- including substances as innocuous and prevalent as coal dust -- could subject Zen-Noh's grain to seizure and destruction.

  but not limited to **heavy metals, sulfur, chlorides, and fluorides**;[5] and
  - **dissolved solids** in the source of Nucor's quench water.

- Electronic copies of the **data input files** for your dispersion modeling, including the PSD increment modeling, Toxic Air Pollutant impact assessment, and deposition modeling, including on-site and off-site emission point data, receptor grids, terrain and meteorology.
- Nucor's evaluation -- which you agreed to provide during our meeting last Tuesday -- of **alternate facility configurations** that would move significant emissions units, including the docks, material conveyors and material storage areas to the lower (east) end of the batture.
- Copies of Nucor's application for a United States Army Corp of Engineers **("USACE") permit to construct and operate the dock** and any supporting documentation and related correspondence, and any other permit or approval related to the Convent facility.
- Supporting and background documentation for each element in Nucor's **Environmental Assessment Statement**, including but not limited to the:
  - **environmental impact** analyses;
  - **economic impact** projections;
  - **alternate site** evaluations; and
  - **alternative process** evaluations.

Although this list may appear large, rest assured that we are only beginning our review of the permit application. There is much information and many assessments that we are just beginning to review. We will let you know as soon as additional questions arise. In the meantime, attached for your records is our request for an initial 45-day extension of the public comment period, which we filed with LDEQ today. We initially requested an indefinite extension, according to your request last Tuesday, but LDEQ has indicated they would only approve a definite extension.

Again, Steve, we truly appreciate your cooperation and willingness to discuss Zen-Noh's concerns. I would be happy to discuss these issues and any concerns you have at any time. We look forward to hearing from you and receiving the requested documentation.

Thank you.

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[5] In particular, the material balances should quantify each byproduct created in Nucor's processes, such as sulfur dioxide and sulfuric acid from sulfur and hydrochloric acid from chloride.

Sincerely,

John D Williams

John Williams
President, Zen-Noh Grain Corporation

cc: Jeff Braun, Nucor

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY (LDEQ)
CONSOLIDATED ENVIRONMENTAL MANAGEMENT, INC.
NUCOR STEEL LOUISIANA

AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

AFFIDAVIT OF DR. PAOLO ZANNETTI, QEP

I, Dr. Paolo Zannetti, QEP, state:

1. I have personal knowledge of the statements made herein.
2. I am President of EnviroComp Consulting, Inc. ("EnviroComp"), an environmental consulting firm.
3. Exhibit 1 hereto is a true and accurate copy of my curriculum vitae, including a list of depositions and trial testimonies in the last 5 years.
4. In the course of my practice as an air pollution consultant, I have reviewed the permits referenced above (the "Permits"), applications and other materials related to the proposed Nucor Steel Louisiana facility, and conducted mathematical modeling of emissions from the proposed Nucor facility.
5. Through my education, training, experience, review of relevant documents, meetings with representatives of the Louisiana Department of Environmental Quality ("LDEQ") and Nucor Steel ("Nucor"), personal visit to the location of the proposed Nucor pig iron mill, and mathematical modeling, I have formed opinions regarding the emissions, control strategies, and environmental impacts of the proposed Nucor pig iron mill.
6. The materials and mathematical modeling I reviewed and performed are what an experienced air pollution consultant would rely upon in forming opinions regarding the emissions, control strategies and environmental impacts of a proposed manufacturing facility.
7. Exhibit 2 hereto is a true and accurate copy of my opinions regarding the emissions, control strategies, and environmental impacts of the proposed Nucor pig iron mill.
8. On November 6, 2008, my Associate at EnviroComp, Dr. Frank Freedman, sent an e-mail to publicrecords@la.gov, requesting an electronic copy of the modeling files submitted by Nucor in support of the Permits. Dr. Freedman was contacted by the LDEQ the following day and offered the CD containing the modeling files for the Part 70 Initial Permit dated May 2008. Since the modeling had been updated since then (see Sept. 11, 2008 letter from ERM/NUCOR to LDEQ regarding "Addendum No 2 – Additional Dispersion Modeling"), Dr. Freedman asked for the most recent CD of the modeling files. LDEQ said that they would

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check the availability of the most recent modeling files. On November 12, 2008 LDEQ recontacted Dr. Freedman and said that the May 2008 CD contained the only modeling files they had. On November 12, 2008, Dr. Freedman received an email from the LDEQ with a request to mail a check of $5.75 in order to obtain the CD. Dr. Freedman mailed the check on the same day via airmail. Subsequently, Dr. Freedman made a few phone calls to the LDEQ to inquire about the status of the shipment of the CD. He finally received the CD on November 20, 2008. Our analysis confirms that this CD does not contain the files for the most recent modeling results presented by ERM/NUCOR to LDEQ in the September 11, 2008 "Addendum 2" letter.

9. During a meeting with LDEQ representatives on November 10, 2008, I personally again requested an electronic copy of the modeling files. LDEQ agreed to provide a copy. I confirmed this request with an e-mail to LDEQ on November 14, 2008. Exhibit 3 contains a copy of all email correspondences between the LDEQ and EnviroComp.
10. During a meeting with Nucor representatives on November 11, 2008, I personally requested an electronic copy of the modeling files, including additional modeling that Nucor stated they had received the day before. Nucor agreed to provide the modeling files. Nucor has not provided the modeling files.
11. An electronic copy of the modeling files mailed by LDEQ was not received by EnviroComp until the afternoon of Thursday, November 20, 2008.
12. Based on my experience, it will take at least three to six weeks to re-run and verify all the modeling submitted by Nucor, conduct modeling of significant emission scenarios not modeled by Nucor, and evaluate all potential impacts of Nucor's emissions on grain and equipment at Zen-Noh. However, the modeling I have reviewed and performed to date are sufficient to support my opinions set forth in Exhibit 2 to the degree commonly accepted in my field of practice.

I hereby certify under penalties of perjury that the foregoing representations are true to the best of my knowledge.

23 November 2008

Date

Dr. Paolo Zannetti, QEP

Exhibit 1

True and accurate copy of the curriculum vitae of
Dr. Paolo Zannetti, QEP, including a list of depositions
and trial testimonies in the last 5 years

CURRICULUM VITAE

OF

PAOLO ZANNETTI

PRESIDENT, ENVIROCOMP CONSULTING, INC.

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EDUCATION AND TITLES

- *Qualified Environmental Professional (QEP),* Institute of Professional Environmental Practice (IPEP) www.ipep.org
  Certificate #029440029 (2/1994) – Recertified on 7/2007
- *Doctoral Degree in Physics*, University of Padua, Italy (12/1970)
  www.unipd.it
- *Diploma of Maturita' Scientifica*, Scientific Lyceum Ippolito Nievo, Padua, Italy (7/1965)

PROFESSIONAL EXPERIENCE

- ***President*, EnviroComp Consulting, Inc. (4/2001 – present)**
  www.envirocomp.com

    - *President and Founder*, EnviroComp Institute (10/1996-present) www.envirocomp.org

    - *Regional Coordinator* for the Institute of Professional Environmental Practice (IPEP) in the San Francisco Bay Area (9/1997- present); www.ipep.org

    - *Visiting Professor*, Wessex Institute of Technology, Southampton, UK (1991-present); www.wessex.ac.uk

    - *Visiting Professor*, Polytechnic University of Bari-Taranto, Italy (1999 – present)
      www.poliba.it/Taranto/TARAS_1.htm

    - *Peer-Reviewer*, Kuwait Institute of Scientific Research, Kuwait. Wessex Institute of Technology, Southampton, UK (2002-present); http://www.kisr.edu.kw/

- ***Principal Scientist*, Exponent, Inc., Menlo Park, California (11/1991-4/2001)**
  www.exponent.com

    - *Instructor*, University Extension, University of California, Berkeley (10/1992-7/1997); www.unex.berkeley.edu:4243

- ***Department Manager*, AeroVironment, Inc., Pasadena/Monrovia, California (10/1979-11/1991)**
  www.aerovironment.com

    - *Consultant*, IBM Semea, Milan, Italy (1-10/1991; on leave of absence from AeroVironment)

    - *Head, Environmental Sciences*, IBM Scientific Center, Bergen, Norway and *Leader, Environmental Sciences Activities of IBM Europe* (3-12/1990; on leave of absence from AeroVironment)

    - *Consultant*, Research Center of the Italian National Electric Power Company (CRTN/ENEL), Milan, Italy. (3-10/1984; on leave of absence from AeroVironment)

  - *Project Manager*, Kuwait Institute for Scientific Research (KISR), Kuwait (2/1982-2/1984; on leave of absence from AeroVironment); www.kisr.edu.kw

- ***Researcher*, IBM Scientific Center, Venice, Italy (8/1971-10/1979)**

  - *Visiting Scientist*, Department of Statistics, Stanford University, California (1/1978-3/1979; on assignment from IBM Italy)

  - *Visiting Scientist*, IBM Scientific Center, Palo Alto, California (1/1978-3/1979; on assignment from IBM Italy)

  - *Assistant Professor*, Department of Civil Engineering, University of Padua, Italy (1974-78); www.unipd.it

- ***Systems Analyst*, UNIVAC/Sperry Rand, Milano, Italy (3-7/1971)**

EDITORIAL RESPONSIBILITY

- Editor of the Book Series "Environmental Sciences and Environmental Computing"
  www.envirocomp.org/esec

- Editor and co-Author of the Book Series "Air Quality Modeling - Theories, Methodologies, Computational Techniques, and Available Databases and Software"
  www.envirocomp.org/aqm

- Member of the Editorial Board of "Environmental Forensics" (AEHS) (2003- present)

- Founder and President (since 1996) of the EnviroComp Institute - The International Institute of Environmental Sciences and Environmental Computing (www.envirocomp.org)

- Founder and Editor-in-Chief (1986-93) of the quarterly journal *Environmental Software*, published by Computational Mechanics Publications since June 1986 and by Elsevier Applied Science since September 1991. Currently Founding Editor.

- Founder and Director of the biennial ENVIROSOFT Conference - Computer Techniques in Environmental Studies (conferences have been held every two years since 1986).

- Founder and Co-Director of the first two AIR POLLUTION Conferences - Computer Techniques in Environmental Studies (1993-94). Currently Member of the Conference Board.

- Associate Editor/Member of the Editorial Board, *Atmospheric Environment*, published by Pergamon Press (1987-1999).

- Member of the Editorial Board, *Ecological Modeling*, published by Elsevier Applied Science (1992-2007).

- Member of the Editorial Board, *ENVIRONews*, published by FiatLux Publications (1993-1998); www.envirocomp.org/html/news/flpub.htm

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MEMBERSHIPS

- Member, International Scientific Advisory Committee, AIR POLLUTION Conference Cycle, Wessex Institute of Technology, UK. (since 2000)

- Member of the "SATURN Specialist Group" (http://aix.meng.auth.gr/lhtee/saturn.html), subproject of EUROTRAC-2 (http://www.gsf.de/eurotrac) dealing with urban air pollution (since 1998)

- San Francisco Bay Area Regional Coordinator for the Institute of Professional Environmental Practice (IPEP) (since 1997)

- Athens 2004 Committee (1997-2000)

- Reviewer group for the Center for Indoor Air Research (CIAR), 1995-1999.

- International Scientific Advisory Committee, Environmental Engineering and Management Conference, Barcelona, Spain. October 1998.

- International Scientific Advisory Committee, Environmental Engineering, Education and Training Conference (EEET96), Southampton, UK, April 1996.

- Scientific Advisory Board, International Congress on Modelling and Simulation (MODSIM 93 and MODSIM 95), Modeling and Simulation Society of Australia Inc.

- International Federation for Information Processing (IFIP), Working Group WG 5.11 (Computers and Environment), (1992-1997)

- ISATA Programme Committee (1992-1994)

- Scientific Committee of the Technological Consortium THETIS (Venice, Italy), (1991)
- Board of Directors, MONDOMETANO, published by RES Editrice srl. (1989-92).
- European Association for the Science of Air Pollution (EURASAP), (1987-94)
- EPA-ASRL pool for the review of U.S. Environmental Protection Agency publications, (1987-96)
- American Meteorological Society (AMS) (1978-1985)
- Air and Waste Management Association (AWMA), since 1978 (originally Air Pollution Control Association, APCA)

MISCELLANEA

- Italian Citizen by birth. U.S. Citizen since 1989.
- Languages: English, Italian, French, plus understanding of Spanish

HONORS

- Medal award from Computational Mechanics, Ashurst, England, in recognition of contribution to the development of Environmental Modeling (11/1994)
- Plaque award from the South Coast Air Quality Management District, in recognition of contribution to the Toxic Symposium at Caltech, Pasadena, California (7/1986)

PUBLICATIONS

Books

B.25 Zannetti, P., Ed. (2008) Air Quality Modeling - Theories, Methodologies, Computational Techniques, and Available Databases and Software. Vol III – Special Issues. Book Series published by the EnviroComp Institute and the Air & Waste Management Association. (www.envirocomp.org/aqm)

B.24 Zannetti, P., Scott Elliott, and Damian Rouson, Eds. (2007) Environmental Sciences and Environmental Computing, Vol III. Electronic book (on CD-ROM), The EnviroComp Institute (www.envirocomp.org/esec)

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B.19 C.A. Brebbia and P. Zannetti, Eds. (2002) Development and Application of Computer Techniques to Environmental Studies IX. WIT Press (www.witpress.com).

B.18 Ibarra-Berastegi, G., C.A. Brebbia, and P. Zannetti, Eds. (2000) Development and Application of Computer Techniques to Environmental Studies VIII. WIT Press (www.witpress.com).

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B.13 Zannetti, P., Ed. (1994) *Pollution Modeling.* Volume I of the Proceedings of the ENVIROSOFT 94 Conference, San Francisco, November. Computational Mechanics Publications, Southampton.

B.12 Zannetti, P., Ed. (1994) *Environmental Systems.* Volume II of the Proceedings of the ENVIROSOFT 94 Conference, San Francisco, November. Computational Mechanics Publications, Southampton.

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B.5 Melli, P. and P. Zannetti, Eds. (1992): *Environmental Modelling.* Computational Mechanics Publications, Southampton, and Elsevier Applied Science, London.

B.4 Zannetti, P. (1990): *Air Pollution Modeling - Theories, Computational Methods and Available Software.* Computational Mechanics Publications, Southampton, and Van Nostrand Reinhold, New York. 450 pp. (http://www.amazon.com/Pollution-Modeling-Theories-Computational-Available/dp/0442308051)

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B.1 Zannetti, P., Ed. (1986): *ENVIROSOFT 86.* Proceedings of the International Conference on Development and Application of Computer Techniques to Environmental Studies, Los Angeles, USA, November 1986. Ashurst, United Kingdom: Computational Mechanics Publications.

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BC.15 P. Zannetti (2008) Air Quality Modeling Resources on the Web. Chapter 27 of AIR QUALITY MODELING - Theories, Methodologies, Computational Techniques, and Available Databases and Software. Vol. III – Special Issues (P. Zannetti, Editor). Published by The EnviroComp Institute and the Air & Waste Management Association. (www.envirocomp.org/aqm).

BC.14 Freedman, F. and P. Zannetti. 2007. Global Warming and Climate Change: State of the Science. Chapter 5 of AMBIENT AIR POLLUTION (P. Zannetti, D. Al-Ajmi, and S. Al-Rashied, Editors). Published by The Arab School for Science and Technology (ASST) and The EnviroComp Institute (http://www.envirocomp.org/). Also published as Chapter 10 of Environmental Sciences and Environmental Computing. Vol. III (P. Zannetti, S. Elliott and D. Rouson, Editors). Published by The EnviroComp Institute (http://www.envirocomp.org/).

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BC.11 Byun, Daewon W., Avraham Lacser, Robert Yamartino, and Paolo Zannetti (2005) Eulerian Dispersion Models. Chapter 10 of AIR QUALITY MODELING - Theories, Methodologies, Computational Techniques, and Available Databases and Software. Vol. I - Fundamentals (P. Zannetti, Editor). Published by The EnviroComp Institute and the Air & Waste Management Association. (www.envirocomp.org/aqm)

BC.10 Zannetti, P. (2004) Air Pollution Dispersion Modeling. Section 16.6 of The CRC Handbook of Mechanical Engineering, Second Edition, Eds., Kreith, F. and D. Yogi Goswami. CRC Press.

BC.9 Calamari, D., K. Jones, K Kannan, A. Lecloux, M. Olsson, M. Thurman, P. Zannetti (2000) Monitoring as an Indicator of Persistence and Long-Range Transport. Chapter 6 of Evaluation of Persistence and Long=Range Transport of Organic Chemicals in the Environment, Edited by G. Klecka et al. – SETAC Press (www.setac.org).

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BC.7 Zannetti, P. (1996) Environmental Modeling: Today and Tomorrow. Chapter 1 of *ENVIRONMENTAL MODELING - Computer Methods and Software for Simulating Environmental Pollution and its Adverse Effects - Volume III*, Zannetti, P., Ed., Computational Mechanics Publications, Southampton.

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BC.4 Zannetti, P. (1993) Numerical Simulation Modeling of Air Pollution: An Overview. Section of *Ecological Physical Chemistry*, Bonati, L., U. Cosentino, M. Lasagni, G. Moro, D. Pitea, and A. Schiraldi, Eds., Elsevier Science Publishers, London. Also published in *Air Pollution*, Zannetti, P., C.A. Brebbia, J.E. Garcia Gardea and G. Ayala Milian, Eds. (1993), First International Conference on Air Pollution, Monterrey, Mexico, February. Computational Mechanics Publications, Southampton, and Elsevier Science Publishers, London.

BC.3 Zannetti, P. (1992) Particle Modeling and its Application for Simulating Air Pollution Phenomena. Chapter 11 of *Environmental Modelling,* Melli, P. and P. Zannetti, Eds., Computational Mechanics Publications, Southampton, and Elsevier Applied Science, London.

BC.2 Zannetti, P. (1989): Simulating Short-Term, Short-Range Air Quality Dispersion Phenomena. Chapter V of *Library of Environmental Control Technology,* Volume 2, Air Pollution Control, P.N. Cheremisinoff, Ed., Houston, Texas: Gulf Publishing.

BC.1 Zannetti, P., G. Carboni and A. Ceriani (1986): AVACTA II model simulations of worst-case air pollution scenarios in Northern Italy. Section of *Air Pollution Modeling and Its Application,* C. De Wispelaere, F. A. Schiermeider and N. V. Gillani, Eds., Plenum Press, New York.

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JA.24 Liberti, L., Michele Notarnicola, Roberto Primerano, and Paolo Zannetti (2006) Air Pollution from a Large Steel Factory: Polycyclic Aromatic Hydrocarbon Emissions from Coke-Oven Batteries. ISSN 1047-3289 J. Air & Waste Manage. Assoc. 56:255–260.

JA.23 Zannetti, P. (1996) Modeling Danger – Computer Simulations Analyze Pollution Effects, Forecast Problems. *Contingency Magazine*, March/April, pp 73-75.

JA.22 Boybeyi Z., S. Raman and P. Zannetti (1995): Numerical Investigation of Possible Role of Local Meteorology in Bophal Gas Accident. *Atmospheric Environment (Urban Atmosphere),* Vol. 29, No. 4, pp 479-496.

JA.21 Zannetti, P., I. Tombach, S. Cvencek and W. Balson (1993): Calculation of visual range improvements from SO_2 emission controls - II. An application to the Estern United States. *Atmospheric Environment,* **27A**:1479-1490.

JA.20 Zannetti, P., I. Tombach and W. Balson (1990): Calculation of visual range improvements from SO_2 emission controls - I. Semi-empirical methodology. *Atmospheric Environment,* **24A**:2361-2368.

JA.19 Zannetti, P., I.H. Tombach, and S. Cvencek (1989): An analysis of visual range in the eastern United States under different meteorological regimes. *Journal of the Air & Waste Management Association,* **39**:200-203.

JA.18 Brusasca, G., G. Tinarelli, D. Anfossi, P. Zannetti (1987): Particle modeling simulation of atmospheric dispersion using the MC-LAGPAR package. *Environmental Software,* **2**(3):151-158.

JA.17 Zannetti, P. (1986b): A new mixed segment-puff approach for dispersion modeling. *Atmospheric Environment,* **20**(6):1121-1130.

JA.16 Zannetti, P. (1986a): Monte-Carlo simulation of auto- and cross-correlated turbulent velocity fluctuations (MC-LAGPAR II model). *Environmental Software,* **1**(1):26-30.

JA.15 Tirabassi, T., M. Tagliazucca and P. Zannetti (1986): KAPPA-G, a non-Gaussian plume dispersion model: description and evaluation against tracer measurements. *Journal of the Air Pollution Control Association,* **36**:592-596.

JA.14 Zannetti, P. (1984): New Monte Carlo scheme for simulating Lagrangian particle diffusion with wind shear effects. *Applied Mathematical Modeling,* **8**:188-192.

JA.13 Zannetti, P. (1982): Il "Controlled Trading" negli Stati Uniti [Controlled Trading of pollution emissions in the US]. *Note di Inforrnatica,* **1**:71-83. IBM Italia (also in *Inquinamento,* **25**(7/8):61-64, Etas Kompass, 1983).

JA.12 Zannetti, P. (1981b): Scommessa con il sole [Solar Challenger]. *Scienza e Vita Nuova,* **3**(7):16-21, Rusconi Editore.

JA.11 Zannetti, P. (1982a): E' la anidride carbonica nella atmosfera uno dei futuri maggiori pericoli per l' umanita'?[Is the increase of atmospheric CO_2 one of the most serious future problems for the human beings?]. *Inquinamento,* **24**(3):59-62, Etas Kompass.

JA.10 Zannetti, P. (1981a): An improved puff algorithm for plume dispersion simulation. *Journal of Applied Meteorology,* **20**(10):1203-1211.

JA.9 Zannetti, P. (1980-81): Problemi energetici ed ambientali negli USA. [Energy and environmental problems in the US] *Inquinamento,* **22**(12):65-69 and **23**(1):63-66, Etas Kompass.

JA.8 Finzi, G., P. Zannetti, G. Fronza and S. Rinaldi (1979): Real time prediction of SO_2 concentration in the Venetian Lagoon area. *Atmospheric Environment,* **13**:1249-1255.

JA.7 Runca, E., P. Zannetti and P. Melli (1978): A computer-oriented emissions inventory procedure for urban and industrial sources. *Journal of the Air Pollution Control Association,* **28**(6):584-588.

JA.6 Zannetti, P. (1977): Metodiche adottate nell'analisi dei dati misurati nelle reti di monitoraggio dell'area veneziana. [Analysis of atmospheric monitored data in the Venitian region] Tavola Rotonda su "La gestione operativa di una rete di monitoraggio dell'inquinamento atmosferico," Venice, Italy, June 1976. Annex to *Inquinamento,* **19**(6), Etas Kompass.

JA.5 Zannetti, P., P. Melli and E. Runca (1977): Meteorological factors affecting SO_2-pollution level in Venice. *Atmospheric Environment,* **11**:605-616.

JA.4 Zannetti, P. (1977): Stabilita' atmosferica e livelli di SO_2 in Venezia: limiti del modello gaussiano. [Atmospheric stability and SO_2 levels in Venice - the limitations of the Gaussian model] *Inquinamento,* **19**(3):49-53, Etas Kompass.

JA.3 Runca, E., and P. Zannetti (1976): Applicazione di un metodo per il censimento degli scarichi gassosi di origine industriale nell'area Veneziana. [A method based on optical reading for the inventory of air pollution emissions in the Venetian area] *Inquinamento,* **18**(11):13-17, Etas Kompass.

JA.2 Runca, E., P. Melli and P. Zannetti (1976): Computation of long-term average SO_2 concentration in the Venetian area. *Applied Mathematical Modeling,* **1**:9-15.

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P.48 Zannetti, P. (2000) Environmental data, software, information, and resources on the Internet – a review. Keynote address in the Proceedings of ENVIROSOFT 2000, June, Bilbao, Spain. [Published as: Ibarra-Berastegi, G., C.A. Brebbia, and P. Zannetti (2000) Development and Application of Computer Techniques to Environmental Studies VIII. WIT Press (www.witpress.com)]

P.47 Zannetti, P. and R. Sire (1999) MONTECARLO - A New, Fully-Integrated PC Software for the 3D Simulation and Visualization of Air Pollution Dispersion Using Monte Carlo Lagrangian Particle (MCLP) Techniques. AIR POLLUTION 99, Stanford, California, July. WIT Publications, Ashurst, UK.

P.46 Canepa, E., C.F. Ratto, and P. Zannetti (1999) Calibration of the dispersion code SAFE_AIR using a release in nocturnal low wind conditions. AIR POLLUTION 99, Stanford, California, July. WIT Publications, Ashurst, UK.

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P.44 Jackson, J. and P. Zannetti (1997) Design of a Supplemental Control Program for SO2 Episodes in the Region of Ilo, Peru. Proceedings of AIR POLLUTION 97, Bologna, Italy, September. Computational Mechanics Publications, Southampton, UK.

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P.13 Runca, E., P. Zannetti and P. Melli (1978): Air quality management: Proposal for a computer oriented approach. International Symposium "Simulation '77," Montreux, Switzerland, June 1977.

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More than 50 Short Communications, plus

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- **EnviroNews**, a bimonthly environmental newsletter publisher by FiatLux Publications (1993-2000) www.envirocomp.org/html/news/flpub.htm

UNPUBLISHED WORKS

Doctoral Degree Thesis

Zannetti, P. (1970) Riconoscimento a mezzo di elaboratore elettronico di caratteri numerici manoscritti. [Computer pattern recognition of handwritten digits] Relatori: Profs. L. Mezzetti and D. Toniolo. University of Padua, Faculty of Science (Physics).

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C.33 Zannetti (2005) 1. Introduction to Air Pollution. 2. Introduction to Air Pollution Modeling. 3A. Air Pollution Case Studies. 3B. Global Issues. Workshop on Ambient Air Pollution, 5-9 February 2005. The Kuwait Foundation for the Advancement of Science (KFAS), Kuwait.

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Reconstruction, Air Dispersion Modeling, Source Identification, and Allocation of Responsibility. Environmental Litigation: Advanced Forensics and Legal Strategies. April 4-5, San Francisco, CA.

C.27 Zannetti, P. (2000) Fluid Pollution Modeling. Engineering Faculty, Taranto, Italy. October 9-12.

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C.7 Zannetti, P., J.C.R. Hunt and A.G. Robins (1985): Air Pollution Modeling Course. Computational Mechanics Centre, Ashurst (Southampton), England, September.

C.6 Gopalakrishnan, T.C., and P. Zannetti (1983): Numerical Modeling Course. Kuwait Institute for Scientific Research, Kuwait, December.

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C.1 Zannetti, P. (1977): 1) Statistical models and their application to data collected in Venice. 2) Statistical programs application to meteorological and air quality data (Computer practical exercise). EURATOM CCM

Courses, Modeling and Simulation of Ecological Processes, Ispra, Italy, October.

More than 100 Invited Lectures/Seminars

Recent Invited Lectures/Seminars:

- Air Pollution Modeling of Accidental Releases - Science and Litigation. Presented at the Universidade Federal de Santa Maria, Brazil, 15 September 2005.
- Computer Modeling of Accidental Releases of Air Pollutants – University of PADOVA, Department of Mathematical Methods and Models for Applied Sciences (DMMMSA), 26 March 2008; and University of VENEZIA, Faculty of Science, 27 March 2008.
- Business-Oriented Environmental Applications – Case Studies and ICT Tools. April 20, 2008 University of Damascus, Syria; April 21, 2008 University of Homs, Syria; April 22, 2008 University of Lattakia, Syria; April 23, 2008 University of Aleppo, Syria.
- 1) Introduction to Air Pollution; 2) Introduction to Air Pollution Modeling; 3) Litigation case studies for accidental releases of chemicals in the atmosphere. 22 October 2008, Guest lecturer for the course Environmental Science for Lawyers at Tulane Law School, Louisiana.

Testimony Experience of Dr. Paolo Zannetti, QEP, Since 2003

Since 2003 he has given testimony in deposition in 16 cases:

1) San Leandro, CA, May 29, 2003. Superior Court of the State of Arizona, County of Manicopa. Bobbie Holden et al. v. State of Arizona et al., NO. CV2000-016167, CV2001-009443, CV2001-013152, CV2002-014966, CV2002-015018, CV2002-014225.

2) San Francisco, California, 13-14 August 2003. 23rd Judicial District Court, Parish of Ascension, State of Louisiana. Vulcan Litigation- April 2001 incidents. Number 69,388, Division "A".

3) Newark, California, 19 November 2003. Mest et al. v. Cabot Corporation et al. United States District Court, Eastern District of Pennsylvania, No. 01-CV-4943.

4) Los Angeles, CA, 24 May 2004. 23rd Judicial District Court, Parish of Ascension, State of Louisiana. Vulcan Litigation- April 2001 incidents. Number 69,388, Division "A".

5) Baton Rouge, LA, September 28, 2004. 14th Judicial District Court, Parish of Calcasieu, State of Louisiana. Brenda Stevens et al. v. ConocoPhillips Company, No. 2003-3061

6) Fremont, CA. April 18, 2004. Rivera v. Dormex. Riverside Superior Court, Indio Branch, Indio, CA. INC 019888.

7) Los Angeles, California, February 23, 2006. Superior Court of the State of California, County of Los Angeles – Central Civil West. Lori Lynn Moss, et al., vs. Venoco, Inc., et al. No. BC 297083

8) Los Angeles, California, May 3, 2006. Superior Court of the State of California, County of Los Angeles – Central Civil West. Lori Lynn Moss, et al., vs. Venoco, Inc., et al. No. BC 297083

9) Houston, Texas, January 12, 2007. Civil District Court for the Parish of Orleans, State of Louisiana. Mr. and Mrs. Adam Thomas, Sr., et al. vs. Mobil Oil Corporation, et al. No. 90-23370

10) Half Moon Bay, California, Monday, May 21, 2007. UNITED STATES DISTRICT COURT SOUTHERN DISTRICT OF ALABAMA, CIVIL NO. 03-566, DIVISION: WS-B. JESSIE FISHER, et al. v. CIBA SPECIALTY CHEMICALS CORPORATION et al.

11) Oakland, CA, Aug. 9, 2007. SUPERIOR COURT OF CALIFORNIA, COUNTY OF SAN FRANCISCO, UNLIMITED JURISDICTION, CYNTHIA DIANE SMITH, Plaintiff, vs. EDWARD J. CONNER, et al, Defendants, No. CGC-02-411127.
12) San Francisco, CA, November 6, 2007. UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF PENNSYLVANIA No. 2:06-CV-01743-G, GLENN GATES and DONNA GATES, h/w on behalf of themselves and all others similarly situated, Plaintiffs, vs. ROHM AND HAAS COMPANY, et al., Defendants.

13) Fremont, CA, February 19, 2008. Superior Court of the State of California, County of Kern, Metropolitan Division. Beatriz Perez, Guardian ad Litem for Raul Sepulveda, a minor, Plaintiff, v. Vince Crop Dusters, Inc.; Rick Rhoades; Buttonwillow Warehouse Company, Inc.; and Jeffrey Hunter, Defendants. Case No. CV259271, Action filed 9/26/06.

14) Burlingame, CA, April 30, 2008. Civil District Court for the Parish of Orleans, State of Louisiana. No. 04-7935, Division "B". In re: Arts Street Fire. Rose-Abena Assensoh et al. v. Advanced Commercial Contracting, Inc.

15) 15.Santa Cruz, California, August 19, 2008. SUPERIOR COURT OF THE STATE OF CALIFORNIA FOR THE COUNTY OF SANTA CRUZ. JACOBS FARM/DEL CABO, INC., Plaintiffs vs WESTERN FARM SERVICE, INC., et al., Defendants. CASE NO.CIS CV 157041.

16) Beverly Hills, CA, OCTOBER 30, 2008. SUPERIOR COURT OF THE STATE OF CALIFORNIAFOR THE COUNTY OF LOS ANGELES. LESLIE HENSLEY AND RICK HENSLEY, PLAINTIFFS, VS. PETER T. HOSS, et al. DEFENDANTS. CASE NO. SC094173.

Since 2003 he has given testimony in the courtroom in 5 cases:

1) Indio, CA, 24 November 2003. Riverside Superior Court, Indio Branch, Indio, CA, Rivera v. Dormex. INC 019888.

2) Baton Rouge, Louisiana, 7 July 2004. 23rd Judicial District Court, Parish of Ascension, State of Louisiana. Vulcan Litigation- April 2001 incidents. Number 69,388, Division "A".

3) Fresno, California, 30 January 2008. FORTUNE FARMS vs. GROULEFF AVIATION, Case No. 05 CECG 01050, Before the Honorable Adolfo Corona, Judge, Department 52.

4) San Francisco, California, 13 February 2008. SUPERIOR COURT OF THE

STATE OF CALIFORNIA IN AND FOR THE COUNTY OF SAN FRANCISCO, CYNTHIA DIANE SMITH, Plaintiff, vs. EDWARD J. CONNER, AMORE PROPERTY MANAGEMENT, and DOES 1 to 30, Defendants. CASE NO. 411127.

5) Santa Cruz, California, September 22, 2008. SUPERIOR COURT OF THE STATE OF CALIFORNIA FOR THE COUNTY OF SANTA CRUZ. JACOBS FARM/DEL CABO, INC., Plaintiffs vs WESTERN FARM SERVICE, INC., et al., Defendants. CASE NO.CIS CV 157041.

<u>Other testimonies under oath since 2003:</u>

1. Hayward, CA, December 17, 2007. BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA - APPLICATION FOR CERTIFICATION FOR THE DOCKET NO. 06-AFC-6 EASTSHORE ENERGY CENTER IN HAYWARD (AFC ACCEPTED 11/8/06) BY TIERRA ENERGY.

Exhibit 2

True and accurate copy of Dr. Paolo Zannetti, QEP, opinions regarding the emissions, control strategies, and environmental impacts of the proposed Nucor pig iron mill

In collaboration with my associates, I have reviewed the ERM/Nucor permit documents.

I. With reference to the air pollution emission data presented in the permit documents, I have the following comments:

1. The emissions for Nucor sources listed in the current version of the Title V Permit (contained in the pdf document '38131069.pdf' obtained from LDEQ EDMS) are different than those used in the Initial Permit Report of May 2008.
2. A September 11, 2008 letter from ERS/Nucor to LDEQ regarding "Addendum No 2 – Additional Dispersion Modeling" presented air dispersion modeling results for criteria pollutants using changed emission rates from what were applied in the May 2008 permit report.
3. The "Addendum No 2" letter does not state why the emission rates changed.
4. The PM10 emissions from coke ovens were reduced by 90% in the changed emissions relative to the original emissions (see Table 4 of the September 11, 2008 "Addendum No 2" letter).
5. The average emissions from the coke ovens for certain metals (for example, cadmium, copper, chromium) were reduced by 99% in the emissions reported in the current Title V permit (see Page 15 of 24 of "Emission Rates for TAP/HAP & Other Pollutants" in the '38131069.pdf' document) relative to emissions applied in the Initial Permit modeling (see Table 6-4 of the Initial Permit Report of May 2008).
6. ERM/Nucor relied on vendor data for PM, SO2 and NOx emissions from the coke ovens.
7. ERM/Nucor relied on AP-42 factors for toxics emissions from coke ovens.

II. With reference to the air pollution concentrations simulated by ERM, I have the following comments:

1. ERM/Nucor used the "adjusted background concentration" in the PSD analysis in their permit modeling. It is our understanding that the "adjusted background concentration" is no longer allowed by EPA and LDEQ. See Exhibit 3 for email between Trinity Consultants (sub-contracted to EnviroComp for this project) and LDEQ on this point.

2. ERM/Nucor did not include lead emissions from the coke oven heat recovery by-pass vents or flue gas stacks (see Appendix C of the May 2008 Initial Permit modeling) in its modeling of lead concentrations for SIA analysis (see Table 6-3 of the May 2008 Initial Permit modeling). The coke oven lead emissions are much larger than those for any of the sources ERM/Nucor accounted for in its SIA lead modeling, so the omission of the coke oven lead emissions is of major concern. The accuracy and full treatment of lead in the ERM/Nucor air permit modeling are important especially in light of the recent lowering of the NAAQS lead standard by EPA and our concern for metal contamination on the grains of the neighboring Zen-Noh facility (see Item IV below).

3. The meteorological input files for AERMOD applied by ERM/Nucor in their permit modeling (contained on the May 2008 modeling CD) contain roughly 20% calm wind hours. Since AERMOD does not make calculations for calm wind hours, the suitability of the meteorological input files for this permitting application is questionable.

4. Several emission sources from neighboring facilities applied in ERM/Nucor NAAQS/PSD modeling contain erroneously high exit velocities (in excess of 100 m/s). See listings of the sources in Appendix F-2 of the May 2008 Initial Permit document for details.

5. The exit velocities and release heights for several of the Nucor emission sources applied by ERM/Nucor in their air permit modeling seem unreasonably high. One example is the exit velocity (18.3 m/s) and release height (30.5 meters) applied for the Coke Ovens Coal Handling, Crushing and Compacting area (source ID COK-100). By comparison, the Suncoke Energy facility in Middletown, OH used an exit velocity of 0.1 m/s and release height of 9 meters in their permit modeling for the Coal Crushing source (see Table 5 of Suncoke's July 2008 document "Revised Air Quality Modeling for the Proposed Suncoke Energy Middletown Coke Company, Middletown, Ohio"). The Suncoke values are reasonable based on our understanding of typical coal handling procedures in coke plants. Those applied for the Nucor facility, on the other hand, seem unreasonably high. No explanation or substantiation for the choice of these or any of the source release parameters (exit velocity, exit temperature, release height) applied by ERM/Nucor for the Nucor emission sources was given in any of the documents we reviewed.

6. The ERM/Nucor toxics modeling of PAH resulted in an annual average concentration of 0.039 $\mu g/m^3$ (see Table 6-24 of the May 2008 Initial Permit document). This is within a factor of two of the Louisiana Ambient Air Standard of 0.06 $\mu g/m^3$ for PAH. Noting the several possible errors in the ERM/Nucor modeling that have been noted above, it is possible that the PAH standard may, in fact, be exceeded if a more accurate air quality permit modeling was performed.

7. There appears to be no accounting in the ERM/Nucor air dispersion modeling for fugitive particulate releases due to coal transport and storage on the Nucor facility. By comparison, the Suncoke Energy facility in Middletown, OH accounted for these emissions in their modeling (see Table 5 of Suncoke's July 2008 document "Revised Air Quality Modeling for the Proposed Suncoke Energy Middletown Coke Company, Middletown, Ohio").

8. The preconstruction monitoring thresholds for SO_2 and PM10 were exceeded in the ERM/Nucor permit modeling (see Table 6-1 of the May 2008 Initial Permit document, and Table 6-7b and Table 6-8a of the September 11, 2008 Addendum No 2 letter). Therefore, up to one year of pre-construction monitoring should be required by LDEQ.

III. In regards to Item II-5 above, I have the following comments:

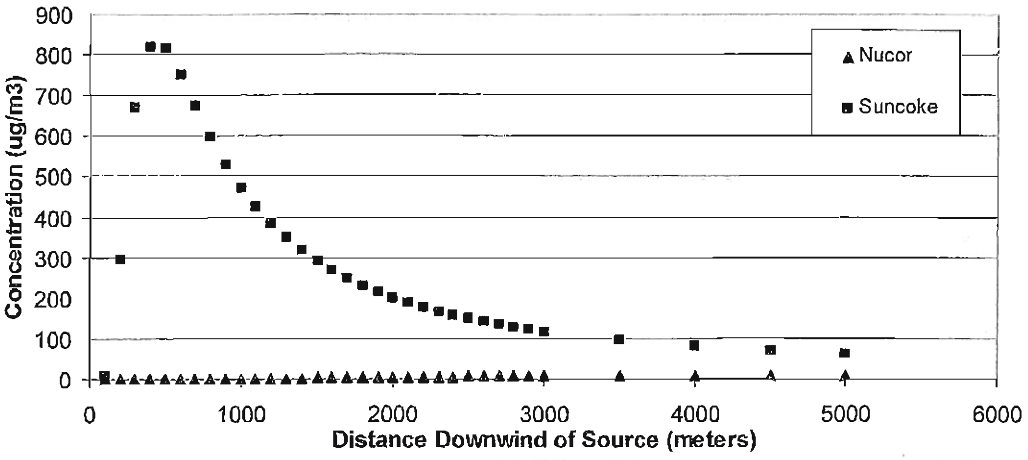
1. We performed air dispersion modeling runs to analyze the effect that the different exit velocities and release heights applied in the Nucor and Suncoke air modeling had on downwind concentrations.

2. We ran the EPA SCREEN3 model, which calculates downwind concentrations for a single source for specified meteorological conditions (see http://www.epa.gov/scram001/dispersion_screening.htm for further information on SCREEN3).

3. We compared the surface concentrations versus distance calculated by SCREEN3 for the Nucor and Suncoke coal crushing emission sources for a "unit" emission rate of 1 gram per second. The exit velocity and release height applied for the Nucor source were 18.3 m/s and 30.5 meters, respectively. The exit velocity and release height applied for the Suncoke source were 0.1 m/s and 9 meters, respectively. These were the values for these parameters chosen by ERM/Nucor and SunCoke for their respective permit modeling for these sources (see Item II-5 above). We ran SCREEN3 using a wind speed of 1 m/s and a stability class of 'F'. We applied an ambient temperature of 293 K.

4. The results for this SCREEN3 comparison are shown Figure III-1. As seen, the surface concentrations from the Nucor source are much less than for the Suncoke source. Based on Item II-5 above, we feel the Suncoke concentrations are more accurate. We therefore have great concerns about that the concentrations calculated by ERM/Nucor in their air permit modeling are significantly underestimated.

Figure III-1: Concentration from Coal Crushing Emissions



IV. **With regard to possible grain contamination at the Zen-Noh granary due to Nucor emissions, I have the following comments:**

1. We have identified metals (for example, Cadmium, Mercury, Chromium, Copper and Lead) as chemicals of concern. These metals are routinely tested for in food or feed grains.

2. We have identified PCBs, dioxins and PAH as organic chemicals of concern.

3. Residue tolerances for grain residue are generally in the parts-per-billon range. It is therefore possible that low, yet above-background levels of metals and organic chemical concentrations can cause grain residue levels to not pass tolerance testing.

Exhibit 3

Email correspondences

Correspondence between Dr. Paolo Zannetti (EnviroComp) and Yvette McGehee (LDEQ) over the period 11/10/08 – 11/17/08.

(Page 1 or 2)

From: Paolo Zannetti
Sent: Monday, November 17, 2008 11:52 AM
To: 'Yvette McGehee'
Cc: Frank Freedman (freedman@envirocomp.com)
Subject: RE: electronic files

Great. Thanks!

From: Yvette McGehee [mailto:Yvette.McGehee@LA.GOV]
Sent: Monday, November 17, 2008 11:51 AM
To: Paolo Zannetti
Subject: RE: electronic files

There was a hold on the cd because of the fee. But they have received it and they are mailing it out today.

From: Paolo Zannetti [mailto:pzannetti@envirocomp.com]
Sent: Monday, November 17, 2008 1:43 PM
To: Yvette McGehee
Subject: RE: electronic files

Dr. Frank Freedman

From: Yvette McGehee [mailto:Yvette.McGehee@LA.GOV]
Sent: Monday, November 17, 2008 11:35 AM
To: Paolo Zannetti
Subject: RE: electronic files

What is the name of the person who put in the request to public records for these files.

From: Paolo Zannetti [mailto:pzannetti@envirocomp.com]
Sent: Monday, November 17, 2008 10:22 AM
To: Yvette McGehee
Subject: RE: electronic files

Hi Yvette:

We have not received any material so far. I will let you know if we receive something today.

Regards, Paolo

From: Yvette McGehee [mailto:Yvette.McGehee@LA.GOV]
Sent: Monday, November 17, 2008 5:18 AM
To: Paolo Zannetti
Subject: RE: electronic files

You should have received one disc already, is that correct.

(Page 2 of 2)

From: Paolo Zannetti [mailto:pzannetti@envirocomp.com]
Sent: Friday, November 14, 2008 4:10 PM
To: Yvette McGehee
Cc: Kermit Wittenburg; pvance@bhbmlaw.com; Mike Bowman; jburke@bhbmlaw.com
Subject: FW: electronic files

(sent by email and fax)

Yvette:

Just as a follow up after our meeting on Nov 10, I would like to remind you about our request to obtain a copy of all the electronic modeling files submitted by Nucor in support of its permit application for the proposed new Pig Iron facility. We also requested the electronic model input files by e-mail to publicrecords@la.gov on November 6, 2008. Please let me know if you can expedite this request and if you need any additional information from us to perform this task.

Sincerely, Paolo

From: Paolo Zannetti
Sent: Monday, November 10, 2008 2:51 PM
To: 'Yvette McGehee (yvette.mcgehee@la.gov)'
Cc: Kermit Wittenburg (kermit.wittenburg@la.gov); 'Paul Vance'; 'Mike Bowman'; James Burke
Subject: electronic files

Yvette:

Thanks for your time today. As discussed, I look forward to receiving a CD with the modeling files submitted by Nucor in support of its permit application for the proposed new Pig Iron facility. Let me know if you need any information from us in order to process this request. For the shipment, you may use my Fedex account number 234754645.

Regards, Paolo

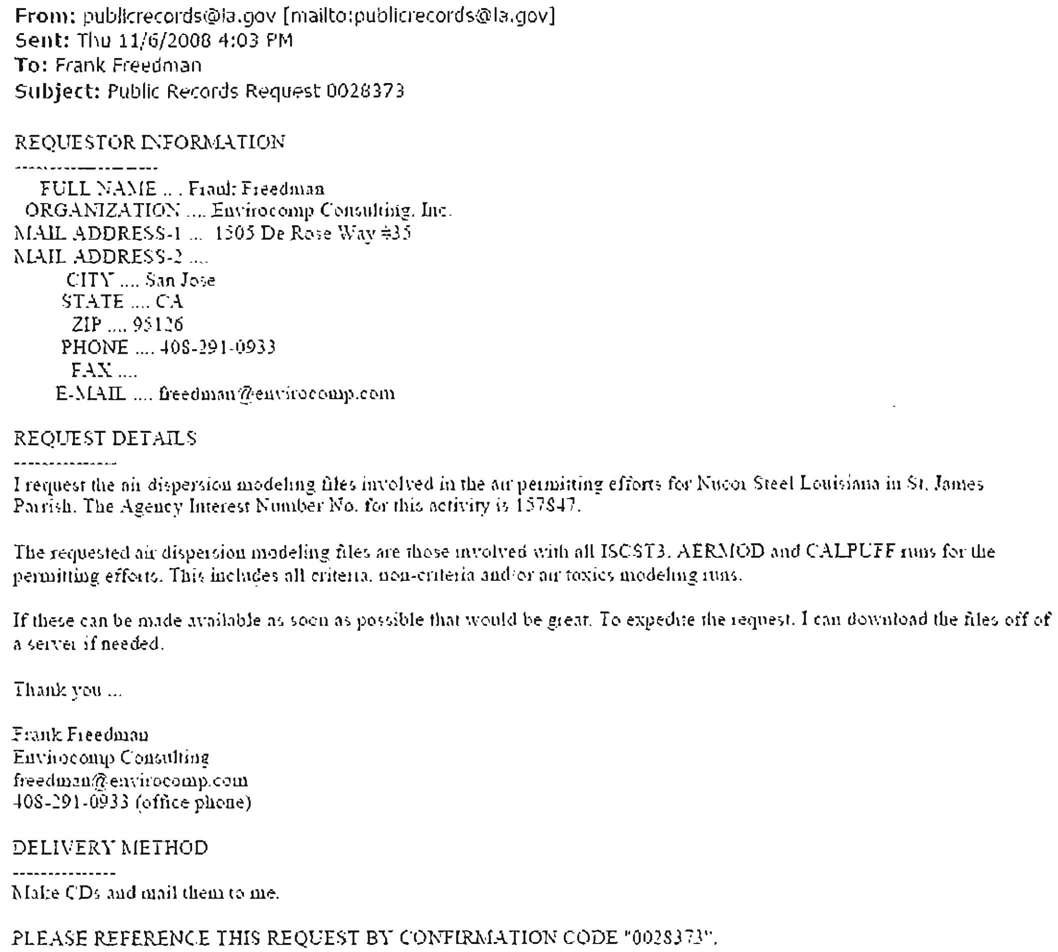
==

Dr. Paolo Zannetti, QEP
President, EnviroComp Consulting, Inc.
2298 Ocaso Camino
Fremont, CA 94539 (USA)

Phone: (510) 490-3438
Toll-free: 1-866-DIAL-ENV
Fax: (510) 490-3357
Mobile phone/pager: (510) 220-8014
Skype: paolo.zannetti

Email: zannetti@envirocomp.com
Web site: http://www.envirocomp.com
Personal Web page: http://www.envirocomp.org/html/meetus/zannetti.htm

Public Record Request made by Dr. Frank Freedman (EnviroComp) to LDEQ to obtain ERM/Nucor air dispersion modeling file CD.



From: publicrecords@la.gov [mailto:publicrecords@la.gov]
Sent: Thu 11/6/2008 4:03 PM
To: Frank Freedman
Subject: Public Records Request 0028373

REQUESTOR INFORMATION

FULL NAME ... Frank Freedman
ORGANIZATION .... Envirocomp Consulting, Inc.
MAIL ADDRESS-1 ... 1505 De Rose Way #35
MAIL ADDRESS-2 ....
CITY .... San Jose
STATE .... CA
ZIP 95126
PHONE 408-291-0933
FAX ....
E-MAIL .... freedman@envirocomp.com

REQUEST DETAILS

I request the air dispersion modeling files involved in the air permitting efforts for Nucor Steel Louisiana in St. James Parish. The Agency Interest Number No. for this activity is 157847.

The requested air dispersion modeling files are those involved with all ISCST3, AERMOD and CALPUFF runs for the permitting efforts. This includes all criteria, non-criteria and/or air toxics modeling runs.

If these can be made available as soon as possible that would be great. To expedite the request, I can download the files off of a server if needed.

Thank you ...

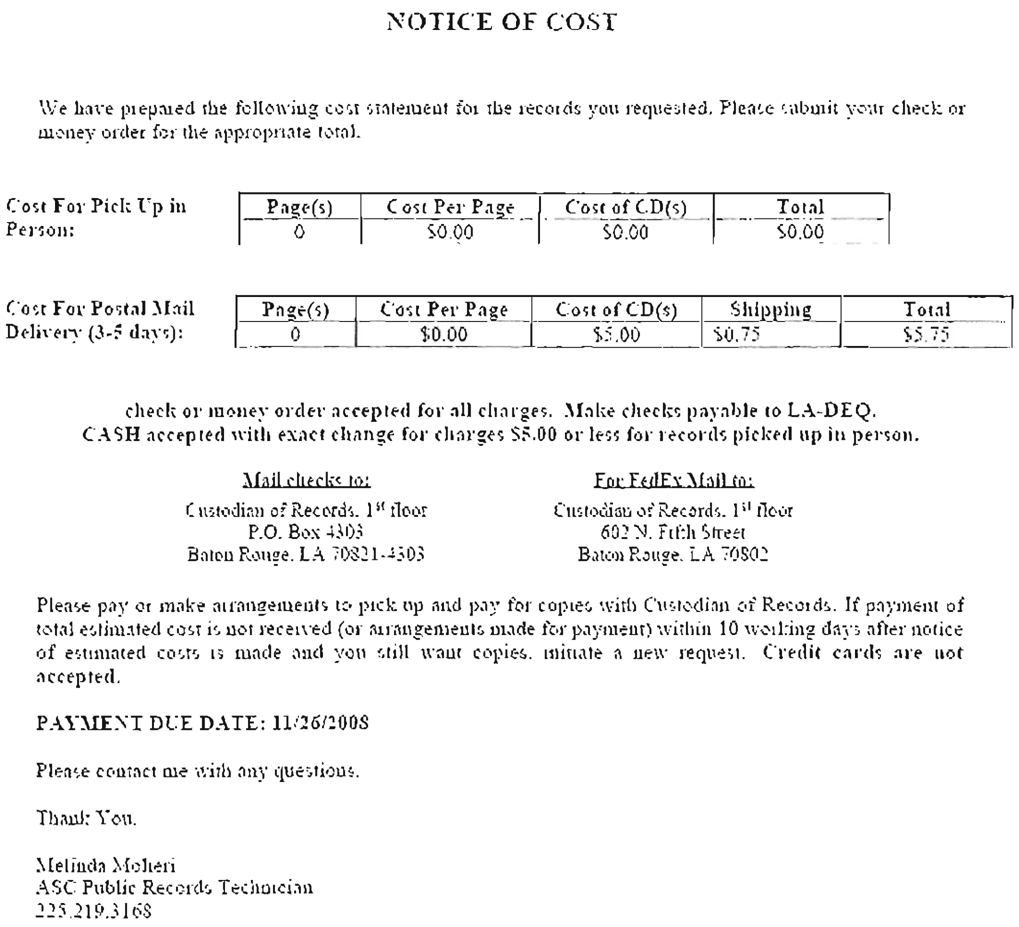
Frank Freedman
Envirocomp Consulting
freedman@envirocomp.com
408-291-0933 (office phone)

DELIVERY METHOD

Make CDs and mail them to me.

PLEASE REFERENCE THIS REQUEST BY CONFIRMATION CODE "0028373".

Notice of Cost sent on 11/12/08 by LDEQ to Dr. Frank Freedman (EnviroComp) to obtain ERM/Nucor air dispersion modeling file CD.



NOTICE OF COST

We have prepared the following cost statement for the records you requested. Please submit your check or money order for the appropriate total.

Cost For Pick Up in Person:

Page(s)	Cost Per Page	Cost of CD(s)	Total
0	$0.00	$0.00	$0.00

Cost For Postal Mail Delivery (3-5 days):

Page(s)	Cost Per Page	Cost of CD(s)	Shipping	Total
0	$0.00	$5.00	$0.75	$5.75

check or money order accepted for all charges. Make checks payable to LA-DEQ.
CASH accepted with exact change for charges $5.00 or less for records picked up in person.

Mail checks to:

Custodian of Records, 1st floor
P.O. Box 4303
Baton Rouge, LA 70821-4303

For FedEx Mail to:

Custodian of Records, 1st floor
602 N. Fifth Street
Baton Rouge, LA 70802

Please pay or make arrangements to pick up and pay for copies with Custodian of Records. If payment of total estimated cost is not received (or arrangements made for payment) within 10 working days after notice of estimated costs is made and you still want copies, initiate a new request. Credit cards are not accepted.

PAYMENT DUE DATE: 11/26/2008

Please contact me with any questions.

Thank You,

Melinda Moheri
ASC Public Records Technician
225.219.3168

Correspondence between Dr. Paolo Zannetti (EnviroComp) and ERM on 11/11/08

From: Paolo Zannetti
Sent: Tuesday, November 11, 2008 2:46 PM
To: 'tim.desselles@erm.com'
Cc: 'Paul Vance'; 'Mike Bowman'; 'James Burke'
Subject: files and reports

Tim:

It was nice meeting you today. As discussed, I would like to receive an electronic copy of all the air modeling files created/used by ERT for Nucor in support of its permit application for the proposed new Pig Iron facility. Perhaps you can put all the files on a CD and fedex it to me. These files may include the modeling runs actually presented in the permit application and other modeling runs ERM performed for this proposed new facility.

Also, I would really appreciate it if you could email to me a pdf (or Word) copy of the permit application report that I can use for text searching. The current version I have is only an image pdf version.

Let me know if you need any information from us in order to process this request. For the shipment, you may use my Fedex account number 234754645.

Regards, Paolo

==

Dr. Paolo Zannetti, QEP
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Email: zannetti@envirocomp.com
Web site: http://www.envirocomp.com
Personal Web page: http://www.envirocomp.org/html/meetus/zannetti.htm

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Title: **The Shell Dioxin Destruction System**
Author: **Dr. H. S. Tang, Regional Business Manager, CRI Asia Pacific**
(A Division of CRI/Criterion Marketing Asia Pacific Pte Ltd, A wholly owned affiliate of the Royal Dutch Shell Group. Website: cri-catalysts.com)
Location: **Solid & Hazardous Waste Management Conference, Singapore, 26-27 February 2003**

ABSTRACT

The Shell Dioxin Destruction System (SDDS) has been developed specifically for municipal and industrial waste incineration plants. It belongs to the best available control technology and is designed to meet the increasingly stringent global dioxin emission standards. SDDS combines Shell's proprietary Lateral Flow Reactor technology (LFR) with super-active oxidative catalyst technology. Both technologies were developed at Shell's Research and Technology Centre in Amsterdam, The Netherlands.

SDDS can achieve over 99.9% destruction of dioxins and furans, down to the EU (European Union) emission limit of less than 0.1ng [TEQ]/Nm^3. Moreover, SDDS has been offered with performance guarantees of outlet dioxin concentrations of less than 0.05 ng [TEQ]/Nm^3 and 0.01 ng [TEQ]/Nm^3 at a number of incineration plants, where owners demand emission levels even lower than local regulations require.

SDDS costs less and achieves higher performance than conventional dioxin removal methods. Its advanced reactor technology reduces system pressure drop and lowers operating and maintenance costs. Coupled with its highly active and long-life catalyst, SDDS delivers significant economic and technical advantages for dioxin destruction at low temperatures (160-230°C).

Furthermore, with ammonia injection, SDDS can simultaneously remove both dioxin and nitrogen oxides (NOx) in one cost-effective system. Both emission performances are contractually guaranteed.

This paper introduces the Shell technology and its commercial applications.

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EXHIBIT
3

1.0 INTRODUCTION

"Dioxin" represents a family of 210 chemical compounds, which do not breakdown easily; they are known as "Persistent Organic Pollutants" or "POPs". Dioxin compounds are potent carcinogens that have the potential of causing a wide range of cancers. Possible long-term adverse effects include neurological, developmental, reproductive, and immunotoxic effects. Major sources of dioxin emissions include: municipal and industrial waste incineration plants, medical waste incineration plants; iron ore sinter plants, and non-ferrous metal industry. Additional sources are: coal and wood combustion, backyard/landfill fires, accidental fires, copper smelters, pulp and paper mills, and ECD/vinyl chloride manufacture.

Once released, dioxin compounds continue to stay in the global inventory for future generations. Countries around the world are now intensifying their effort in regulating the release of dioxin into the environment.

2.0 HISTORY

Shell developed its proprietary Lateral Flow Reactor (LFR) and low-temperature DeNOx catalyst technology in the 1980's. Later, Shell introduced the high-reactivity dioxin destruction catalyst technology in the 1990's. As global air emission standards become more stringent, the Shell DeNOx System (SDS) and the Shell Dioxin Destruction System (SDDS) have emerged as among the best available control technologies for low-temperature air pollution control applications.

3.0 THE COMPANY

SDDS is marketed by CRI International (CRII) group of companies. CRII is the Global Catalyst Technology Company of the Royal Dutch Shell Group, with worldwide research and development laboratories, manufacturing plants, and business units dedicated to supplying the best performing and value-added catalytic solutions to customers throughout the world.

4.0 CRI's EXPERIENCE IN AIR POLLUTION CONTROL

CRI has built up a wide experience of treating flue gases from both small (2,000 Nm3/h) and large (>1,000,000 Nm3/h) processes. Typical components removed from the flue gas include NOx, CO, VOC's and dioxin. The experiences have been documented in a variety of papers, e.g. waste incineration, gas turbines, nitric acid plants, process furnace, and on an Internet website (cri-catalysts.com) (references 1-6).

5.0 COMPARISON WITH CONVENTIONAL METHODS

The Shell Dioxin Destruction System has many technical and cost advantages over conventional dioxin removal methods:

- SDDS is kinder to the environment and less costly than carbon absorption technology. No removal or disposal of highly concentrated and toxic activated carbon is required, and related handling costs and maintenance worries are eliminated. SDDS converts dioxins and furans to harmless gases, so there's nothing to handle and re-incinerate.

- SDDS is less bulky and less costly than honeycomb catalyst solutions, which require a larger system volume and higher operating temperatures. With SDDS, catalyst replacement volume is just 20-30 percent that of conventional catalyst systems, reducing catalyst replacement costs significantly. SDDS requires only small land area and space for equipment installation.

- SDDS costs less and offers better performance and longer catalyst life than catalytic bagfilter systems. In a number of SDDS systems currently in operation, the actual dioxin outlet concentration is often lower than the detection limit of the method of analysis.

6.0 THE TECHNOLOGY

The Shell Dioxin Destruction System consists of a Lateral Flow Reactor (LFR) filled with a high-reactivity catalyst. Unlike technologies based on carbon adsorption where the dioxins are only transferred to solid particles, which require further processing, The Shell Dioxin Destruction System catalytically destroys the dioxin compounds in a single process step. The SDDS uses a Shell proprietary catalyst to convert dioxins to a mixture of harmless gases. A typical reaction is shown below.

$C_{12}H_nCl_8-nO_2+(9+0.5n)O_2 \rightarrow (n-4)H_2O+12CO_2+(8-n)HCl$

The process does not require the addition of any reactant. Only oxygen in the flue gas is required for the destruction.

6.1 Lateral Flow Reactor

A schematic of the reactor system is shown in figure 1. The stainless steel reactor is fabricated with multiple layers of open flue gas channels and catalyst slabs. Dioxin-laden flue gas enters the Lateral Flow Reactor in the flue gas inlet channels, which are blocked at the opposite end. The flue gas then must travel laterally through catalyst slabs to reach the outlet channels; hence the name "Lateral Flow Reactor". As the flue gas passes through these catalyst layers the dioxin compounds are oxidized and destroyed by the active metals on the catalyst to form water, carbon dioxide, and hydrogen chloride.

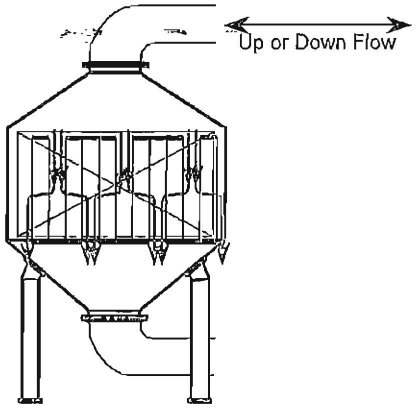
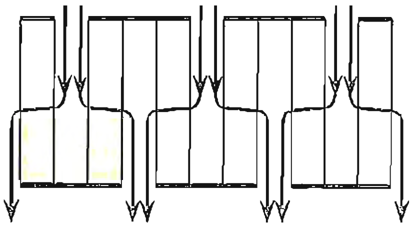


Figure 1. Shell Lateral Flow Reactor



Typical size of one single LFR module ranges from 0.8x0.8x0.8 meters to 2.1x1.4x1.4 meters. Because of its flexible design, other sizes have been custom-made for honeycomb catalyst replacement applications. Depending on gas flow rate, SDDS can be composed of a single or multiple LFR modules. A reactor housing is required for multiple LFR system. To-date, LFR has been commercially applied to gas flows spanning from 2,000 to 2,500,000 Nm3/hr.

The LFR design provides large cross-section area for the flue gas to pass through. Moreover, the catalyst layers are relatively thin, due to the catalyst's high reactivity at low temperatures. These two factors allow very low pressure-drop to be achieved across the SDDS (e.g., < 5-10 mbar). Coupled with minimum or no flue gas reheat, plant owners can realize significant energy savings, especially for large gas flow volumes.

In many cases, custom-made SDDS LFR modules have been successfully retrofitted into existing honeycomb SCR reactor housing. The results are lower dioxin emissions to meet more stringent regulations; and reduced pressure drop and flue gas temperature to achieve lower overall operating costs.

6.2 High-Activity Catalyst

The catalyst, S-090, was developed at Shell's Amsterdam Research Laboratories in The Netherlands. It is a high activity, high metals loaded catalyst with high surface area and porosity. These features give the catalyst its low temperature activity. The physical shape of the catalyst is typically a tri-lobe extrudate of from 0.8 to 3.2 mm diameter and nominally 6 to 13 mm in length. It is manufactured at CRI's ISO 9002 certified catalyst-manufacturing plant in Ghent, Belgium. Each batch of catalyst is carefully tested in CRI's laboratories to insure that the physical properties and the activity meet CRI's rigorous standards of excellence. Before shipping, the catalyst is pre-loaded at the plant into the stainless steel Lateral Flow Reactor module.

The combination of the high activity catalyst with the Lateral Flow Reactor (Figure 1 above) allows the Shell Dioxin Destruction System to easily attain high dioxin conversions. From inlet concentrations of up to 100ng [TEQ]/Nm^3, the Shell Dioxin Destruction System can achieve over 99.9% destruction of dioxins and furans, down to emission limits of less than 0.1-0.01ng [TEQ]/Nm^3. The ability to engineer the thickness of the catalyst layers within the Lateral Flow Reactor allows the Shell Dioxin Destruction System to be designed for very low pressure-drop if required.

SDDS operates at a wide-range of flue gas temperatures – from 160 to 380 °C. Because of its low pressure-drop, SDDS can be positioned at the tail end of most existing processes, just prior to the stack. Since SDDS can be placed downstream of the scrubber and particulate removal systems, catalyst poisoning is minimized allowing longer catalyst life. As the last operation in the flue gas cleanup system, the Shell System insures that the required dioxin emission limits are met. The compact, lightweight nature of the unit can allow ease of retrofit on existing facilities where space is limited. Installation at the end of the process results in significant savings in installation and operating costs with minimal downtime for installation.

The Shell Dioxin Destruction System (and The Shell DeNOx System) is regarded as among the best available control technologies for low-temperature applications (160-230°C).

Average SDDS catalyst life is three to over five years. Longer life is often possible if poisons (e.g., heavy metals) in flue gas are minimized by good operation of the upstream particulate removal device (i.e., bagfilters).

Initial installed-cost of the SDDS (LFR plus catalyst) is either competitive or less than competing technology such as honeycomb SCR or catalytic bagfilters. Once installed, SDDS requires little operating and maintenance costs. This is in sharp contrast to that of activated carbon absorption technology (AC powder injection, AC fixed bed, or AC absorption tower), which demands very high variable operating costs. In most cases, catalyst replacement costs for SDDS are lower than those of honeycomb or catalytic bagfilters. A summary of the SDDS advantages is given below:

Table 1. Advantages of Shell Dioxin Destruction System

	SDDS
Best-available-control-technology performance, dioxin emissions	< 0.1-0.01 ng [TEQ]/Nm3
Excellent dioxin destruction efficiency	99.9+%
Low temperature, with range	160 - 380 °C
Low pressure drop, mbar	< 4 - 10 mbar
Gas flow rates, wide-range	2,000 – 1,000,000+ Nm^3/hr
Catalyst and reactor house volumes	Small
Long catalyst life, average	3-5+ years
Ease of installation, typical	7-21 days
Low catalyst replacement costs	Yes
Low operation/maintenance costs	Yes
Low total plant life-cycle costs	Yes
Combined NOx removal	Yes - with NH3 injection
Meet future Dioxin/NOx limits	Easily Expandable
Strong world-wide technical and engineering support	Local EPC partners/CRI/Shell

7.0 COMMERCIAL REFERENCES

7.1 Lateral Flow Reactor in Shell DeNOx Systems

LFR technology has been used in numerous Shell DeNOx Systems (SDS) since the 1980's, in a variety of industries – e.g., gas turbines, co-generation units, gas fired heaters and boilers, ethylene cracking furnaces, chemical industry (nitric acid, Caprolactam) and waste incineration plants. Some examples are given below:

Table 2. LFR in SDS applications.

Application	Location	Design Conv.%	Temp. °C	Flow, Nm^3/hr
Waste Incinerator	The Netherlands	>85	220	65,000
Refinery Heater	Los Angeles	> 99	200	30,000
Caprolactam	The Netherlands	>98	260	40,000
	Korea	>98	260	40,000
	Korea	>98	260	45,000
	Germany	>98	260	35,000
Gasmotor	The Netherlands	>80	120	2,000
	Austria	>80	260	3,000
Catalyst Plant	Belgium	>99.5	220	20,000
	California	>99.5	220	30,000
Ethylene Cracker	Germany	>80	150	350,000
	Germany	>80	160	55,000
Nitric Acid Plant	South Africa	>90	180	80,000
	Europe	>85	170	30,000
	USA	>85	170	30,000
Gas Turbines	San Francisco	>90	190	250,000
	San Francisco	>90	190	400,000 (3x)
	Gulf Coast	>90	180	50,000
	San Francisco	>94	190	350,000 (3x)
	The Netherlands	> 90	170	275,000

7.2 SDDS COMMERCIAL PLANTS

Shell Dioxin Destruction Systems have been successfully installed for flue gas streams originating from chemical, industrial, and municipal waste incineration plants.

Since 1996, CRI has sold over thirty SDDS commercial plants in Europe, Asia ~~and~~ USA - where dioxin regulations are more stringent and strongly enforced (Table 3). In Asia, Japan is currently the leading country applying SDDS technology. A partial listing of SDDS reference plants is shown in Table 3:

Table 3. SDDS Reference Plants

Year	Country	Application	Gas Flow (Nm^3/hr)	Gas temp. (°C)
1996	Netherlands	MWI	66,000	240
1999	Netherlands	IWI	24,000	163
1999	Japan	MWI with gasification	11,000 13,000 12,000 14,000	184 182 191 192
1999	Italy	Hazardous waste incinerator	5,400	150 – 165
2000	Belgium	Wood / biomass incinerator	20,000	170
2000	Japan	MWI	100,000	170
2000	Japan	RDF	20,000	220
2001	UK	Pyrolysis / gasification	6,875	200
2001	Ireland	Pharmaceutical waste Incineration plant	39,000	255 – 275
2001	Japan	Ash melting plant	1,800	245
2001	Japan	MWI with gasification	27,600	210
2001	Japan	Hazardous waste incinerator	5,400	250
2001	Japan	RDF	2,819	210
2001	Japan	MWI	40,000	180
2001	Japan	IWI	69,000	180
2002	Japan	RDF	4 x 15,000	210
2002	Japan	MWI	15,000	190
2002	Japan	MWI	55,200	230
2002	Japan	MWI	18,300	180
2002	Italy	MWI	72,400	165
2003	Japan	RDF	40,000	180
2003	Japan	IWI	90,000	190
2003	France	MWI	17,000	270
2003	Italy	RDF	85,000	165
2003	Italy	MWI - 2 lines	2 x 87,000	260
2003	Italy	MWI - 2 lines	2 x 25,000	165
2003	Italy	MWI - 2 lines	2 x 46,000	210

8.0 SCOPE OF SUPPLY

CRI prefers to work with local EPC companies with expertise in the relevant market segment in order to ensure successful implementation of SDDS.

Typically, CRI supplies basic engineering, catalyst, reactor modules and technical consulting services. Local EPC partners are responsible for detailed engineering, installation and erection, instrumentation & control systems, as well as plant commissioning.

9.0 PERFORMANCE GUARANTEES

CRI offers performance guarantees for dioxin emissions. Normal guarantee period ranges from 1 to 5 years, depending on specific application and contractual terms.

10.0 SUMMARY

The Shell Dioxin Destruction System offers high performance, low-cost, and reliable solution for dioxin destruction. Since 1996, many SDDS have been installed at municipal and industrial incineration plants worldwide.

SDDS can attain over 99.9% destruction of dioxins and furans, down to the European Union limit of less than 0.1ng [TEQ]/Nm3. Moreover, SDDS has been offered with commercial guarantees of outlet dioxin concentrations of less than 0.05 ng [TEQ]/NM3 or 0.01 ng [TEQ]/Nm3 at a number of incineration plants where owners demand emission levels even lower than local regulations require.

SDDS costs less and achieves higher performance than conventional dioxin removal methods. Its advanced reactor technology reduces system pressure drop and lowers operating and maintenance costs. Coupled with proprietary high-activity oxidative catalyst technology, SDDS delivers significant economic and technical advantages for dioxin destruction at low temperatures (160-230°C).

REFERENCES

1. Liljelind P., Unsworth J., Maaskant O., and Marklund O., 2001. Removal of dioxins and related aromatic hydrocarbons from flue gas steams by adsorption and catalytic destruction. Chemosphere 42 (2001) 615-623.
2. Clark D.M., and Maaskant, O., 1997. The Shell DeNOx System for NOx Removal & Dioxin Destruction. Presented at Korea Dioxin Control Technology Fair, October 7-8, 1997, Seoul, Korea.
3. Gas turbine world July-August, 1997, also Application and operation of the Shell low temperature DeNOx system on a gas co-generation plant presented at CIBO conference, 10-12th March, 1996
4. Asia Nitrogen '96
5. Nitrogen '97
6. Maaskant, O., The Shell DeNOx System: A cost effective NOx removal technology for the Nitric Acid manufacturing industry. AFA 14th International Technical Annual Conference, 25-27 June 2001, Alexandria, Egypt.

BIOGRAPHY

Dr. H. S. TANG – Regional Business Manager, CRI Asia Pacific, SINGAPORE

EDUCATION BACKGROUND

M.B.A., with Honours, Saint Mary's College, Moraga, California, USA

Ph.D., M.S.E., in Chemical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania, USA

B.S., Summa cum laude in Chemical Engineering, Texas A&M University, College Station, Texas, USA

PROFESSIONAL EXPERIENCE

2000-Present: REGIONAL BUSINESS MANAGER – ENVIRONMENTAL CATALYSTS AND SYSTEMS - CRI ASIA PACIFIC, SINGAPORE

1998-1999: REGIONAL TECHNICAL SERVICE MANAGER – ETHYLENE OXIDE CATALYST - CRI ASIA PACIFIC PTE LTD., SINGAPORE

1993-1997: PROJECT MANAGER FOR FEDERAL AND CALIFORNIA CLEAN AIR ACTS COMPLIANCE - SHELL OIL COMPANY REFINERY AT MARTINEZ, CALIFORNIA, USA

1991-1993: ENGINEERING MANAGER FOR REFINERY OPERATIONS - SHELL OIL COMPANY REFINERY AT MARTINEZ, USA

1988-1991: GROUP LEADER FOR COMBUSTION AND REACTION ENGINEERING DEPARTMENT - SHELL WESTHOLLOW TECHNOLOGY CENTER, HOUSTON, TEXAS, USA

1987 - 1988: SENIOR EXCHANGE SCIENTIST - SHELL RESEARCH B.V., KONINKLIJKE-SHELL LABORATORIUM, AMSTERDAM, THE NETHERLANDS

1980-1987: RESEARCH/SENIOR RESEARCH ENGINEER – CHEMICAL ENGINEERING DEPARTMENT - SHELL WESTHOLLOW RESEARCH CENTER, HOUSTON, TEXAS, USA.

TITLE OF PAPER

THE SHELL DIOXIN DESTRUCTION SYSTEM

10. Emissions of Dioxins and Furans from Metallurgical Processes:

Iron Ore Sintering and Secondary Zinc Production

by Mr.Ulrich Quaß

Introduction

Emissions of dioxins and furans from production processes in the metallurgical industries have largely been underestimated in the past. Measurement programs performed in several European countries during the recent years revealed that especially processes using secondary materials are of major concern. This will be illustrated in the following by recent results obtained from research projects which focused on iron ore sinter plants and a secondary zinc smelter.

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4

A. Iron ore sinter plants

In sintering machines iron ore and certain additives are agglomerated to be applicable in the blast furnace process. Typical characteristics of sinter bands operated in Western Europe are shown in Table 1.

parameter	range
width [m]	2,5-4,5
area [m²]	50-400
specific flue gas flows [m³/t sinter]	1800-2500
flue gas flows [million m³/h]	up to 1.5
height of sinter layer	ca. 250 -650 mm
coke input [kg/ton sinter]	38-55

The sinter plant plays a central role in an integrated iron and steel work for making use of production residues which would have to be disposed otherwise. Slags from steel production, filter dusts of diverse flue gas cleaning systems (including those applied to the sinter plant itself) and various iron-containing materials from residue treatment are recycled in the sinter plant (Table 2).

Recycling may lead to an enrichment of relevant compounds, particularly heavy metals. Some residue materials like roll mill scale may be contaminated with organic compounds (oils) that could act as precursors for PAH and PCDD/F formation.

Material	% 1)
hematite	81.3
magnetite	2.7
returns	7.9
pellet abrasions	2.2
blast furnace dust	0.3

The flow of materials in a sintering machine is shown in fig. 1 /Theobald /. Iron ore and additives are mixed in a mixing drum. Before they enter the sinter band this is protected by a layer of material that has already been sintered. On the sinter machine air is sucked through the mixture by several suction hoods which are connected to a electrostatic precipitator. This waste gas constitute the main flue gas flow which could be more than 1 million m³/h. Further waste gas is collected from the feeding process at the front and from the sieving process at the end of the sinter band (so-called „room-dedusting").

Flue gas concentrations measured at European sinter plants usually ranged from below 1 to more than 10 ng I-TEQ/m³ (Table 3), however, an extreme concentration of 43 ng I-TEQ/m³ was found at one plant leading to an estimate freight of 250g I-

steel work dust	0.6
roll scale	1.3
limestone	9.4
olivine	3.5
coke breeze	5

TEQ/year generated by this particular sintering machine / NRW /. These extraordinary high emissions could be reduced by - unfortunately not specified - primary measures to normal levels; however, a considerable variability of the flew gas concentrations was concluded from follow-up measurements (Fig. . 2, Pütz / /).

Country	**Flue gas conc. [ng I-TEQ/m^3]**			**Emission factors [µg I-TEQ/t]**		
	typ	min	max	typ	min	max
A		0.20	2.50	2.35		
B				*5.00*	*1.50*	*50.00*
D 1)	0.08	0.11	0.62		0.88	0.89
D 2)	6.00	0.80	14.10	5.90	1.30	27.70
E				*6.00*		
F				*18.00*	*10.00*	*100.00*
I						
L						
NL		4.50	6.80	13.86	11.30	17.00
P						
S	0.86	0.46	1.30	1.67	1.00	2.80
UK		0.60	3.40	3.29	1.20	9.00

When the high potential for dioxin emissions became public in Germany a special working group was founded by the operators of sintering plants. With subsidy from the Federal Agency for Environment (UBA) additional measurements were conducted at facilities of iron and steel industry. Besides a confirmation of the typical emission data these experiments also revealed that the PCDD/F homologue profile is determined by the lower chlorinated furans (fig. 3 Theobald / /); dioxin emissions therefore are most probably due to de-novo-synthesis during the sintering process.

The generation of dioxins and furans in the sintering process can be understood from the temperature profile of the sinter layer (cf. Fig 4, Dietrich / / . There are two zones with a temperature window being favourable for dioxin formation. However, only PCDD/F molecules formed in the bottom *zone E* are likely to be emitted since those generated in the top *zone A* would have to pass the high temperature peak (*zone C*) and thus most probably will be destroyed. Dioxins from *zone E* may be adsorbed by the cold layers below; however, with the temperature peak wandering from top to bottom adsorbed dioxins may finally be vaporised and emitted Pütz //. This model of dioxin generation in sinter plants is supported by the experimental founding that the main emission of PCDD/F takes place near the end of the sinter grate (suction hoods 10 to 12 in Fig. 5 Pütz //).

In view of the high relevance of sinter plants several attempts have been made to reduce their emissions of dioxin and furans. The main difficulty arises from the very high flew gas flows of up to 1 million m^3/h which pretend the application of the well developed abatement techniques used at waste incinerators. At sinter plants abatement strategies generally aim at a higher efficiency of dedusting leading in parallel to a reduction of PCDD/F emissions. Four systems are in use today which show distinct technological complexity. In the emission optimised sintering (EOS) process the flue gas pre-cleaned by an electrostatic precipitator is partly recirculated (fig. 6); a decrease of about 40% compared to conventional sintering is reported for dust and dioxins as well werz / /. Also electrostatic precipitator with moving electrodes (MEEP, fig. 7) has successfully been used.

None of the both mentioned systems are able to achieve a dioxin reduction to emission levels below 0.1 ng I-

TEQ/m³ being set as target value /UMK /. This goal was reached however at the Austrian sinter plant in Linz /UTECH / here a high-performance washer was installed which also reduces atmospheric dioxin emissions satisfactory; levels below 0.5 ng I-TEQ/m³ could be achieved during normal operation which could be lowered to < 0.1 ng I-TEQ/m³ by additional injection of lignite coke dust. Unfortunately this technology requires a time and energy consuming multi-step process for the treatment of the washing water.

In Germany, a 4-channel adsorbent injection/tube filter system operates behind the common electrostatic precipitator of a sinter plant localised in Bremen (Fig. 8) Lahl // . For emissions lower than 0.1 ng I-TEQ/m³ open hearth coke is used as adsorbent at a dosage of more than 40 kg/h. However, this abatement technology is in an prototype state and will have to be improved with respect to operational stability. According to the German iron and steel association (VDEh) future activities will be focused on the development of a flow injection system using zeolithes as adsorbent for dioxins and furans.

B. Secondary zinc production

Dioxin emissions from facilities in a secondary zinc smelter have become of particular concern because of their very high flue gas concentrations (up to 200 ng I-TEQ/m³).The plant concerned comprises several distinct units; dioxin emissions from these units have been shown to be largely different and cover a range of six orders (fig. 9). Fig. 10 shows a flow scheme of the plant with the most important emission source -the hot-briquetting process - marked as "C".

With flue gas volumes considerably lower than those obtained at sinter plants the zinc smelter contributes only moderately to the annual dioxin load in Germany; however, high flue gas concentrations imply the possibility of direct local impact. This could be proven directly by immission measurements at locations in the vicinity of the plant Hiester//. As Fig 11 reveals the ambient air concentrations nearby the plant („Wanheim") remarkably exceed those found in other parts of the city. Further, it could be shown that the probability to measure high concentrations correlates with wind direction (fig 12). Finally, also from a comparison of homologue profiles the conclusion can be drawn that measured immissions are directly caused by emissions from the secondary zinc smelter (Fig. 13). It should be noted, that also soil samples collected in the vicinity of the plant exhibit increased dioxin contents; therefore recommendations and limits for agricultural use have been given from the ministry of environment. Currently abatement facilities are being constructed that are expected to improve the situation largely in the near future.

C. Conclusions

Both types of plants presented in this paper are examples for important PCDD/F emission sources that had not been known a few years ago. This stresses the importance of a systematic approach to identify emission sources which should comprise both, an inventory of operated facilities and a measurement program. The high effort associated with such programs becomes justifiable in view of the considerable improvement of the environmental situation as it can be seen from the decrease of dioxin levels in ambient air (fig 14) and in human tissue (fig 15) as well /hister2 /

Financial support of the European Dioxin Project by the European Commission, DG XI and sponsoring for the author's participation at the St Petersburg meeting by the German Federal Ministry of Environment is gratefully acknowledged

Treated BFgas component	Concentration	Unit	Specific factor	Unit
BFgas production	1.0 - 7.0	$1 \cdot 10^5$ Nm^3/h	1200 - 2000	[Nm^3/t pig iron]
Particulate matter	1 - 10	[mg/Nm^3]	1 - 20	[g/t pig iron]
Hydrocarbons (C_xH_y)	n/a	[mg/Nm^3]	n/a	[g/t pig iron]
H_2S	14	[mg/Nm^3]	17-26	[g/t pig iron]
Cyanide compounds (as CN^-)	n/a	[mg/Nm^3]	n/a	[g/t pig iron]
Ammonia (NH_3)	n/a	[mg/Nm^3]	n/a	[g/t pig iron]
Heavy metals**				
Mn	0.10 - 0.29	[mg/Nm^3]	0.22 - 0.37	[g/t pig iron]
Pb	0.01 - 0.05	[mg/Nm^3]	0.02 - 0.07	[g/t pig iron]
Zn	0.03 - 0.17	[mg/Nm^3]	0.07 - 0.22	[g/t pig iron]
Carbon monoxide (CO)	20 - 28	[vol.%]	300 - 700	[kg/t pig iron]
Carbon dioxide (CO_2)	17 - 25	[vol.%]	400 - 900	[kg/t pig iron]
Hydrogen (H_2)	1 - 5	[vol.%]	1 – 7.5	[kg/t pig iron]

n/a = data not available

Table 7.4 : Blast furnace gas composition (after two stage treatment) – based on [InfoMil, 1997]

In the EU wet scrubbing is the technique most commonly applied as a second step in BFgas treatment. Scrubbing generates a contaminated wastewater flow, containing suspended solids (e.g. carbon and heavy metals), cyanide compounds, nitrogen compounds, etc. The separated solids generate a waste problem because of heavy metals, especially zinc. Whereas coarse dust is normally recycled to the sinter plant, sludge from scrubbing is usually de-watered and either recycled to the sinter plant (normally via hydrocyclone) or put to secure landfill.

7.2.2.1.4 Emissions from the cast house

The casting of pig iron generates particulate matter emissions. On average unabated emissions are in the range 400 to 1500 g/t pig iron produced. These emissions mainly arise from contact between the hot metal and slag and ambient oxygen. In order to catch the dust formed during casting in many blast furnaces in the EU cast house de-dusting systems are used (dust extraction at tap-hole, skimmer and pig iron charging to the torpedo ladle) with flows of between 200000 and 700000 m^3/h. Dust emissions depend on applied abatement technique (in some cases there is still none) and dust collection efficiency. In many cases bag filters are applied, achieving less than 10 mg dust/Nm^3. According to Table 7.2 dust emission factors vary between 2 to 85 g/ t pig iron with an average of 32 g dust/ t pig iron.

Furthermore, a certain amount of SO_2 is emitted from the liquid slag and iron during casting (2-270 g/t pig iron – see Table 7.2).

7.2.2.1.5 Emissions from slag processing

The reaction of water with molten slag, particularly with sulphur compounds (essentially CaS and MnS), generates both steam and diffuse H_2S and SO_2 emissions. These emissions cause potential odour and corrosion problems. Their importance varies according to the slag processing technique used.

Emissions can vary greatly from one plant to another, from one slag treatment cycle to another and within the slag treatment cycle itself. Therefore the range of available emission factors is wide. Table 7.2 contains figures varying from 1 – 320 g H_2S/t pig iron and 1 – 150 g SO_2/t pig iron for slag granulation. If slag is not exposed to water but air-cooled, longlasting small

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emissions of mainly SO_2 will occur. From the perspective of nuisance abatement this can be considered an adventage.

The water used in the granulation and the pelletising process can largely be collected and reused. These systems can be operated so as to generate very small amounts of wastewater. The steam generated during this process contains particulate matter, SO_2 and H_2S, which is usually emitted to the atmosphere. Tests have been carried out to reuse the sensible heat of the slag, but no system is commercially available at the moment. The potential for energy recovery is approximately 0.35 GJ/t pig iron.

The production of lump slag from pits usually leads to larger emissions of SO_2 and H_2S, which can be more difficult to control. Conditioning with water can influence the emissions of H_2S.

7.2.2.2 Solid wastes/by-products emissions

7.2.2.2.1 Particulate matter from casting

Between 0.5 and 1.5 kg of dust can be extracted from the cast house (see 7.2.2.1.4) per tonne of pig iron (Table 7.1). This dust can be separated in a bag filter for instance and can easily be recycled to the sinter strand. Recycling the dust in this way is common practice.

7.2.2.2.2 Dust and sludge from BFgas treatment

BFgas is usually treated in two stages: separation of coarse dusts in cyclones followed by fine dust separation in a wet scrubber. This produces 6 – 17 kg of dry dust per tonne of pig iron and 3 – 5 kg of sludge /t pig iron (Table 7.1).

Table 7.5 shows the typical composition of dry coarse dust. This dust mainly contains carbon and iron from coke and sinter abrasion respectively. This coarse dust is normally recycled to the sinter strand. This is much more difficult for the sludge because its zinc content is 10 to 20 times higher and lead content is 20 to 30 times higher.

C	Fe	Pb	Zn	Mn	Al_2O_3	Ti
25 - 40	15 - 40	0.02 - 0.07	0.1 - 0.5	0.1 - 0.5	0.2 - 3.7	0.02 - 0.2
S	SiO_2	P_2O_5	CaO	MgO	Na_2O	K_2O
0.2 -1.3	4 - 8	0.04 - 0.26	2 - 8	0.3 - 2	0.03 - 0.64	0.24 - 0.96

Table 7.5 : Typical composition in [weight-%] of dry coarse dust from BFgas treatment – based on [DSI, 1987; Mertins, 1986; data from European blast furnaces from 1997]

The zinc and lead compounds are mostly passed on to the cyclone and are mainly separated in the scrubber. Most of the particles associated with zinc and lead compounds or these heavy metals themselves have grain sizes of less than 25 µm and concentrate in this fraction of the sludge.

EP.3 Fume suppression during casting

Description: EP.2 describes conventional de-dusting systems of cast house emissions. These systems are rather complex and costly. New approaches prevent the molten iron from reacting with atmospheric oxygen to form "brown fume" (fume suppression). To do so the whole transport route for the hot metal, from the tap-hole via various distribution and transfer points to the torpedo ladle, is enclosed by means of carefully designed screening structures. The space between the molten metal and the covers is kept as small as possible, and it is (if necessary) flooded with nitrogen (inert gas). In integrated steel works, the nitrogen yielded in air separation for oxygen generation may be available for this purpose.

This new method eliminates the installation and operation of complex and expensive exhaust and filter systems which was necessary previously, and thus leads to considerable cost savings. The cost of recycling of filter dust is also reduced.

At the tap-hole, an exhaust system is necessary.

Figure 7.11 shows the quantity of dust generated during charging of hot metal with and without dust suppression. These figures are about 100 times lower when nitrogen inertisation is used.

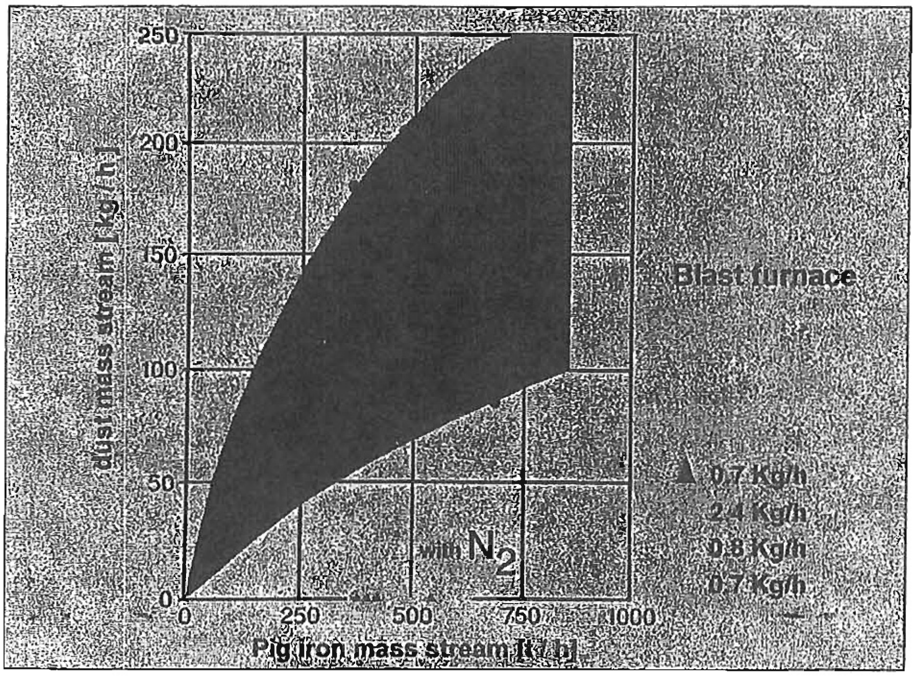

Figure 7.11 : Dust generation with and without nitrogen inertisation during hot metal charging (to the torpedo level) depending on the flow of pig iron – [de Haas, 1997]

Main achieved emission levels: During conventional casting 0.4–1.5 kg dust/t pig iron is generated (Table 7.1). This quantity is reduced by dust suppression to about 0.012 kg dust/t pig iron [de Haas, 1997]. Figure 7.12 shows the effect of dust suppression during charging of hot metal to the torpedo ladle.

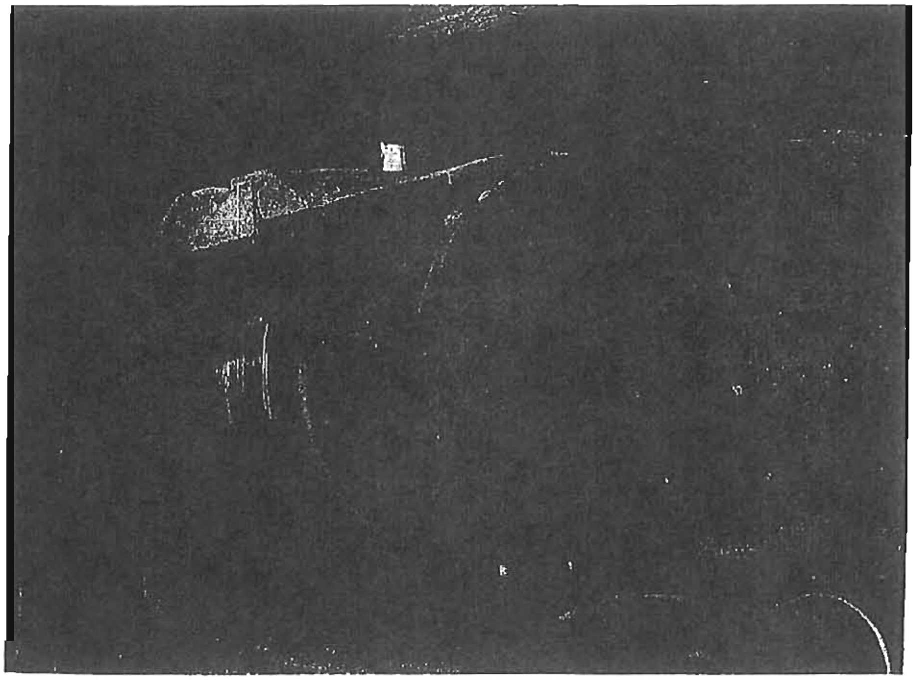

Figure 7.12 : Charging of hot metal into torpedo ladle with dust suppression with inert gas – [Haas, 1997].

Applicability: Applicable both at new and existing plants.

Cross-media effects: There are no significant cross-media effects if the system is compared with conventional de-dusting systems, described in EP.2.

Reference plants: At Stahlwerke Bremen, D-Bremen, this fume suppression technique has been in operation since 1991.

Operational data: Experience with fume suppression at Stahlwerke Bremen shows constant operation conditions without significant problems.

Economics: A comparison of costs is shown in Figure 7.13 shows the comparison of costs. The new fume suppression technique is considerably cheaper. The installation at Stahlwerke Bremen with a production of 3 Mt pig iron/a required an investment of 6.8 million Ecu_{1996} including dust suppression and tap hole de-dusting with a subsequent bag filter.

EP.6 Condensation of fume from slag processing

Description: As mentioned in 7.2.2.1.5 there are H_2S and SO_2 emissions from slag processing. This may lead to odour problems. In order to solve this problem some granulation plants are operated with fume condensation (Figure 7.15). The condensate and the slag de-watering water as well are circulated after cooling.

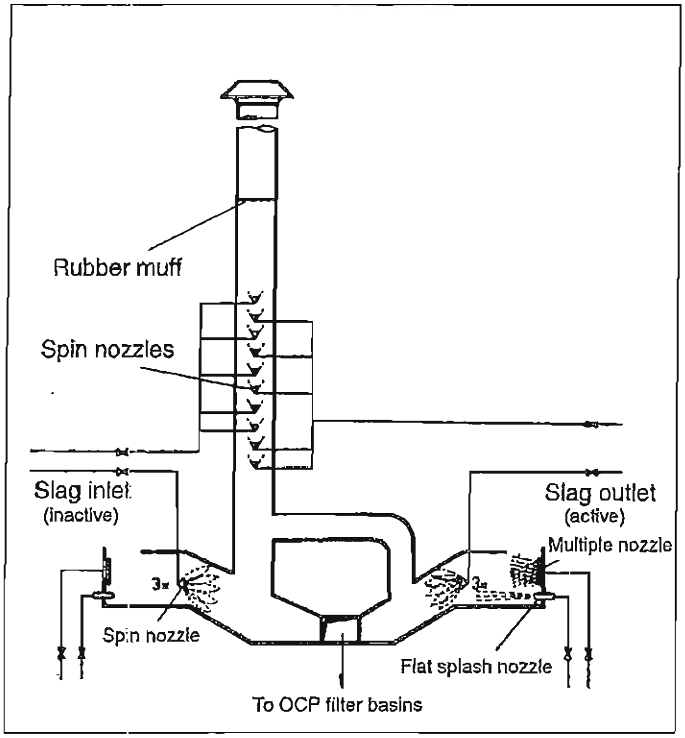

Figure 7.15 : Granulation of blast furnace slag with fume condensation – [Poth, 1985]

Main achieved emission levels: With fume condensation H_2S emissions are below 10 g H_2S/ t pig iron produced. According to Table 7.2 emissions of 1 g H_2S/ t pig iron are achievable.

Applicability: Applicable both at new and existing plants.

Cross-media effects: Cooling the circulated water needs considerable amounts of energy. Energy generation itself is very often linked with sulphur emissions. During fume condensation the absolute quantity of reduced sulphur is relatively small and may be related to the quantity emitted during energy generation.

Reference plants: Several slag granulation plants in Germany are equipped with fume condensation system, e.g. at Thyssen AG, D-Duisburg

Economics: not available

Reference literature: not available

Air Pollution Technology Fact Sheet

1. ***Name of Technology:*** *Fabric Filter - Pulse-Jet Cleaned Type (also referred to as Baghouses)*

2. ***Type of Technology:*** *Control Device - Capture/Disposal*

3. ***Applicable Pollutants:*** *Particulate Matter (PM), including particulate matter less than or equal to 10 micrometers (µm) in aerodynamic diameter (PM_{10}), particulate matter less than or equal to 2.5 µm in aerodynamic diameter ($PM_{2.5}$), and hazardous air pollutants (HAPs) that are in particulate form, such as most metals (mercury is the notable exception, as a significant portion of emissions are in the form of elemental vapor).*

4. ***Achievable Emission Limits/Reductions:***

Typical new equipment design efficiencies are between 99 and 99.9%. Older existing equipment have a range of actual operating efficiencies of 95 to 99.9%. Several factors determine fabric filter collection efficiency. These include gas filtration velocity, particle characteristics, fabric characteristics, and cleaning mechanism. In general, collection efficiency increases with increasing filtration velocity and particle size.

For a given combination of filter design and dust, the effluent particle concentration from a fabric filter is nearly constant, whereas the overall efficiency is more likely to vary with particulate loading. For this reason, fabric filters can be considered to be constant outlet devices rather than constant efficiency devices. Constant effluent concentration is achieved because at any given time, part of the fabric filter is being cleaned. As a result of the cleaning mechanisms used in fabric filters, the collection efficiency is constantly changing. Each cleaning cycle removes at least some of the filter cake and loosens particles which remain on the filter. When filtration resumes, the filtering capability has been reduced because of the lost filter cake and loose particles are pushed through the filter by the flow of gas. As particles are captured, the efficiency increases until the next cleaning cycle. Average collection efficiencies for fabric filters are usually determined from tests that cover a number of cleaning cycles at a constant inlet loading. (EPA, 1998a)

5. ***Applicable Source Type:*** *Point*

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6. *Typical Industrial Applications:*

Fabric filters can perform very effectively in many different applications. Common applications of fabric filter systems with pulse-jet cleaning are presented in Table 1, however, fabric filters can be used in most any process where dust is generated and can be collected and ducted to a central location.

Table 1. Typical Industrial Applications of Pulse-Jet Cleaned Fabric Filters (EPA 1997; EPA, 1998a)

Application	*Source Category Code (SCC)*
Utility Boilers (Coal)	*1-01-002...003*
Industrial Boilers (Coal, Wood)	*1-02-001...003, 1-02-009*
Commercial/Institutional Boilers (Coal, Wood)	*1-03-001...003, 1-03-009*
Ferrous Metals Processing:	
Iron and Steel Production	*3-03-008...009*
Steel Foundries	*3-04-007,-009*
Mineral Products:	
Cement Manufacturing	*3-05-006...007*
Coal Cleaning	*3-05-010*
Stone Quarrying and Processing	*3-05-020*
Other	*3-05-003...999*
Asphalt Manufacture	*3-05-001...002*
Grain Milling	*3-02-007*

7. *Emission Stream Characteristics:*

a. ***Air Flow:*** *Baghouses are separated into two groups, standard and custom, which are further separated into low, medium, and high capacity. Standard baghouses are factory-built, off the shelf units. They may handle from less than 0.10 to more than 50 standard cubic meters per second (sm^3/sec) (("hundreds" to more than 100,000 standard cubic feet per minute (scfm)). Custom baghouses are designed for specific applications and are built to the specifications prescribed by the customer. These units are generally much larger than standard units, i.e., from 50 to over 500 sm^3/sec (100,000 to over 1,000,000 scfm). (EPA, 1998b)*

b. ***Temperature:*** *Typically, gas temperatures up to about 260°C (500°F), with surges to about 290°C (550°F) can be accommodated routinely, with the appropriate fabric material. Spray coolers or dilution air can be used to lower the temperature of the pollutant stream. This prevents the temperature limits of the fabric from being exceeded. Lowering the temperature, however, increases the humidity of the pollutant stream. Therefore, the minimum temperature of the pollutant stream must remain* *above the dew point of any condensable in the stream. The baghouse and associated ductwork should be insulated and possibly heated if condensation may occur. (EPA, 1998b)*

c. ***Pollutant Loading:*** *Typical inlet concentrations to baghouses are 1 to 23 grams per cubic meter (g/m^3) (0.5 to 10 grains per cubic foot (gr/ft^3)), but in extreme cases, inlet conditions may vary between 0.1 to more than 230 g/m^3 (0.05 to more than 100 gr/ft^3). (EPA, 1998b)*

d. ***Other Considerations:*** *Moisture and corrosives content are the major gas stream characteristics requiring design consideration. Standard fabric filters can be used in pressure or vacuum service, but only within the range of about ± 640 millimeters of water column (25 inches of water column). Well-designed and operated baghouses have been shown to be capable of reducing overall particulate emissions to less than 0.05 g/m^3 (0.010 gr/ft^3), and in a number of cases, to as low as 0.002 to 0.011 g/m^3 (0.001 to 0.005 gr/ft^3). (AWMA, 1992)*

8. *Emission Stream Pretreatment Requirements:*

Because of the wide variety of filter types available to the designer, it is not usually required to pretreat a waste stream's inlet temperature. However, in some high temperature applications, the cost of high temperature-resistant bags must be weighed against the cost of cooling the inlet temperature with spray coolers or dilution air (EPA, 1998b). When much of the pollutant loading consists of relatively large particles, mechanical collectors such as cyclones may be used to reduce the load on the fabric filter, especially at high inlet concentrations (EPA, 1998b).

9. *Cost Information:*

Cost estimates are presented below for pulse-jet cleaned fabric filters. The costs are expressed in fourth quarter 1998 dollars. The cost estimates assume a conventional design under typical operating conditions and do not include auxiliary equipment such as fans and ductwork. The costs for pulse-jet cleaned systems are generated using EPA's cost-estimating spreadsheet for fabric filters (EPA, 1998b).

Costs are primarily driven by the waste stream volumetric flow rate and pollutant loading. In general, a small unit controlling a low pollutant loading will not be as cost effective as a large unit controlling a high pollutant loading. The costs presented are for flow rates of 470 m^3/sec (1,000,000 scfm) and 1.0 m^3/sec (2,000 scfm), respectively, and a pollutant loading of 9 g/m^3 (4.0 gr/ft^3).

Pollutants that require an unusually high level of control or that require the fabric filter bags or the unit itself to be constructed of special materials, such as Gore-Tex or stainless steel, will increase the costs of the system (EPA, 1998b). The additional costs for controlling more complex waste streams are not reflected in the estimates given below. For these types of systems, *the capital cost could increase by as much as 75% and the operational and maintenance (O&M) cost could increase by as much as 20%.*

- *a.* ***Capital Cost:*** *\$13,100 to \$54,900 per sm^3/s (\$6 to \$26 per scfm)*
- *b.* ***O & M Cost:*** *\$11,200 to \$51,700 per sm^3/s (\$5 to \$24 per scfm), annually*
- *c.* ***Annualized Cost:*** *\$13,100 to \$83,400 per sm^3/s (\$6 to \$39 per scfm), annually*
- *d.* ***Cost Effectiveness:*** *\$46 to \$293 per metric ton (\$42 to \$266 per short ton)*

10. Theory of Operation:

In a fabric filter, flue gas is passed through a tightly woven or felted fabric, causing PM in the flue gas to be collected on the fabric by sieving and other mechanisms. Fabric filters may be in the form of sheets, cartridges, or bags, with a number of the individual fabric filter units housed together in a group. Bags are most common type of fabric filter. The dust cake that forms on the filter from the collected PM can significantly increase collection efficiency. Fabric filters are frequently referred to as baghouses because the fabric is usually configured in cylindrical bags. Bags may be 6 to 9 m (20 to 30 ft) long and 12.7 to 30.5 centimeters (cm) (5 to 12 inches) in diameter. Groups of bags are placed in isolable compartments to allow cleaning of the bags or replacement of some of the bags without shutting down the entire fabric filter. (STAPPA/ALAPCO, 1996)

Operating conditions are important determinants of the choice of fabric. Some fabrics (e.g., polyolefins, nylons, acrylics, polyesters) are useful only at relatively low temperatures of 95 to 150°C (200 to 300°F). For high-temperature flue gas streams, more thermally stable fabrics such as fiberglass, Teflon®, or Nomex® must be used (STAPPA/ALAPCO, 1996).

Practical application of fabric filters requires the use of a large fabric area in order to avoid an unacceptable pressure drop across the fabric. Baghouse size for a particular unit is determined by the choice of air-to-cloth ratio, or the ratio of volumetric air flow to cloth area. The selection of air-to-cloth ratio depends on the particulate loading and characteristics, and the cleaning method used. A high particulate loading will require the use of a larger baghouse in order to avoid forming too heavy a dust cake, which would result in an excessive pressure drop As an example, a baghouse for a 250 MW utility boiler may have 5,000 separate bags with a total fabric area approaching 46,500 m^2 (500,000 square feet). (ICAC, 1999)

Determinants of baghouse performance include the fabric chosen, the cleaning frequency and methods, and the particulate characteristics. Fabrics can be chosen which will intercept a greater fraction of particulate, and some fabrics are coated with a membrane with very fine openings for enhanced removal of submicron particulate. Such fabrics tend to be more expensive.

Pulse-jet cleaning of fabric filters is relatively new compared to other types of fabric filters, since they have only been used for the past 30 years. This cleaning mechanism has consistently grown in popularity because it can treat high dust loadings, operate at constant pressure drop, and occupy less space than other types of fabric filters. Pulse-jet cleaned fabric filters can only operate as external cake collection devices. The bags are closed at the bottom, open at the top, and supported by internal retainers, called cages. Particulate-laden gas flows into the bag, with diffusers often used to prevent oversized particles from damaging the bags. The gas flows from the outside to the inside of the bags, and then out the gas exhaust. The particles are collected on the outside of the bags and drop into a hopper below the fabric filter. (EPA, 1998a)

During pulse-jet cleaning, a short burst, 0.03 to 0.1 seconds in duration, of high pressure [415 to 830 kiloPascals (kPa) (60 to 120 pounds per square inch gage (psig))] air is injected into the bags (EPA, 1998a; AWMA, 1992). The pulse is blown through a venturi nozzle at the top of the bags and establishes a shock wave that continues onto the bottom of the bag. The wave flexes the fabric, pushing it away from the cage, and then snaps it back dislodging the dust cake. The cleaning cycle is regulated by a remote timer connected to a solenoid valve. The burst of air is controlled by the solenoid valve and is released into blow pipes that have nozzles located above the bags. The bags are usually cleaned row by row (EPA, 1998a).

There are several unique attributes of pulse-jet cleaning. Because the cleaning pulse is very brief, the flow of dusty gas does not have to be stopped during cleaning. The other bags continue to filter, taking on extra duty because of he bags being cleaned. In general, there is no change in fabric filter pressure drop or performance as a result of pulse-jet cleaning. This enables the pulse-jet fabric filters to operate on a continuous basis with solenoid valves as the only significant moving parts. Pulse-jet cleaning is also more intense and occurs with greater frequency than the other fabric filter cleaning methods. This intense cleaning dislodges nearly all of the dust cake each time the bag is pulsed. As a result, pulse-jet filters do not rely on a dust cake to provide filtration. Felted (non-woven) fabrics are used in pulse-jet fabric filters because they do not require a dust cake to achieve high collection efficiencies. It has been found that woven fabrics used with pulse-jet fabric filters leak a great deal of dust after they are cleaned. (EPA, 1998a)

Since bags cleaned by the pulse-jet method do not need to be isolated for cleaning, pulse-jet cleaned fabric filters do not need extra compartments to maintain adequate filtration during cleaning. Also, because of the intense and frequent nature of the cleaning, they can treat higher gas flow rates with higher dust loadings. Consequently, fabric filters cleaned by the pulse-jet method can be smaller than other types of fabric filters in the treatment of the same amount of gas and dust, making higher gas-to-cloth ratios achievable. (EPA, 1998a)

11. Advantages/Pros:

Fabric filters in general provide high collection efficiencies on both coarse and fine (submicron) particulates. They are relatively insensitive to fluctuations in gas stream conditions. Efficiency and pressure drop are relatively unaffected by large changes in inlet dust *loadings for continuously cleaned filters. Filter outlet air is very clean and may be recirculated within the plant in many cases (for energy conservation). Collected material is collected dry for subsequent processing or disposal. Corrosion and rusting of components are usually not problems. Operation is relatively simple. Unlike electrostatic precipitators, fabric filter systems do not require the use of high voltage, therefore, maintenance is simplified and flammable dust may be collected with proper care. The use of selected fibrous or granular filter aids (precoating) permits the high-efficiency collection of submicron smokes and gaseous contaminants. Filter collectors are available in a large number of configurations, resulting in a range of dimensions and inlet and outlet flange locations to suit installation requirements. (AWMA, 1992)*

12. Disadvantages/Cons:

Temperatures much in excess of 290°C (550°F) require special refractory mineral or metallic fabrics, which can be expensive. Certain dusts may require fabric treatments to reduce dust seepage, or in other cases, assist in the removal of the collected dust. Concentrations of some dusts in the collector, approximately 50 g/m^3 (22 gr/ft^3), may represent a fire or explosion hazard if a spark or flame is accidentally admitted. Fabrics can burn if readily oxidizable dust is being collected. Fabric filters have relatively high maintenance requirements (e.g., periodic bag replacement). Fabric life may be shortened at elevated temperatures and in the presence of acid or alkaline particulate or gas constituents. They cannot be operated in moist environments; hygroscopic materials, condensation of moisture, or tarry adhesive components may cause crusty caking or plugging of the fabric or require special additives. Respiratory protection for maintenance personnel may be required when replacing fabric. Medium pressure drop is required, typically in the range of 100 to 250 mm of water column (4 to 10 inches of water column). (AWMA, 1992)

A specific disadvantage of pulse-jet units that use very high gas velocities is that the dust from the cleaned bags can be drawn immediately to the other bags. If this occurs, little of the dust falls into the hopper and the dust layer on the bags becomes too thick. To prevent this, pulse-jet fabric filters can be designed with separate compartments that can be isolated for cleaning. (EPA, 1998a)

13. Other Considerations:

Fabric filters are useful for collecting particles with resistivities either too low or too high for collection with electrostatic precipitators. Fabric filters therefore may be good candidates for collecting fly ash from low-sulfur coals or fly ash containing high unburned carbon levels, which respectively have high and low resistivities, and thus are relatively difficult to collect with electrostatic precipitators. (STAPPA/ALAPCO, 1996)

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Central Pollution Control Board

Ministry of Environment & Forests, Govt of India, Parivesh Bhawan, East Arjun Nagar, Delhi - 110032

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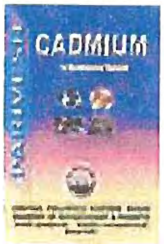

PREVENTIVE & CONTROL MEASURES OF CADMIUM CONTAMINATION TO ENVIRONMENT

The cadmium releases to the environment may be prevented and controlled at different levels.

- National level initiatives
- International conventions and treaties
- Source control
- Product control

Several countries have already promulgated national initiative and action, including legislation, to control releases and limitation on use and exposures of cadmium within their territories. The measures to control cadmium release into the environment are summarized below:

Preventive & control measures of cadmium Contamination to environment

Source	Preventive & Control Measure
During production and use of cadmium	
POINT SOURCES	Apply emission control technologies to limit emissions of cadmium from combustion of fossil fuels and processing of mineral materials
	Prevent or limit the release of cadmium from industrial processes to the waste water system
	Use best available technology to reduce or prevent cadmium releases
PRODUCTS	Prevent or limit cadmium contents in products
	Limitations on the allowable content of cadmium in bulk materials i.e. phosphate fertilizers
	Limitations on the cadmium contents in commercial foodstuffs and feed
During disposal of cadmium containing wastes	
Prevent cadmium waste from being dispose directly to environment, through efficient recycling	
Prevent high content cadmium waste from mixing with less hazardous waste i. e. batteries with general waste	
Prevention or limitation on cadmium emissions to the environment from incineration	
Limitation on cadmium content in sewage sludge and other organic waste used for land application	
Limitation on cadmium emissions during road-building, construction etc.	

TECHNOLOGIES & PRACTICES FOR CONTROL OF CADMIUM RELEASE TO ENVIRONMENT

The specific methods for controlling cadmium releases from the sources may be categorized in following broad categories:

- Substitution
- Emission control
- Waste management
- Waste water treatment

Substitution

The use of cadmium may be substituted with many alternates under development. The suggested substitutes given below:

Cadmium applications and alternative options for substitutes

Application	Alternatives	Remarks
Plating	Zinc, aluminum, tin, nickel, silver, gold plating	No alternative for aerospace, mining, offshore and nuclear activities
Silver-cadmium alloys for solders	Several alternative solders exist e.g. Sn-Ag solder	-

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Alloys	Cu-Cd alloys may be replaced by pure copper Pb-Cd alloys for cable sheaths may be replaced by aluminum sheaths or normal lead sheaths	Alternatives may be utilized
Ni-Cd batteries	Nickel-metal hydride, lithium-Ion- polymer etc.	Comparatively costly
PVC Stabilizers	Ca/zn compounds may be use for indoor purposes. Pb or organotins may be used for outdoor purposes	Comparatively costly
Pigments	Bismuth-vandate and tin-zinc-titanate	Other pigments may be use
Pigments	Gold, Copper, molybdenum and selenide	Gold and copper pigments
AgCdO in high power relays	$AgSnO_2$ and AgNi	

Emission control

Combustion of fossil fuels, roasting and smelting of ores, kiln operations in cement industry and incineration of wastes releases cadmium into the environment. Cadmium vapors are emitted emit from processes in form of fugitive emissions or through flue gas system. Flue gases pass dust emission controls, the major part of cadmium in the flue gas is bound to the particles, and cadmium emissions depends on the particle size and dust control devices. Emission sources their control measures and percent dust reduction efficiencies are presented below:

Performance of dust cleaning devices	
Dust Control Device	Dust after Control (mg/m ^{3})
Fabric filter	<10
Fabric filter (membrane)	<1
Dry ESP	<50
Wet ESP	<50
High efficiency Scrubber	<50

Source: UNECE, 1999

Emission Sources, Dust control measure and Reduction Efficiency

Emission sources	Dust Control measure	Reduction Efficiency (%)
	Iron and Steel production	
Sinter plants	Fabric filter	>99
	Scrubbers	>99
	Cyclone	60-80
	Electrostatic Precipitator (ESP)	95-99
Pellet plants	Scrubbers	>95
	ESP+ fabric filter	>99
Blast furnace	Fabric filter / ESP	>99
	Wet scrubbers	>99
	Wet ESP	>99
	Iron Foundries	
Induction furnace	Fabric filter	>99
Cold blast cupola	Fabric filter	>98
	Fabric filter+ chemisorptions	>99
	Fossil Fuel Combustion	
Combustion of fuel oil	ESP, Fabric filter	Pb, Cd: 100
Combustion of coal	Fabric filter	Dust: >99 Pb: >99 Cd: >99
	Cement Industry	
Rotary kilns	ESP	Pb, Cd: >95
Clinker	ESP	Pb, Cd: >95
Cement mills	Fabric filter	Pb, Cd: >95
Crushers	Fabric filters	Pb, Cd: >95
	Glass industry	
Direct emissions	Fabric filter	Dust: >98
	ESP	Dust: >90
	Waste Incineration	
Stack gases	High efficiency scrubbers	Pb, Cd: >98

	Dry ESP	Pb, Cd: 80-90
	Wet ESP	Pb, Cd: 95-99
	Fabric filter	Pb, Cd: 95-99

Source: Rentz, et.al. 2004

Waste Management Practices

Cadmium in solid waste may be a significant source of cadmium releases to the environment. Control measures for cadmium emissions related to solid waste may be both regulatory and technical measures. The regulatory measure includes guidelines and prohibition of disposal of solid waste on land and waters while Technical control measures may be recycling, biological treatment, land disposal and incineration.

- **Recycling**

The end products may collected for recycling are alloys, cadmium plated items, plastics, pigments and stabilizers. It is estimated that about 17.5 percent of cadmium consumption worldwide recovered through recycling.

- **Biological waste treatment**

The solid waste mainly consist organic materials, such as food waste or garden waste. These waste are increasingly treated biologically, e.g. by composting or fermentation that may be used as fertilizer. The sources of cadmium in compostable solid waste may be waste factions of plastics, atmospheric deposition and zinc wastes.

- **Land filling**

Landfills are a waste management option used for all types of solid waste. The general measure to minimize releases of cadmium from landfills, are to establish top covers liners and approximate treatment of leachate before its discharge to recipient water body.

- **Incineration**

The combustible solid waste sometimes directed to incineration. The fate of metals during incineration depends on the flue gas technology, but it takes place at temperature around 1000 o C. At this temperature cadmium melt and after vaporization adsorbs with the dust particles collected alongwith flue gas treatment devices or ends up in the bottom ash.

Waste Water Treatment

Wastewater may be treated by mechanical, biological and chemical treatment techniques. The amount removed from wastewater will be retained in sludge, which is directed to agricultural areas, landfills or incineration. Cadmium can be removed from wastewater through ferric sulphate coagulation at a pH above 8.0 through lime softening or excess lime softening. The cadmium ions are precipitated as cadmium hydroxide at a pH of 10 to 11. Precipitation as sulphide has an advantage of minimum solubility. Since the sludge does not thicken well, the sulphide precipitation is frequently used as a polishing step following hydroxide precipitation.

Chelating ion exchange resins selectively remove many heavy metals in the presence of high concentrations of univalent and divalent cations. The order of selectivity is Cu>Ni>Co>Cd>Fe ++ >Mn>Ca. The heavy metals are removed as weak acidic chelated complexes. This process is suitable for end of pipe polishing and for metal concentration and recovery. Activated carbon and Reverse Osmosis (RO) processes are also employed to remove and recover heavy metals.

Level of achievable cadmium removal from industrial wastewater

Technology	Achievable concentration (mg/l)
Hydroxide precipitation at pH 10-11	0.050
Co-precipitation with ferric hydroxide	0.050
Sulphide precipitation	0.008

Photovoltaic (PV) solar cell Vs Coal for Electricity generation

Coal burning routinely generates cadmium because coal contains substantial amount of cadmium. The coal-power plants usually generate waste in form of huge ash or bottom ash. The solar photovoltaic (PV) cells replaces burning coal for electricity generation, preventing substantial cadmium emissions during electricity production.

SAFETY MEASURES FROM CADMIUM MATERIALS

- **Fire Fighting Measures**

Cadmium is a bluish silver metal that does not burn in bulk. Clouds of fine dust are a fire explosion hazard, however, when cadmium is heated in air, oxide fumes generated. A self-contained breathing apparatus (SCBA) and full protective clothing are required when cadmium is involved in a fire situation. Such fires should not be sprayed with water or foam. Apply dry chemical, dry sand or special powder for extinguish.

- **First Aid Measures during cadmium exposure**

Eye Contact: Flush with warm running water, including under the eyelids for at least 15 minutes.

Skin Contact: Remove dust-contaminated clothing and wash affected areas with soap and warm water. If molten cadmium is contacted then flush contacted area to solidify and cool.

Inhalation: Remove exposed person from exposure area. If breathing has stopped, provide artificial respiration. The affected person may be kept warm and at rest.

Ingestion: If victim is conscious, dilute stomach contents with 2-4 cupful of water or milk. Do not induce vomiting. When vomiting occurs naturally, rinse mouth and repeat water administration.

- **Accidental Release Measures**

Safely control the source of spillage of cadmium bearing material if possible. Restrict accesses to the area until completion of clean up. Molten metal should be solidify before clean up. Close fitting safety goggles may be necessary to prevent eye contact with dust and fumes. Where molten cadmium is involved, heat resistant gloves should be worn.

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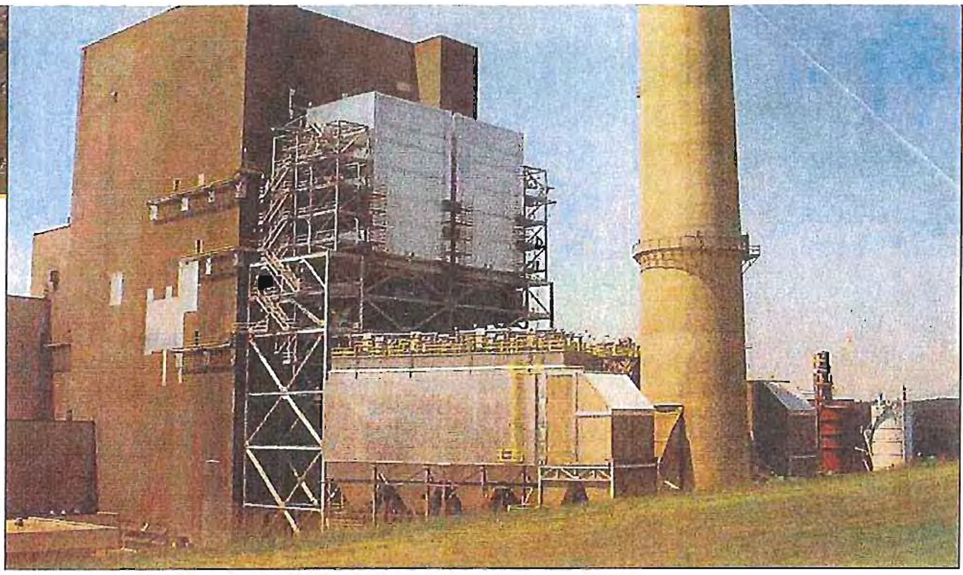

Increasing SCR NO_X removal from 85% to 93% at the Duke Power Cliffside Steam Station

By Terence R. Ake, Clayton A. Erickson, and Linton K. Hutcheson

Introduction

Tests were completed at the Duke Power Cliffside Steam Station on the Unit 5 SCR system to increase NO_X removal from an initial design value of 85 percent to an in-use operating level of 93 percent. These tests took place from May 24 to May 26, 2004 at the start of the third OTAG season for the SCR that was furnished by Riley Power, Inc., a Babcock Power Inc. company. Unit 5 is a balanced draft, subcritical boiler that operates at 590 MW firing eastern bituminous coal. Two SCR reactors are installed at the economizer outlet of ~~the~~ boiler including economizer bypasses for low load operation. Anhydrous ammonia is the reagent for NO_X reduction. Each reactor had two initial catalyst layers when the unit was tested.

The Selective Catalytic Reduction system for the Unit 5 boiler at the Duke Power Cliffside Steam Station was commissioned in May 2002 to remove NO_X at a design rate of 85 percent [1]. After the SCR operated through two OTAG seasons, Duke Power hired Riley Power to performed tests to increase NO_X removal from 85 percent to 93 percent while keeping the ammonia to NO_X ratio variation within design limits. A low variation in the ammonia to NO_X ratio results in low ammonia slip and increased catalyst life.

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Important terms

NO_x = nitrogen oxide in boiler flue gas measured in parts per million corrected to a common oxygen basis (3% O_2)

$NO_x{}^{IN}_{Avg}$ = average of the inlet grid NOx measurements

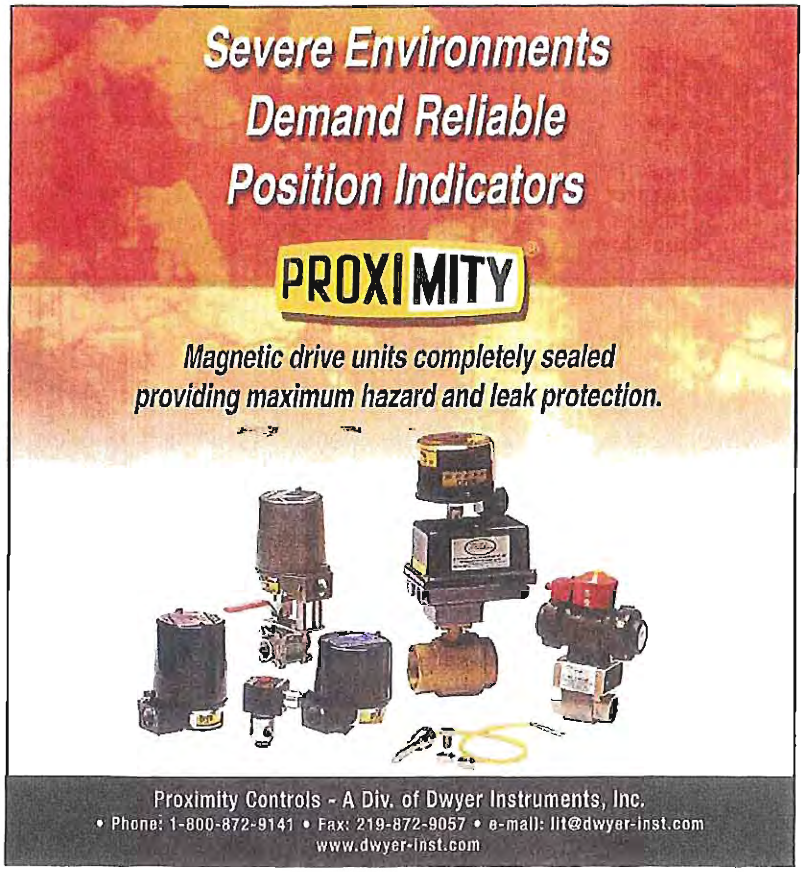
$NO_x{}^{OUT}_{i}$ = NO_x measured at a point in the outlet grid

$NO_x{}^{OUT}_{Avg}$ = average of the outlet grid NO_x measurements

SCR = Selective Catalytic Reduction system for the removal of NO_x from boiler flue gas.

Background

The Cliffside Unit 5 boiler is a balanced draft, subcritical pressure, superheat and single reheat unit. The full load capability is 562 MW net (590 MW gross) at a steam flowrate of 4.2 x 106 lb/hr. The unit predominantly operates at full load with ozone seasonal capacity factors near 80 percent. The furnace is corner-fired by 24 tilting, tangential coal burners. Six bowl mills, arranged in a row across the unit near ground level, pulverize coal for the burners. A large population of Central Appalachian coals with less than 1.5 percent sulfur content is currently fired at the Cliffside Station. Limestone is added to the coal to mitigate arsenic poisoning of the SCR catalyst [2]. The boiler is equipped with a dry ESP for particulate control.



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The SCR system, shown in Figure 1, includes two SCR reactors installed in parallel at the economizer exit of the boiler. There is a 100 percent gas bypass around each reactor to take the SCR offline while maintaining boiler operation. The SCR reactors are equipped with sootblowers to periodically remove soot from the catalyst. Anhydrous ammonia is the reagent for NO_x reduction. It is vaporized and conveyed by a dilution air stream to the reactors, and then it is injected through four injectors into the inlet duct for each reactor. The reactors have two layers of catalyst with room for two additional layers. The reactors were designed to reduce NO_x by 85 percent from an inlet NO_x of 0.45 lb/million Btu.

Only four injectors are needed to mix ammonia with the flue gas in each SCR reactor owing to the Delta-Wing® mixing technology in the Riley Power SCR design. As illustrated in

Figure 2, ammonia is injected downstream of a stationary plate so that ammonia mixes with flue gas in the wake caused by the plate. Cross-mixing plates upstream of ammonia injection evenly distribute the flue gas before injection. Homogenizing plates downstream of injection and turning vanes in the reactor cap direct the flow evenly across the catalyst face. This stationary mixing plate system also keeps dust from settling on horizontal surfaces of the ductwork. It is designed for minimum pressure loss. Since there are few injectors, ammonia injector tuning is minor. The system can operate over a wide load range without any adjustments to the ammonia injectors.

Test procedure

The objective was to balance the ammonia injectors to obtain a standard deviation of the ammonia to NO_x ratio variation less than 5 percent for each SCR reactor while operating at 93 percent NOx removal.

Prior to testing, the boiler was operated at full load for several hours, and boiler and SCR sootblowing cycles were completed. Daily coal and ash samples and

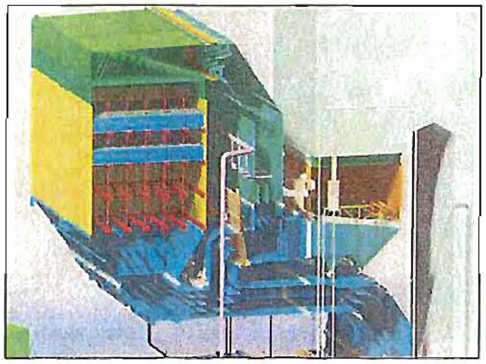

Figure 1. The SCR NOx removal system for the Unit 5 boiler at the Duke Power Cliffside Station.

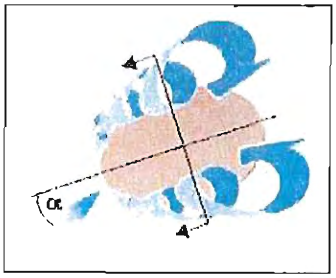

Figure 2. Delta-Wing® mixing technology.

one representative limestone sample were taken during the tests. The data control system continuously recorded fuel, air and steam flows data, boiler draft and flue gas emission data, SCR system data, and stack emission data.

During the tests, flue gas NO_x, O_2, and temperature were measured across a 6 x 7 grid of probes at the outlet of the catalyst in each SCR reactor using several TESTO 350 M/XL flue gas analyzers. Measurements were repeated at several points to intermittently check the analyzers.

A baseline test was completed with no ammonia injection before testing with ammonia injection for each reactor.

The ammonia to NO_x ratio variation was calculated from the grid measurements using the following formula:

$$\Delta(NH_3/NO_x = 100 \times \left[\frac{(NO_{x\,Avg}^{OUT} - NO_{x\,i}^{OUT}}{(NO_{x\,Avg}^{IN} - NO_{x\,Avg}^{OUT}}\right]$$

A plot of the above variation was used to visualize the ammonia and NO_x mixing and to determine whether the ammonia injectors required adjustment. A standard deviation of less than 5% indicated good ammonia to NO_x distribution.

Test results

Figures 3A and 3B show the outlet NO_x contours for reactor A at 93 percent NO_x removal and reactor B at 95 percent NO_x removal. The average outlet NO_x was 12 ppm for reactor A and 9 ppm for reactor B. There were no zero NO_x values in either reactor. Figure 4A and 4B shows the variation in the ammonia to NO_x ratios for the reactors at these high NO_x removal rates. The ammonia to NO_x ratio variation was within ±5 percent for both reactors.

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The standard deviation for reactor A was 2.1 percent, and the standard deviation for reactor B was 2.2 percent.

No ammonia injector adjustments were made when increasing NO_x removal from design value to these high removal rates.

In a separate test, the ammonia injection was set for an overall NO_x removal of 93 percent with both reactors in service. The outlet NO_x contours and ammonia to NO_x ratio variation were very similar to the results for operating each reactor alone. A final test was completed at high NO_x removal after changing the overfire air system in the boiler to decrease the fly ash loss on ignition. Again, similar results were measured with an ammonia to NO_x ratio variation within ±5 percent and a standard deviation of 2 percent for both reactors.

To verify that ammonia slip had not increased, flyash samples were taken during the test period. These samples showed no increase in ammonia concentration with values within acceptable limits.

Conclusion

The SCR system for the Unit 5 boiler at the Cliffside steam station operated at 93% NO_x removal with the ammonia to NO_x ratio variation within ±5% for each reactor. While the SCR is not currently operated at this high NO_x removal rate, the test results showed that the SCR is able to operate at high NO_x removal without added risk to the catalyst or causing excessive ammonia slip.

Note: This article was originally submitted as a paper by the same authors at ASME Power 2005 (PWR2005-50086) in Chicago, IL.)

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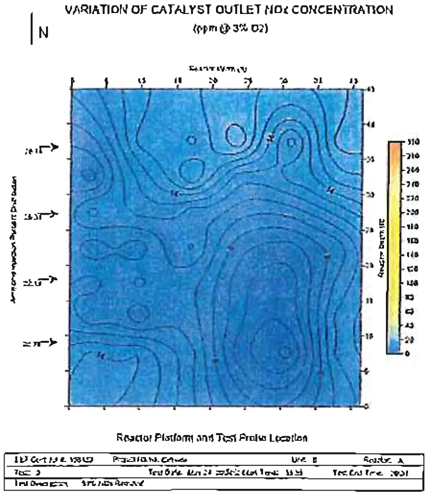

Figure 3A. SCR reactor A outlet NOx distribution at 93% NOx removal.

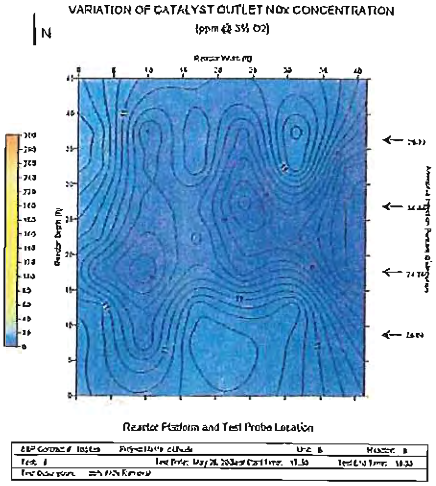

Figure 3B. SCR reactor B outlet NOx distribution at 95% NOx removal.

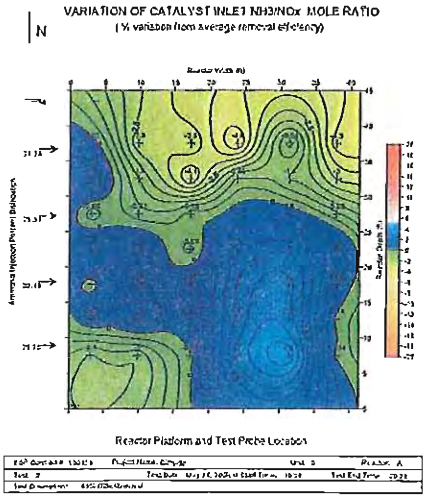

Figure 4A. Ammonia to NOx variation for SCR reactor A at 93% NOx removal.

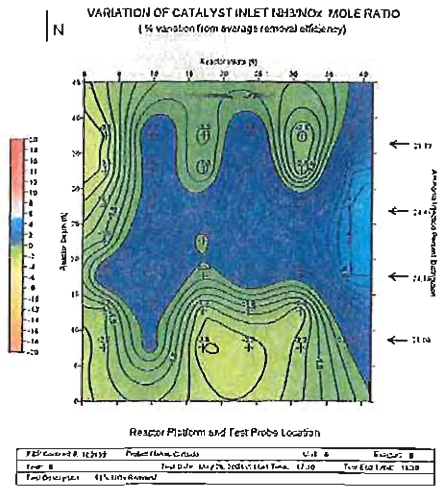

Figure 4B. Ammonia to NOx variation for SCR reactor B at 95% NOx removal.

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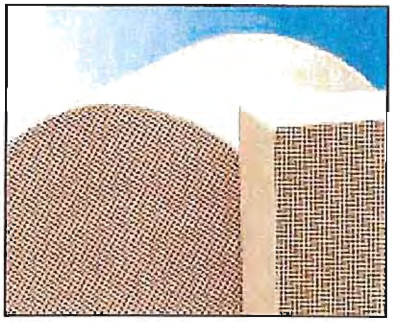

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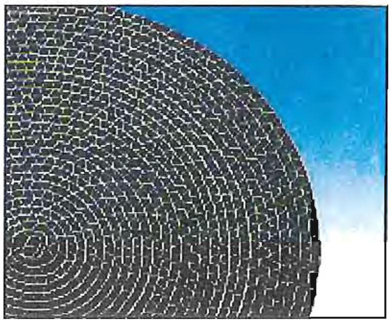

EMx is a continuous process designed to achieve the required emissions reduction at the maximum NOx flowrate:

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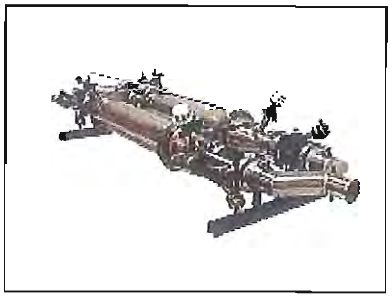

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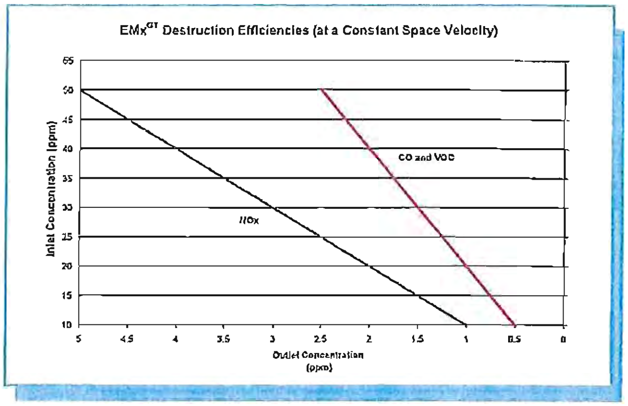
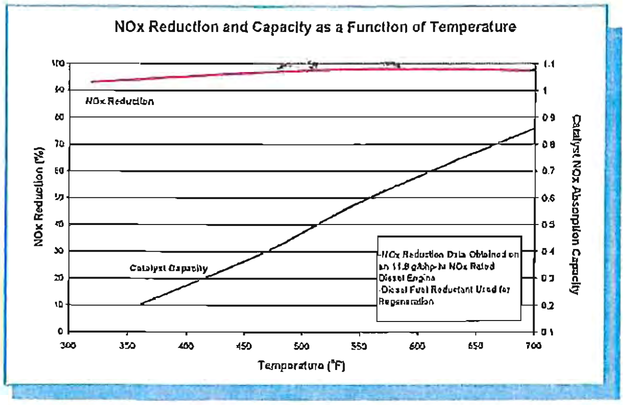
EMx^{TM} Catalyst: Technical Specifications

Type	Material	Properties			Units	Specifications		
Honeycomb Monolith	Ceramic Modules	Cell Density			cpsi	200	300	400
		Wall Thickness			in.	0.0105	0.0080	0.0070
		Geometric Surface Area			in^2/in^3	48.20	59.70	68.80
		Maximum Temperature			°F	1,200	1,200	1,200
		Coefficient of Thermal Expansion			x10^{-6}in/in/°F	3.91	3.91	3.91
		Range of Dimensions	Square	Height	in.	≤42	≤42	≤42
				Width	in.	≤42	≤42	≤42
				Depth*	in.	1-18	1-18	1-18
			Round	Diameter	in.	≤42	≤42	≤42
				Depth*	in.	1-18	1-18	1-18

Listed numbers are nominal values. EmeraChem manufactures catalyst modules in various shapes and sizes.
**For greater depths, multiple units may be stacked to obtain desired dimensions.*

EMx^{GT} Performance Guarantees Available	
NOx	<1.5 ppm
CO	<1.0 ppm
VOC	<1.0 ppm
S	>95%
PM	>30%
NH_3 Slip	0





Inquiries:
Send us specifications, drawings or gas stream data and we will provide you with a custom-tailored solution to your specific application. EmeraChem also provides analytical and technical services to assist in determining your current emissions and catalytic performance.

EmeraChem is a proven leader in the catalytic control of NOx, SOx, CO, VOCs and PM for manufacturing and industrial applications as well as for the power generation industry.

EmeraChem LLC
2375 Cherahala Boulevard
Knoxville, Tennessee 37931
Toll Free: 888.777.4538
Tel: 865.246.3000
Fax: 865.246.3001

www.emerachem.com

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY (LDEQ)
CONSOLIDATED ENVIRONMENTAL MANAGEMENT, INC.
NUCOR STEEL LOUISIANA

AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

AFFIDAVIT OF DR. MICHAEL JENNINGS

I, Dr. Michael Jennings, state:

1. I have personal knowledge of the statements made herein.
2. I am a Professor of Chemical and Materials Engineering at San Jose State University and a Senior Advisor with EnviroComp Consulting, Inc., an environmental consulting firm.
3. Exhibit 1 hereto is a true and accurate copy of my curriculum vitae.
4. In the course of my practice as an air pollution consultant, I have reviewed the permits referenced above (the "Permits"), applications and other materials related to the proposed Nucor Steel Louisiana facility and similar facilities located in the United States and elsewhere, and performed engineering calculations relating to emissions from the proposed Nucor facility.
5. Through my education, training, experience, review of relevant documents, and engineering calculations, I have formed opinions regarding the emissions and control strategies of the proposed Nucor pig iron mill.
6. The materials and engineering calculations I reviewed and performed are what an experienced chemical and materials engineer and air pollution consultant would rely upon in forming opinions regarding the emissions and control strategies of a proposed manufacturing facility.
7. Exhibit 2 hereto is a true and accurate copy of my opinions regarding the emissions and control strategies of the proposed Nucor pig iron mill.

I hereby certify under penalties of perjury that the foregoing representations are true to the best of my knowledge.

Michael B Jennings

22NOV08
Date

Dr. Michael Jennings

EXHIBIT
10
ALL-STATE LEGAL

Exhibit 1 – Curriculum Vitae

CURRICULUM VITAE
OF
MICHAEL JENNINGS
SENIOR ADVISOR, ENVIROCOMP CONSULTING, INC.

Email: jennings@envirocomp.com
Phone: (408) 286-5703
Fax: (408) 286-2604
Cell: (408) 499-0685

Postal Address:
M. B. Jennings
198 South 13th Street
San Jose, CA 95112

Personal Web page: http://www.engr.sjsu.edu/jennimi/

EDUCATION AND TITLES

- *Doctoral Degree in Chemical Engineering*, University of New Mexico, Albuquerque, New Mexico (1981)
- *Master of Science in Engineering*, Southern Illinois University, Carbondale, Illinois, (1073)
- *Bachelor of Science in Chemical Engineering*, University of New Mexico, Albuquerque, New Mexico (1969)

PROFESSIONAL EXPERIENCE

- ***Senior Advisor***, EnviroComp Consulting, Inc. (April 2003 – present)
  www.envirocomp.com
- ***Professor***, *College of Engineering Chemical & Materials Engineering Department*, San Jose State University; San Jose, California (1984 – present)

  Director, *College of Engineering Master of Science in Engineering Program*, San Jose State University; San Jose, California (2004 – 2008)

  Chair, *Chemical & Materials Engineering Department, College of Engineering*, San Jose State University; San Jose, California (1989-2000)

- ***Project Engineer***, Kaiser Engineers, Inc., Oakland, California (1974 - 1984)

  Research Engineer, Occidental Research, Inc. (formerly Garrett R & D), La Verne, California (1973 - 1974)

- ***Production Supervisor***, Monsanto, Inc; Sauget, Illinois, (1971 – 1973)
- ***Start-Up Engineer***, Monsanto, Inc; Sauget, Illinois, (1970 – 1971)
- ***Process Engineer***, Monsanto, Inc; Sauget, Illinois, (1969 – 1970)
- ***Industrial Hygiene Technician (Internship)***, Los Alamos Scientific Laboratory, Los Alamos, New Mexico (1965 – 1966)

MEMBERSHIPS

- Member, American Institute of Chemical Engineers, (1965 – present).
  Director Northern California (2004 – present)
  Recipient of Northern California AIChE 1997 Professional Progress Award
- Member, American Chemical Society, (1965 – present)
- Member, American Society for Engineering Education (1993 – present)

SELECTED PUBLICATIONS

- Jennings, M., The Hybrid Cycle – A Unique Method for Production of Clean Fuels and Power Generation for a Coal Based Energy Center, International Coal Utilization Exhibition and Conference, November 1979
- Hempill, H. and Jennings, M. B., Offsites, Utilities and General Facilities for Coal Conversion Plants, International Energy Conversion Engineering Conference, San Francisco, 1984
- Sampson, M. J., Jennings, M. B., and Zsutty, T. C., Storage and Handling of Hazardous Materials (Facility Design), 3 day short course October 1985
- Jennings, M. B., Roberts, D. L, and Zare, A. R., Conceptual Processes for Recovery of Argon with Membranes in an Air Separation Process, 1987 Summer National Meeting, American Institute of Chemical Engineers, Minneapolis, 1987
- Jennings, Michael B., Cryogenic Gas Processing: Current Technology and Future Applications, (invited lecture), Dow Gas Separations Symposium, Lafayette, CA, July 1991
- Jennings, Michael B., Mah, W. and Guinnane, V., Final Report for United Technolgies Propellant Mixing Modeling Project, proprietary report, January 1992
- Jennings, Michael B., Rushforth, C. and Wickman, P., Final Report for Used Oil Characterization Project, California Integrated Waste Management Board Project Number IWM-C3124, June 1996
- Frattini, P. L., Su, T., Yengoyan, L. S., Jennings, M. B. and Millett, P. J., Molecular Weight Measurements of Polymeric Sulfonate Extractables from low cross-linked BWR Condensate Polishing Resins, VII International Conference of Water Chemistry of Nuclear Reactor Systems, Bournemouth, UK, October 1966
- Anagnos, T. and Jennings, M., Preparing an Assessment Plan at San Jose State University, American Society for Engineering Education Annual Meeting, Seattle, 1998
- Diaz, A. and Jennings, M., Environmental Health and Safety – An Industry-Driven 4 Year Degree Program, Project Number P116B981262, August 2002, Fund for the Improvement of Post-Secondary Education, Federal Department of Education (http://www.fipse.aed.org/grantshow.cfm?grantNumber=P116B981262)
- Bhyullar, Echaluse, Sun, Dinh, Odeh, Jennings and Komives. Fuel Grade Ethanol using New Technologies, AIChE National Convention, San Francisco, Nov. 2006

RELEVANT PROFESSIONAL ACTIVITY

Academic Instruction

Developed and teach graduate and undergraduate courses in Project Engineering, Thermodynamics, Separations Processes, Air Pollution Technology, Hazardous Waste Management, Transport Phenomena, Process Dynamics & Control, and Heat Transfer.

Academic Administration

Chair of Chemical and Materials Engineering Department at San Jose State University and managed multidisciplinary Master of Science in Engineering (MSE) Program for the College of Engineering. The MSE program includes on-campus and off-campus degree programs for a range of technical options. As Chair and Professor in Chemical Engineering and Materials Engineering Departments offering complete BS and MS programs, developed significant research component and recruited new faculty in the program. Helped initiate restructuring project to increase interdisciplinary skills of students, improve program quality and efficiency. Added areas of concentration to Chemical Engineering in Environmental Health & Safety Engineering, Biotechnology, and Semiconductor Processes.

Academic Research

Completed applied and basic research in mixing of three phase, high solids concentration slurries, such as used for rocket propellant; process simulation; rheological characteristics of mixtures; hazardous wastes incineration; respirators for use by wildland fire fighters and food drying technology. Coordinated research projects for new faculty in the areas of plasma etching for electro-less plating and properties of solders applied to lead frames. Other projects include characterization of waste lubricating oils for reprocessing potential, removal of iron from power plant cooling water systems, development of processes for formed epoxy components, and control of corrosion in power plant cooling water systems. Currently have a patent pending for an emergency escape respirator system.

Consulting

Completed conceptual design of prototype for cereal production system. Evaluation of methods to optimize batch process for plasticizer production and design modifications to reduce process emissions. In coordination with client engineers, coordinated development of a process for recovery of glycerin used as a processing agent. Submitted technical reviews and depositions for litigation in several cases, including groundwater contamination, equipment failure and industrial exposure incidents.

Chemical Production Experience

Responsible for first line business and technical management of large volume production facilities for an intermediate chemical used for production of lube oil additives and herbicides. Required development of production and maintenance schedules, operating budgets, coordination with production research to meet product specifications and develop new product forms, assisting marketing, compliance with regulatory groups and maintaining contractual relationships with the union representatives and members. Assisted in start-up of new plasticizer production facility including technical revisions to the unit, shift supervision, development of analytical methods for products and by-products. Developed projects for optimization of energy consumption, utilization of raw materials and reduction of effluent streams from facilities.

Design & Construction

Responsible for commercial and technical administration of design and construction of an air separation plant used in the prototype, contemporary, commercial-scale coal Gasification plant for the US. Air Separation plant was the largest using a unique technology and included numerous international contracts. Worked as technical and commercial liaison for installation of a new coke oven by-products processing plant at Republic Steel in South Chicago. Spent six months in Germany to coordinate design for the facility between German designers and US fabricators. Coordinated project with Kaiser Steel to evaluate SO2 scrubbing technology for the Fontana Steel Plant. Completed numerous technical and economic evaluations of new or revised technologies related to power production, energy conservation or production of metals and chemicals. Completed several reports used for preparation of Environmental Impact Statements.

Industrial Research Projects

Primary responsibility for design and implementation of pilot plant systems used to demonstrate new technology and obtain data required for design of larger scale units. Particular experience related to production of phosphoric acid, coal Gasification, coal liquefaction and processing of municipal solid wastes.

Graduate School Research

Developed model to test effect of agitation on change of phase heat transfer in viscous systems for MS thesis activity.

Developed model to correlate effects of temperature on transport properties of liquid mixtures for PhD Dissertation.

Summary of Deposition and Testimony Activities – Dr. Michael B. Jennings

Attorney(s)	Type of Case	Participation
Smith, Horner and Bakke, Bismarck, ND 701-258-0630 Attorneys for Kaiser Engineers	Liability for Building Structural Failure	1993 Deposition for Project Management for construction of building and operating conditions that led to failure
Cronin, Fried, Sekiya, Kekina and Fairbanks, Honolulu, HI 808-524-1433 Attorneys for Honolulu Board of Water Supply Contact: Keith K. H. Young, Esq.	Drinking water contamination from nematocide	2001 Preparation for deposition of experts
Layser & Freiwald, Philadelphia, PA 215-875-8000 Attorneys for Class Action – Glenn and Donna Gates, et. al. Contact: Aaron J. Freiwald, Esq.	Groundwater contamination	2007 Deposition regarding release from stripper
Duplass, Zwain, Bourgeois & Morton, Metairie, LA. 504-832-3700, Heller, Draper, Hayden, Partrick & Horn, New Orleans, LA., Leonard, Street & Deinard, Minneapolis, MN., Powers & Hightower, LLP, Baton Rouge, LA Haily, McNamara, Hall, Larmann & Papale, LLP., Metairie, LA Attorneys for Defendants in Arts Street Fire Contact: Warren Horn, Esq. Andrew Parr Sellers, Jr. Esq.	Release from fire in wood specialties operation	2008 Deposition for release of ammonia from materials in fire. Testimony for Class Certification Hearing
Schaffer, Lax, McNaughton and Chen 213-337-1000 Attorneys for Plains Exploration & Production Company : Contacts : Kevin J. McNaughton or Jill A. Franklin	Possible exposure to emissions from oil field operations	2008 Deposition for release of gaseous emissions from oil field operations

Exhibit 2 – Opinion

Proposed Methods to Reduce Emissions from the Nucor Plant

Dr. Michael Jennings, Senior Advisor
EnviroComp Consulting, Inc.

1.0 Statement of Opinion

The Nucor Iron Production Plant currently anticipates release of untreated flue gas form coke ovens through bypass stacks during maintenance operations for Heat Recovery Steam Generators, bag houses and SO2 scrubbers. The estimated duration of these releases is 12 days; which will result in a release of 5.1 million kilograms (11.3 million pounds) per year of untreated flue gas[1]. It is my opinion that the coke oven plant can be reconfigured to have negligible emissions during periods of coke oven plant equipment maintenance.

2.0 Factual basis of Opinion:

EnviroComp has reviewed the design of the Iron making facility proposed by Nucor for installation in Convent, St. James Parish, Louisiana, to determine design revisions that could reduce the emissions from the operations. The criteria for this analysis include use of demonstrated technology and the operating modes indicated by Nucor in their proposal to LDEQ.

The operating plans proposed by Nucor include diversion of flows normally sent to the Heat Recovery Steam Generators (HRSG) to bypass stacks during periods of maintenance of the HRSGs, the bag houses, or the SO2 Scrubber[2]. A more effective emission control design would relegate flow to the bypass stacks for emergency conditions and avoid these releases to the atmosphere. There are at least two designs that could accomplish these objectives and they are described below.

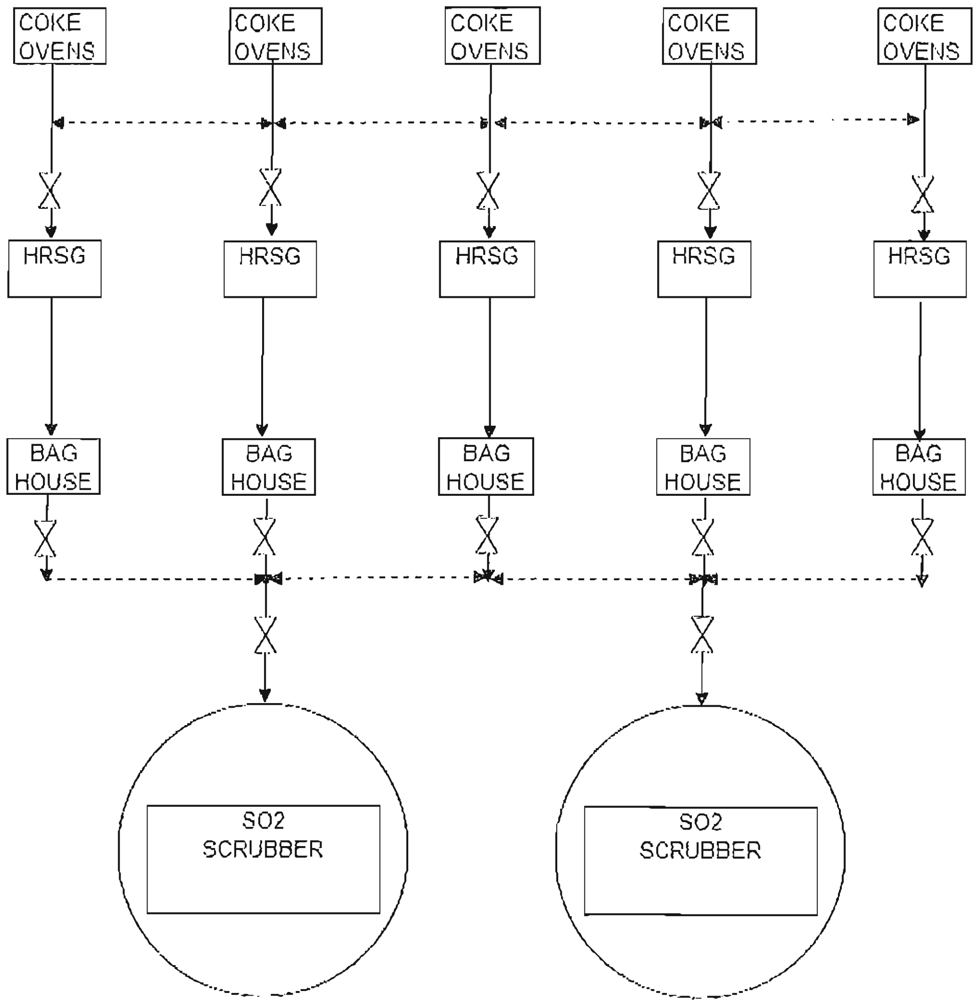
Alternate 1 is shown below in Figure 1 and is based on increasing the capacity of each HRSG and bag house train, plus the addition of a parallel SO2 scrubber. As shown on the sketch, the capacity of each HRSG unit and each bag house unit is increased by 25 percent above the current design. Under normal operations, the flue gas flows from the coke ovens go directly to the HRSG and bag house units as currently proposed by Nucor. When it is necessary to maintain an HRSG or bag house unit, the flows to those devices are diverted with a flue gas manifold to the other four trains for the duration of the maintenance operations. Four trains can accommodate the flue gas flows from five sets of coke ovens because they are each installed with an extra 25 percent capacity. The flows are directed back to the original configuration when the maintenance operations are completed and there should have been no releases through the bypass units during this period.

This increased capacity design is similar to the one proposed for Nonrecovery Coke Ovens proposed by Haverhill North Coke Company in Ohio, so it is not a novel design for this type of operation.[3]

A second SO2 Scrubber is added to the design for operation when it is necessary to shutdown the primary SO2 scrubber for maintenance. This additional unit is attached to the manifold in the existing design for the discharges from the bag houses. Flows can be directed to either SO2 scrubber during normal operations and either unit can be isolated for maintenance, without the necessity of directing flue gas flows to the bypass stacks.

This alternative would use equipment that is similar to the current Nucor design, so it would not be necessary to increase quantities of spares for the equipment or have special maintenance techniques. It might also be possible to eliminate some of the bypass stacks by connecting the flue gas manifold to a single large bypass stack.

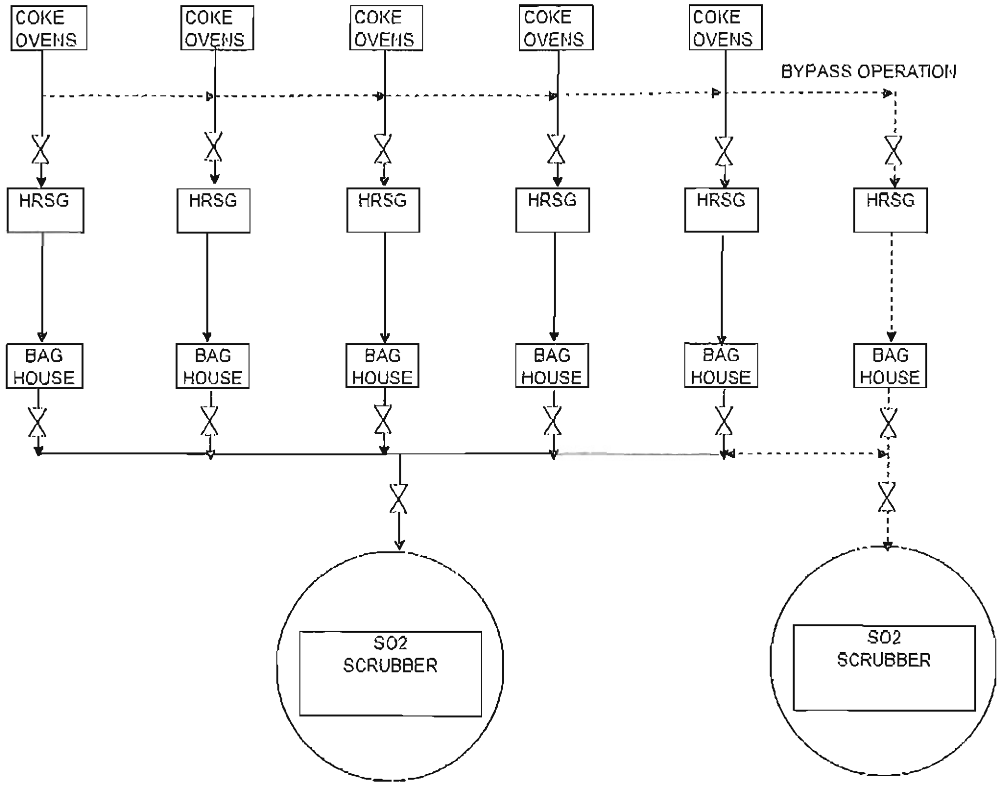
Figure 1 - ALTERNATE 1 INCREASED CAPACITY FOR COMPONENTS



The second alternative to avoid emissions from using the bypass stacks during maintenance is shown in Figure 2 and is based on adding a parallel HRSG/bag house train to the existing design, plus a second SO2 scrubber. This design allows flue gas flows to be diverted to the bypass train while isolating the train to be maintained. The bypass train is designed with the same capacity as the other primary trains in the system.

A second SO2 Scrubber is included in the design for operation when it is necessary to shutdown the primary SO2 scrubber for maintenance.

ALERNATE 2 - PARALLEL EMISSION CONTROL TRAIN



Either of these alternatives would provide the following advantages:

- They eliminate the need to send untreated releases through the bypass stacks during maintenance
- They employ the same technology as the current design and use alternate configurations
- They provide redundancy that should result in additional levels of operating reliability and flexibility.

Refererences

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[1] Nucor Steel Louisiana Part 70 Initial Permit and Authorization to Construct and PSD Permit Application

[2] .Ibid

[3] Sun Coke Haverhill North Permit Application

Section V.D.2.

Guidance by source category: Annex C, Part II Source Categories

Sinter plants in the iron industry

Coordinated by Mr. Patrick Finlay (Canada)

ALL-STATE LEGAL®
EXHIBIT
11

Guidelines on Best Available Techniques (BAT) for Sinter Plants in the Iron Industry

List of Contents

1.0 Process Description

Iron sintering plants are associated with the manufacture of iron and steel, often in integrated steel mills. The sintering process is a pre-treatment step in the production of iron, where fine particles of iron ores and in some plants, also secondary iron oxide wastes (collected dusts, mill scale), are agglomerated by combustion. Agglomeration of the fines is necessary to enable the passage of hot gases during the subsequent blast furnace operation.[1]

Sintering involves the heating of fine iron ore with flux and coke fines or coal to produce a semi-molten mass that solidifies into porous pieces of sinter with the size and strength characteristics necessary for feeding into the blast furnace. Moistened feed is delivered as a layer onto a continuously moving grate or "strand." The surface is ignited with gas burners at the start of the strand, and air is drawn through the moving bed causing the fuel to burn. Strand velocity and gas flow are controlled to ensure that "burn through" (i.e. the point at which the burning fuel layer reaches the base of the strand) occurs just prior to the sinter being discharged. The solidified sinter is then broken into pieces in a crusher and is air-cooled. Product outside the required size range is screened out, oversize material is recrushed, and undersize material is recycled back to the process. Sinter plants that are located in a steel plant recycle iron ore fines from the raw material storage and handling operations and from waste iron oxides from steel plant operations and environmental control systems. Iron ore may also be processed in on-site sinter plants.[2]

The flexibility of the sintering process permits conversion of a variety of materials, including iron ore fines, captured dusts, ore concentrates, and other iron-bearing materials of small particle size (e.g., mill scale) into a clinker-like agglomerate.[3]

Waste gases are usually treated for dust removal in a cyclone, electrostatic precipitator, wet scrubber or fabric filter.

Figure 1 provides a schematic of an iron sintering plant using wet scrubber and Figure 2 provides a schematic for a typical iron sintering plant which uses an electrostatic precipitator for dust control.

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[1] United Nations Environment Programme (UNEP), *Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases*, (Switzerland: UNEP Chemicals, 2003), p. 60

[2] Environment Canada, *Environmental Code of Practice for Integrated Steel Mills – CEPA 1999 Code of Practice*, (Canada: Public Works and Government Services, 2001), p. 18.

[3] William T. Lankford Jr., Norman L. Samways, Robert F. Craven, and Harold E. MacGannon, eds., *The Making, Shaping and Treating of Steel, 10th Edition*, (USA: Association of Iron and Steel Engineers, 1985), p. 305-6.

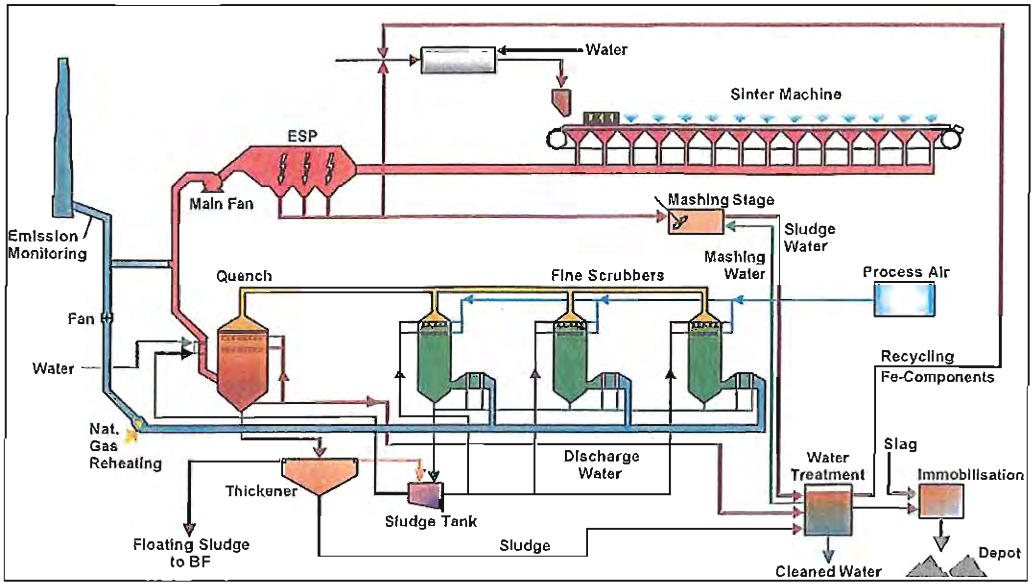

Figure 1: Process Diagram from a Sinter Plant (Source: K. Hofstadler et al., *Dioxin at Sinter Plants and Electric Arc Furnaces – Emission profiles and removal efficiency*: downloaded May 2003 http://g5006m.unileoben.ac.at/downloads/Dioxin.doc)

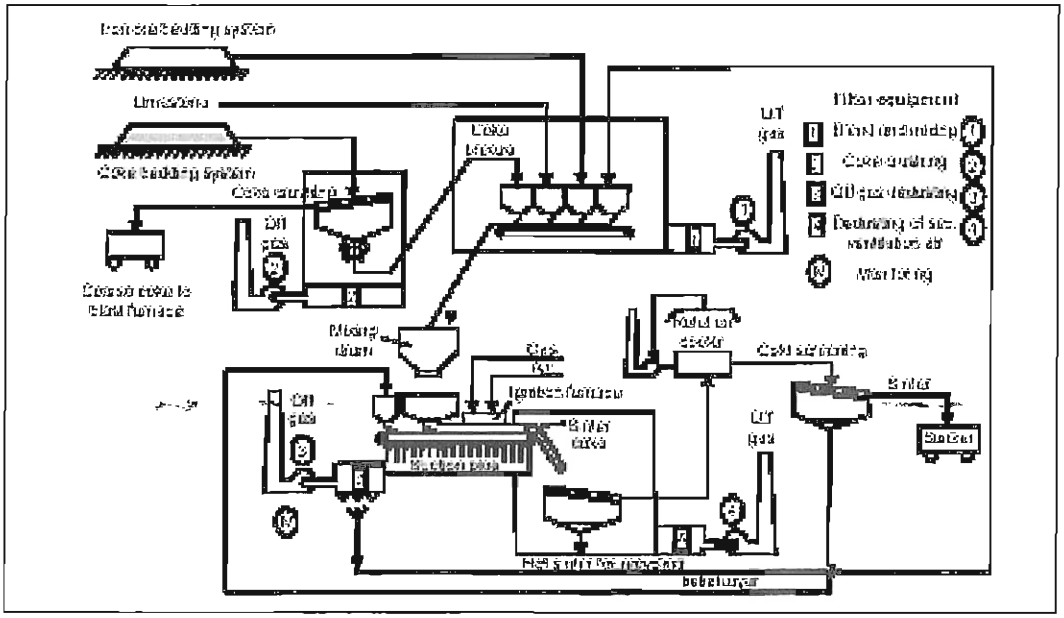

Figure 2: A Typical Iron Sintering Plant (Source: United-Kingdom Environment Agency, *Integrated Pollution Prevention and Control: Guidance for the Coke, Iron and Steel Sector*, Sector Guidance Note IPPC S2.01, 2001)

2.0 Sources of Unintentional POPs

Iron sintering has been identified as a source of polychlorinated dibenzoparadioxins (PCDD) and polychlorinated dibenzofurans (PCDF). The formation and release of hexachlorobenzene (HCB) and polychlorinated biphenyls (PCB) are less understood from this potential source.

2.1 Releases to Air

2.1.1 General Information on Emissions from Iron Sintering Plants 4

"Emissions from the sintering process arise primarily from materials-handling operations, which result in airborne dust, and from the combustion reaction on the strand. Combustion gases from the latter source contain dust entrained directly from the strand along with products of combustion such as CO, CO_2, SO_x, NO_x, and particulate matter. The concentrations of these substances vary with the quality of the fuel and raw materials used and combustion conditions. Atmospheric emissions also include volatile organic compounds (VOCs) formed from volatile material in the coke breeze, oily mill scale, etc., and dioxins and furans, formed from organic material under certain operating conditions. Metals are volatilized from the raw materials used, and acid vapours are formed from the halides present in the raw materials.

Combustion gases are most often cleaned in electrostatic precipitators (ESPs), which significantly reduce dust emissions but have minimal effect on the gaseous emissions. Water scrubbers, which are sometimes used for sinter plants, may have lower particulate collection efficiency than ESPs but higher collection efficiency for gaseous emissions. Significant amounts of oil in the raw material feed may create explosive conditions in the ESP. Sinter crushing and screening emissions are usually controlled by ESPs or fabric filters. Wastewater discharges, including runoff from the materials storage areas, are treated in a wastewater treatment plant that may also be used to treat blast furnace wastewater.

Solid wastes include refractories and sludge generated by the treatment of emission control system water in cases where a wet emission control system is used. Undersize sinter is recycled to the sinter strand."

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[4] Environment Canada, *Environmental Code of Practice for Integrated Steel Mills – CEPA 1999 Code of Practice,* (Canada: Public Works and Government Services, 2001), p. 23-25.

2.1.2 *Emissions of PCDD and PCDF*[5]

The processes by which PCDD/PCDF are formed are complex. PCDD/PCDF appear to be formed in the iron sintering process via *de novo* synthesis. PCDF generally dominate in the waste gas from sinter plants.

The PCDD/PCDF formation mechanism appears to start in the upper regions of the sinter bed shortly after ignition, and then the dioxin/furan and other compounds condense on cooler burden beneath as the sinter layer advances along the sinter strand towards the burn through point. The process of volatilization and condensation continues until the temperature of the cooler burden beneath rises sufficiently to prevent condensation and the PCDD/PCDF exit with the flue gas. This appears to increase rapidly and peak just before burn through and then decrease rapidly to a minimum. This is supported by the dioxin/furan profile compared to the temperature profile along the sinter strand in several studies.

The quantity of PCDD and PCDF formed has been shown to increase with increasing carbon and chlorine content. Carbon and chloride are present in some of the sinter feed materials typically processed through a sinter plant.

2.1.3 *Research findings of interest:*[6]

It appears that the composition of the feed mixture has an impact on the formation of PCDD/PCDF i.e., increased chlorine content results in increased PCDD/PCDF formation while the replacement of coke as a fuel with anthracite coal appears to reduce PCDD/PCDF concentration.

The form of the solid fuel may also impact furan emissions. Coal, graphite, and activated coke in a Japanese laboratory research program reduced pentachlorinated dibenzofuran emissions by approximately 90 percent.

The operating parameters of the sintering process appear to have an impact on the formation of PCDD/PCDF.

2.2 Releases to Other Media

No information was identified on releases of UPOPs from iron sintering operations to other media such as through wastewater or collected dusts.

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[5] William Lemmon & Associates Ltd., *Research on Technical Pollution Prevention Options for Iron Sintering, Draft of 2003/05/17* (Canada: prepared for the Canadian Council of Ministers of the Environment, 2003), p.20-21

[6] Ibid.

3.0 Alternatives

In accordance with the POPs Convention, when consideration is being given to proposals for construction of a new iron sintering plant, priority consideration should be given to alternate processes, techniques or practices that have similar usefulness but which avoid the formation and release of the identified substances.

Alternate processes to iron sintering include:

The FASTMET process: This process converts iron oxide pellet feed, oxide fines, and/or steel mill wastes into metallic iron, and produces a direct reduced iron (DRI) product suitable for use in a blast furnace. Emission concentration of PCDD and PCDF from the FASTMET process is reported to be <0.1 ng TEQ/m^3. Carbon contained in the wastes or added as coal, charcoal or coke is used as the reductant.

Direct reduction processes: This technique processes iron ore to produce a direct reduced iron (DRI) product which can be used as a feed material to steel manufacturing electric arc furnaces, iron making blast furnaces, or steelmaking basic oxygen furnaces. Natural gas is reformed to make hydrogen and carbon dioxide, where hydrogen is the reductant used to produce the DRI product. The availability and cost of natural gas will impact the feasibility of using this technique.

Direct smelting processes: Direct smelting replaces the traditional combination of sinter plant, coke oven and blast furnace to produce molten iron. A number of direct smelting processes are evolving and are at various stages of development/commercialization.

4.0 Primary and Secondary Measures

Primary and secondary measures for reducing emissions of PCDD and PCDF from iron sintering processes are outlined below.

The extent of emission reduction possible with implementation of primary measures only is not readily known. It is therefore recommended that consideration be given to implementation of both primary and secondary measures at existing plants.

4.1 Primary Measures

Primary measures are understood to be pollution prevention measures that will prevent or minimize the formation and release of the identified substances (PCDD, PCDF, HCB and PCB). These are sometimes referred to as process optimization or integration measures. Pollution prevention is defined as: *The use of processes, practices, materials, products or* *energy that avoid or minimize the creation of pollutants and waste, and reduce overall risk to human health or the environment.*

Primary measures have been identified which may assist in preventing and minimizing the formation and release of the identified substances. Emission reductions associated with implementation of the following primary measures only is not known. It is recommended that the following measures be implemented together with appropriate secondary measures to ensure the greatest minimization and reduction of emissions possible. Identified primary measures include:

1. Stable and consistent operation of the sinter strand: Research has shown that PCDD/PCDF are formed in the sinter bed itself, likely just ahead of the flame front as the hot gases are drawn through the bed. Disruptions to flame front (i.e., non-steady-state conditions) have been shown to result in higher PCDD/PCDF emissions.

   Sinter strands should be operated to maintain consistent and stable process conditions (i.e., steady-state operations, minimization of process upsets) in order to minimize the formation and release of PCDD, PCDF and other pollutants. Operating conditions to consistently manage include strand speed, bed composition (consistent blending of revert materials, minimization of chloride input), bed height, use of additives (e.g., addition of burnt lime may help reduce PCDD, PCDF formation), minimization of oil content in mill scale, minimization of air in-leakage through the strand, ductwork and off-gas conditioning systems, and minimization of strand stoppages. This approach will also have beneficial operating performance improvements (e.g., productivity, sinter quality, energy efficiency).[7][8]

2. Continuous Parameter Monitoring: A continuous parameter monitoring system (CPMS) should be employed to ensure optimum operation of the sinter strand and off-gas conditioning systems. Various parameters are measured during emission testing to determine the correlation between the parameter value and the stack emissions. The identified parameters are then continuously monitored and compared to the optimum parameter values. Variances in parameter values can be alarmed and corrective action taken to maintain optimum operation of the sinter strand and/or emission control system.

   Operating parameters to monitor may include damper settings, pressure drop, scrubber water flow rate, average opacity, strand speed, etc.

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[7] European Integrated Pollution Prevention and Control Bureau (EIPPCB), *Best Available Techniques Reference Document on the Production of Iron and Steel*, (Seville, Spain, 2000), p.47.

[8] U.K. Environment Agency, *Integrated Pollution Prevention and Control (IPPC) Guidance for the Coke, Iron and Steel Sector*, (United Kingdom: Environment Agency, 2001), p. 39.

Operators of iron sintering plants should prepare a site-specific monitoring plan for the CPMS that addresses installation, performance, operation and maintenance, quality assurance and record keeping, and reporting procedures. Operators should keep records documenting conformance with the identified monitoring requirements and the operation and maintenance plan.[9]

3. Recirculation of Off-gases: Recycling of sinter off-gas (waste-gas) has been shown to minimize pollutant emissions, and reduce the amount of off-gas requiring end-of-pipe treatment. Recirculation of part of the off-gas from the entire sinter strand, or sectional recirculation of off-gas, can minimize formation and release of pollutants. The European Integrated Pollution Prevention and Control Bureau (EIPPCB) BREF document on Iron and Steel Production and the ECSC Steel Research and Technology Development Programme[10] provide additional information on this technique.[11]

   Recycling of iron sintering off-gases can reduce emissions of PCDD, PCDF, NOx and SO_2.

4. Feed material selection: Unwanted substances should be minimized in the feed to the sinter strand. Unwanted substances include POPs and other substances associated with the formation of PCDD, PCDF, HCB and PCB (e.g., chlorine/chlorides, carbon, precursors, oils, etc.).

   A review of feed inputs to determine its composition/structure and concentration of substances associated with POPs and their formation should be conducted. Options to eliminate or reduce the unwanted substance in the feed material should be identified. For example:

   - removal of the contaminant from the material (e.g., de-oiling of mill scales);
   - substitution of the material (e.g., replacement of coke breeze with anthracite);
   - avoid use of the contaminated material (e.g., avoid processing ESP sinter dusts which have been shown to increase PCDD/PCDF formation and release[12]);
   - specification of limits on permissible concentrations of unwanted substances (e.g., oil content in feed should be limited to less than 0.02 percent[13]).

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[9] U.S. Environmental Protection Agency, *National Emission Standards for Hazardous Air Pollutants: Integrated Iron and Steel Manufacturing; Final Rule*, (United-States: 40 CFR Part 63, Federal Register/ Vol. 68, No. 97, May 20, 2003), URL: www.epa.gov

[10] European Coal and Steel Community (ECSC), *The Impact of ECSC Steel Research on Steel Production and Sustainability*, downloaded 2003/09/15, URL: http://www.stahl-online.de//medien_lounge/medieninformationen/hintergrundmaterial.htm

[11] European Integrated Pollution Prevention and Control Bureau (EIPPCB), *Best Available Techniques Reference Document on the Production of Iron and Steel*, (Seville, Spain, 2000), p. 56-62

[12] Kasai, E. et al, Effect of Additives on the Dioxins Emissions in the Iron Ore Sintering Process. *ISIJ International*, Vol. 41 (2001), No.1, pp. 93-97.

Documented procedures should be developed and implemented to carry out the appropriate changes.

5. Feed material preparation: Fine feed materials (e.g., collected dusts) should be adequately agglomerated before they are placed on the sinter strand and feed materials should be intimately mixed or blended. These measures will minimize formation and entrainment of pollutants in the waste gas, and will also minimize fugitive emissions.

4.2 Secondary Measures

Secondary measures are understood to be pollution control technologies or techniques, sometimes described as 'end-of-pipe' treatments.

Primary measures identified earlier should be implemented together with appropriate secondary measures to ensure the greatest minimization and reduction of emissions possible. Measures that have been shown to effectively minimize and reduce PCDD and PCDF emissions include:

1. Removal Techniques

   a. Adsorption/Absorption and High Efficiency De-dusting: This technique involves sorption of PCDD and PCDF to a material such as activated carbon together with effective particulate matter (de-dusting) control.

      For *regenerative activated carbon technology*[14] an ESP is used to reduce dust concentration in the off-gases prior to entry to the activated carbon unit. The waste gas passes through a slowly moving bed of char granules which acts as a filter/adsorption medium. The used char is discharged and transferred to a regenerator, where it is heated to elevated temperatures. PCDD and PCDF adsorbed to the char are decomposed and destroyed within the inert atmosphere of the regenerator. This technique has been shown to reduced emissions to 0.1 to <0.3 ng TEQ/m^3.

      Another sorption technique is the use of *lignite or activated carbon injection, together with a fabric filter*. PCDD and PCDF are sorbed onto the injected

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[13] U.S. Environmental Protection Agency, *National Emission Standards for Hazardous Air Pollutants: Integrated Iron and Steel Manufacturing; Final Rule*, (United-States: 40 CFR Part 63, Federal Register/ Vol. 68, No. 97, May 20, 2003), URL: www.epa.gov

[14] William Lemmon & Associates Ltd., *Research on Technical Pollution Prevention Options for Iron Sintering, Draft of 2003/05/17* (Canada: prepared for the Canadian Council of Ministers of the Environment, 2003), p.29-30

material, and the material is collected in the fabric filter. Along with good operation of the sinter strand, this technique is associated with PCDD/PCDF emission concentrations ranging from 0.1 to 0.5 ng TEQ/m^3.[15]

b. Fine Wet Scrubbing System: The Airfine scrubbing system, developed by Voest Alpine Industries (Austria), has been shown to effectively reduce emission concentrations to 0.2 to 0.4 ng TEQ/m^3. The scrubbing system uses a counter current flow of water against the rising waste gas to scrub out coarse particles and gaseous components (e.g., sulphur dioxide (SO_2)), and to quench the waste gas. (Note, an ESP may also be used upstream for preliminary dedusting.) Caustic soda may be added to improve SO_2 absorption. A fine scrubber, the main feature of the system, follows, employing high-pressure mist jet co-current with the gas flow to remove impurities. Dual flow nozzles eject water and compressed air (creating microscopic droplets) to remove fine dust particles, PCDD and PCDF.[16,17]

   This technique should be combined with effective treatment of the scrubber waste waters and waste water sludge should be disposed of in a secure landfill.[18]

The following measures can assist in minimizing pollutant emissions, but should be combined with other measures (e.g., adsorption/absorption, recirculation of off-gases, etc.) for effective PCDD/PCDF formation and release.

2. General Measures

   a. De-dusting of the sinter off-gases. It has been suggested that effective removal of dust can help reduce emissions of PCDD and PCDF. Fine particles in the sinter off-gas have extremely large surface area for adsorption and condensation of gaseous pollutants, including PCDD and PCDF.[19] Best available technique for de-dusting is use of fabric filters to remove particulate matter. Use of fabric

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[15] U.K. Environment Agency, *Integrated Pollution Prevention and Control (IPPC) Guidance for the Coke, Iron and Steel Sector*, (United Kingdom: Environment Agency, 2001), p. 135.

[16] William Lemmon & Associates Ltd., *Research on Technical Pollution Prevention Options for Iron Sintering, Draft of 2003/05/17* (Canada: prepared for the Canadian Council of Ministers of the Environment, 2003), p.29-30

[17] EIPPCB, *Best Available Techniques Reference Document on the Production of Iron and Steel*, (Seville, Spain, 2000), p. 72-74, URL: http://eippcb.jrc.es

[18] Ibid.

[19] K. Hofstadler et al., *Dioxin at Sinter Plants and Electric Arc Furnaces – Emission profiles and removal efficiency*, (Austria: VOEST ALPINE Indstrienlagenbau GmbH, no date), Url: g5006m.unileoben.ac.at/downloads/Dioxin.doc (May 2003)

filters for sinter plants is associated with particulate matter emission concentrations of <10 to <30 mg/m^3.[20,21]

Other dedusting options that are commonly used for sinter plant off-gases include ESPs and wet scrubbers. Particulate removal efficiency is not as high as for fabric filters. Good performance of ESPs and high efficiency wet-gas scrubbers is associated with particulate matter concentrations of <30 to 50 mg/m^3. [22,23, 24]

Adequately sized capture and dedusting controls for both the feed and discharge ends should be required and put in place.

b. Hooding of the sinter strand: Hooding of the sinter strand reduces fugitive emissions from the process, and enables use of other techniques, such as waste gas recirculation.

5.0 Emerging Research

Catalytic Oxidation:
Selective catalytic reduction (SCR) has been used for controlling NOx emissions from a number of industrial processes, including iron sintering. Modified SCR technology (i.e., increased reactive area) and select catalytic processes have been shown to decompose PCDD and PCDF contained in off-gases, likely through catalytic oxidation reactions. This may be considered as an emerging technique with potential for reducing POPs emissions from iron sintering plants and other applications.

A study investigating stack emissions from four sinter plants, noted that those with SCR had lower concentrations of PCDD/PCDF (0.995 – 2.06 TEQ/Nm^3) in the stack gases than a sinter plant without SCR (3.10 ng TEQ/Nm^3), and that the PCDD/PCDF degree of chlorination was lower for plants with SCR. It was concluded that SCR did indeed decompose PCDD/PCDF, but would not necessarily be sufficient as a stand alone

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[20] United Nations Economic Commission for Europe (UNECE), Annex III Best available techniques for controlling emission of heavy metals, *Protocol to the 1979 Convention on Long-Range Transboundary Pollution on Heavy Metals (Aarhus)*, (Geneva: UNECE, 1998), URL: www.unece.org

[21] UK Environment Agency, *Integrated Pollution Prevention and Control (IPPC) Guidance for the Coke, Iron and Steel Sector*, (United Kingdom: Environment Agency, 2001), p. 131.

[22] Ibid.

[23] William Lemmon & Associates Ltd., *Research on Technical Pollution Prevention Options for Iron Sintering, Draft of 2003/05/17* (Canada: prepared for the Canadian Council of Ministers of the Environment, 2003), p.26.

[24] UNECE, Annex III Best available techniques for controlling emission of heavy metals, *Protocol to the 1979 Convention on Long-Range Transboundary Pollution on Heavy Metals (Aarhus)*, (Geneva: UNECE, 1998), URL: www.unece.org

PCDD/PCDF destruction technology to meet stringent emission limits. Add-on techniques (e.g., activated carbon injection) to SCR may be required.[25]

Further study of the use of SCR and other catalytic oxidation techniques at iron sintering applications is needed to determine its value and effectiveness in destroying and reducing PCDD/PCDF released from this source.

Urea Injection:
Tests using urea injection to suppress formation of dioxins and furans have been conducted at an iron sintering plant in the United Kingdom. Controlled quantities of urea prills were added to the sinter strand, and this technique is thought to prevent/reduce both PCDD/PCDF and sulphur dioxide emissions. The trials indicate that PCDD/PCDF formation was reduced by approximately 50%. It is estimated that a 50% reduction in PCDD/PCDF would achieve a 0.5 ng TEQ/m^3 emission concentration. Capital costs are estimated at £0.5 to £1.0 million per plant (UK) (approximately $0.9 million to $1.8 million USD).[26]

5.0 Summary of Measures

The following tables present a summary of the measures discussed in previous sections.

Table 5.1 Alternatives and Requirements for New Iron Sintering Plants

Measure	Description	Considerations	Other comments
New Iron Sintering Plants			
Alternate Processes	Priority consideration should be given to alternate processes with potentially less environmental impacts than traditional iron sintering.	Examples include: -FASTMET -direct reduction of iron -direct smelting	
Performance Requirements	New iron sintering plants should be permitted to achieve stringent performance and reporting requirements associated with best available techniques.	Consideration should be given to the primary and secondary measures listed in Table 5.2 below.	Performance requirements for achievement should include: - <0.2 ng TEQ/Rm^3 for PCDD/PCDF -<20 mg/Rm^3 for particulate matter

Table 5.2 Summary of Primary and Secondary Measures for Iron Sintering Plants

Measure	Description	Considerations	Other Comments
Primary Measures			

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[25] Wang, L-C, et al. Emission of polychlorinated dibenzo-p-dioxins and dibenzofurans from stack flue gases of sinter plants, *Chemosphere*, Vol. 50, Issue 9, March 2003, pg 1123-1129.

[26] Entec UK Limited, *Development of UK Cost Curves for Abatement of Dioxins Emissions to Air, Final Report – draft for consultation*, November 2003, pg D-10 to D-20.

Measure	Description	Considerations	Other Comments
Stable and consistent operation of the sinter plant.	The sinter strand should be operated to maintain stable consistent operating conditions (e.g., steady-state conditions, minimization of process upsets) to minimize formation of PCDD, PCDF and other pollutants.	Conditions to optimize operation of the strand include: -minimization of stoppages -consistent strand speed -bed composition -bed height -additives (e.g., burnt lime) -minimization of oil content -minimization of air in-leakage	This approach will have co-benefits such as increased productivity, increased sinter quality and improved energy efficiency.
Continuous Parameter Monitoring	A continuous parameter monitoring system (CPMS) should be employed to ensure optimum operation of the sinter strand and off-gas conditioning systems. Operators should prepare a site-specific monitoring plan for the CPMS and keep records that document conformance with the plan.	Correlations between parameter values and stack emissions (stable operation) should be established. Parameters are then continuously monitored in comparison to optimum values. System can be alarmed and corrective action taken when significant deviations occur.	
Recirculation of Waste Gases	Waste gases should be recycled back to the sinter strand to minimize pollutant emissions and reduce the amount of off-gas requiring end-of-pipe treatment.	Recirculation of the waste gases can entail recycling of part of the off-gas from the entire sinter strand, or sectional recirculation of off-gas.	This technique will result in only a modest reduction of PCDD/PCDF.
Feed material selection: ***Minimization of feed materials contaminated with POPs or leading to POPs formation.***	A review of feed materials and identification of alternate inputs and/or procedures to minimize unwanted inputs should be conducted. Documented procedures should be developed and implemented to carry out the appropriate changes.	Examples include: -removal of the contaminant from the material (e.g., de-oiling of mill scales) -substitution of the material (e.g., replacement of coke breeze with anthracite) -avoid use of the material (e.g.,	

Measure	Description	Considerations	Other Comments
		collected sinter ESP dust) -specification of limits on permissible concentrations of unwanted substances (e.g., oil content in feed should be limited to less than 0.02 percent)	
Feed material preparation	Fine material (e.g., collected dusts) should be agglomerated before being placed on the sinter strand. Feed materials should be intimately mixed before placement on the sinter strand.		These measures will help reduce entrainment of pollutants in the waste gas, and minimize fugitive emissions.
Secondary Measures			
The following secondary measures can effectively reduce emissions of PCDD/PCDF and should be considered as examples of best available techniques.			
Adsorption/ Absorption and high efficiency dedusting.	Use of this technique should include an adsorption stage together with high efficiency particulate control as key components of the off-gas conditioning system.	Two adsorption techniques have been demonstrated: (1) regenerative activated carbon technology where off-gases are first cleaned by ESP, and passed though moving adsorption bed (char) to both adsorb PCDD, PCDF, and to filter particulates. Adsorptive material is then regenerated. (2) injection of activated carbon, lignite or other similar adsorptive material into the gas stream followed by fabric filter dedusting.	These techniques are associated with the following emission concentration levels: (1) <0.3 ng TEQ/m^3 (2) 0.1 to 0.5 ng TEQ/ m^3
Fine wet scrubbing of waste gases	Use of this technique should include a preliminary counter current wet scrubber to quench gases and remove larger particles, followed by a fine scrubber using high pressure mist jet co-current with off-gases to remove fine particles and impurities.		The fine wet scrubbing system under the trade name Airfine ® as developed by Voest Alpine Industries, has been shown to reduce emission concentrations to 0.2 to 0.4 ng TEQ/m^3.
The following secondary measures should not be considered as BAT on their own. For effective minimization and			

Measure	Description	Considerations	Other Comments
reduction of PCDD, PCDF and other POPs, the following should be employed in concert with other identified measures.			
De-dusting of waste gases.	Waste gases should be dedusted using high efficiency techniques, as this can help minimize PCDD/PCDF emissions. A recommended BAT for dedusting is the use of fabric filters. Feed and discharge ends of the sinter strand should be adequately hooded and controlled to capture and dedust fugitive emissions.	Fabric filters have been shown to reduce sinter off-gas particulate emissions to <10 to <30 mg/m^3.	Other dedusting techniques used include ESPs and high efficiency scrubbers. Good performance of these technologies are associated with particulate concentrations of <30 to 50 mg/m^3.
Hooding of the sinter strand	The sinter strand should be hooded to minimize fugitive process emissions.		Hooding of the strand will enable use of other measures, such as waste gas recirculation.

6.0 *Achievable Levels*

Achievable levels were identified for emissions of PCDD/PCDF only. No levels were identified for the other unintentionally produced POPs or for releases to other media.

6.1 Achievable Levels of PCDD/PCDF

Achievable levels for emissions of PCDD/PCDF from iron sintering plants are identified as follows:

Source Type	Emission Limit Value
New Plants	<0.2 ng TEQ/Rm^3
Adsorption/Absorption and High Efficiency De-dusting	0.1 to 0.5 ngTEQ/Rm^3
Fine Wet Scrubbing System	0.2 to 0.4 ng TEQ/Rm^3

6.2 Country Emission Limits for Iron Sintering

The following provides a brief overview of emission concentration limits that have been established for or are applicable to iron sintering operations.

Country	Emission Limit (PCDD/PCDF)	Comment
Austria	0.4 ng I-TEQ/m3	Applicable to new plants built after 2001
Canada	0.2 ng I-TEQ/Rm^3	For new plants
	<1.35 ng I-TEQ/Rm^3	For existing plants, to be achieved by 2002
	<0.5 ng I-TEQ/Rm^3	For existing plants, to be achieved by 2005
	<0.2 ng I-TEQ/Rm^3	For existing plants, to be achieved by 2010
Germany	0.1 ng I-TEQ/m^3	Target
	0.4 ng I-TEQ/m^3	Upper limit
Japan	0.1 ng WHO-TEQ/m^3	For new plants
	1 ng WHO-TEQ/m^3	For existing plants
Netherlands	0.1 ng I-TEQ/m^3	Desirable
United Kingdom	0.1 – 0.5 ng I-TEQ/m^3	Benchmark emission values
Other	(PLEASE PROVIDE ANY ADDITIONAL	

	INFORMATION ON EMISSION LIMITS)	

ADEME Seminar on Dioxins and POPs
10 – 11 th of March 2004
Paris France

The Shell Dioxin Destruction System (SDDS) for the Catalytic Destruction of Dioxins / Furans in Flue Gas from Waste Incineration Plants

by O.L.Maaskant

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Table of Contents

1. Abstract

As a result of increasingly stringent limits on dioxin emissions from incinerators and other combustion devices, operators need more demanding requirements from their dioxin removal systems. It is no longer always adequately simply to demonstrate once a year that dioxin levels are below 0.1 ng/Nm3 TEQ in the stack gas. Environmental agencies are requiring more detailed information on the fate of the dioxins and any related pollutants that have been removed. Do dioxins simply end up in the solid waste that is disposed of via landfill? What happens to the other non-2,3,7,8 (less toxic) dioxin isomers? What are the actual mechanisms involved in adsorption and catalytic destruction systems? The purpose of the paper will be to answer such questions for the Shell Dioxin Destruction System based on several years' experience in full scale incinerators and from laboratory scale experiments.

This paper focuses on a newly developed and patented titanium/vanadium oxide catalyst. This catalyst is extremely suitable for removal of dioxins and NOx from waste incineration flue gases at low temperatures.
By loading the catalyst into the newly developed - Lateral Flow Reactor type - modules , the result is a very compact and small size reactor house requiring minimal pressure drop.
The catalyst effectiveness for dioxin destruction has been determined at various temperature levels. The results indicate that this catalyst system is a highly efficient way of destroying dioxins in flue gas stream at temperatures as low as 150oC.
The Shell Dioxin Destruction System therefore represents an interesting technology for installation at the back end of a waste incineration plant.
The Shell System is ideally suited for low temperature applications. Installation is usually end-of-pipe, a more economical solution compared to retrofitting into a high temperature location as required with conventional honeycomb type SCR catalysts.

Furthermore, savings are obtained as no or minimal flue gas reheat is necessary.
In many cases the simultaneous removal of NOx and dioxins is obtained with one single Shell System.
Particularly for the waste incineration industry it is of great operational interest that the Shell System not only removes NOx but that it is also capable of removing dioxins. In order to investigate this further we have carried out a program of basic research into how to destroy dioxins, followed by actual operational proof that the system works in practice.

2. Introduction

CRI Catalysts is a member of the Royal Dutch/Shell group of companies. The prime activities of CRI are research, development, manufacture, supply and servicing of catalysts for refinery, chemical and environmental processes.

- Experience in Environmental Catalysts

CRI has built up a wide experience of treating flue gases from both small (2,000 Nm3/h) and large (1,000,000 Nm3/h) processes. Typical components removed from the flue gas include NOx, CO and dioxins. The experiences have been documented in a variety of papers which are available on request.
The Shell DeNOx System is applied to flue gas streams originating from gas turbines, co-generation units, gas fired heaters and boilers, ethylene cracking furnaces, chemical plants (nitric acid, caprolactam) and the waste incineration industry.
The Shell Dioxin Destruction System ('SDDS') is developed for the complete removal of toxic dioxins/ furans from waste incineration gases to levels far below the EU limit of 0.1 ng/Nm3 TEQ.
The Shell Denox System ('SDS') belongs to the Selective Catalytic Reduction ('SCR') category of NOx removal technology. This process converts NOx in flue-gases with ammonia over a catalyst to environmentally inert compounds, water and nitrogen.
In most applications the Shell System is used for the combined removal of dioxins/ furans and NOx (Typical Lay-out slide 1)

3. Technology description

The Shell DeNOx System is based on two important aspects; a) the catalyst and b) the modular reactor system.

a) The catalyst is a commercially manufactured extrusion consisting of a proprietary mix of titanium/vanadium components. The size and shape allows a ready diffusion of dioxin (and NOx) molecules to the high internal surface area, resulting in a very high intrinsic activity. Consequently, it is possible to achieve very high dioxin removal efficiencies at relatively low operating temperatures, typically 160°C (high activity Shell catalyst slide 2).

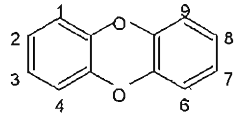
b) The reactor system is based on Lateral Flow Reactor (LFR) technology (CRI SCR-System slide 3). Modules are filled with catalyst before shipment (standard type module slide 4).
The module design ensures very low pressure drop (< 30 mm w.c. or < 3 mbar).

Due to the high contact efficiency between flue gas and catalyst high conversion levels are achieved (Shell Denox module lay-out detail slide 5).

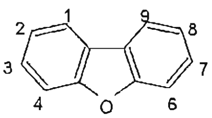
4. Dioxin definitions.

The term dioxin is often used in a collective sense to describe compounds known as PolyChlorinated DibenzoDioxins (PCDDs) and PolyChlorinated DibenzoFurans (PCDFs), as shown below (slide 6).

PCDDs



PCDFs



Other definitions:

a. Homologue : a group of compounds in which each successive number differs from the preceding one by a constant increment , in this case an additional chlorine substituent.

> Example: there are 8 PCDD and PCDF homologues representing progressively increasing chlorine substitution from 1 to 8 atoms: each of these homologues has several isomers : TCDF has 38 isomers and TCDD has 22 isomers. In total there are 75 PCDD and 135 PCDF compounds.

b. Isomer: compounds having the same molecular formula but a different geometric arrangements of atoms, in this case chlorine substituents

> Example: 2,3,7,8- tetrachlorodibenzofuran (TCDF) and 1,2,3,4-TCDF are two isomers from the homologue TCDF.

c. Congener: a class of compounds containing the same geometrical arrangement of chlorine substituents, but not necessarily the same number of chlorine substituents

> Example: 2,3,7,8-TCDF and 1,2,3,7,8- pentachlorodibenzofuran (PeCDF) and 1,2,3,6,7,8 -hexachlorodibenzofuran (HeCDF) are all 2,3,7,8-chlorinated dibenzofuran congeners.

d. Dioxin precursors consists of several types of chlorinated aromatic compounds from which dioxins can be formed in low yield oxidative pyrolysis.

> Example: chlorinated benzenes,chlorinated phenols, chlorinated biphenyls and chlorinated diphenylethers.

The super-toxic compounds are dioxins which contain chlorine substitutes at each of the 2,3,7, & 8 positions, known as 2,3,7,8-congeners. 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) is the most toxic dioxin and is assigned a toxic equivalence factor (TEF) of 1.0. By assigning TEF values relative to that of 2,3,7,8-TCDD for all the remaining seventeen 2,3,7,8-congeners, a simple internationally-accepted method of calculating the toxicity of a complex mixture of dioxins has been adopted. The toxicity of any mixture in toxic-equivalents (TEQ) is taken to be the sum of the amount of each congener multiplied by its TEF. Dioxin concentrations are normally expressed as ng/Nm3 TEQ. (see slides 7 and 7A).

5. Mechanisms for the conversion of dioxins

There are three likely mechanisms for the oxidative destruction of dioxins which could apply to a given catalyst type, operating conditions and concentrations:

1. the complete destruction of dioxins into CO2, HCl and water,

2. the partial destruction of aromatic and oxygen heterocyclic ring structures into smaller, less toxic fragments ,
3. the isomerisation (movement) of chlorine atoms to other locations of the aromatic ring structures .

Evidence accumulated so far favors a combination of mechanisms 1 & 2 above. There is no evidence to indicate progressive removal of chlorine substituents (mechanism 3) from dioxins , although PCB's may be different (see slide 8). So it is extremely unlikely that a highly chlorinated dioxin (such as octa-chloro-dibenzo-furan with a relatively low TEF of 0.001) will be transformed into a less chlorinated, but highly toxic dioxin (such as 1,2,3,7,8- penta-chloro-dibenzo-furan with a TEF of 0.5).

6. Exploratory work

The basic exploratory work has been carried out in conjunction with the University of Umea in Sweden. The experiments were carried out using a laboratory scale fluid bed incinerator with a flue gas composition of HCl (212 mg/Nm3),SOx (181 mg/Nm3) and O2 (10%v) with the purpose of producing high dioxins levels for test purposes (see slide 9).

- A. Testing with high levels of dioxins

The following results were obtained:

Temp. OC	Inlet dioxins ng/Nm3 TEQ	Outlet dioxins ng/Nm3 TEQ
230	**286**	**0.03**
152	**55**	**< 0.1**

- B. Testing of temperature effect of adsorption versus conversion

The Umea testing has also concentrated on confirming that dioxin destruction occurs rather than just adsorption. In the experiments 14Carbon labeled dioxins were used to track the reaction pathway. It was concluded that even at temperatures between 100 and 150oC dioxins can be removed with high efficiency. However to ensure that there will be no dioxin on the catalyst after many years of operation it was decided to take the minimum operating temperature as 160oC. From the following slide (slide 10) can be concluded that:

110 - 130oC :	adsorption	70 – 40 %
	conversion	30 – 60 %
	removal	100%
130 - 150oC :	adsorption	40 – 5 %
	conversion	60 – 95 %
	removal	100%
above 150oC :	conversion	100%

- C. Testing in Japan

A small slip stream test was carried out together with a Japanese company. This trial was carried out at a temperature of 160°C.

Temp. OC	Dioxins at inlet ng/Nm3 TEQ	Dioxins at outlet ng/Nm3 TEQ
160	**2.4**	**< 0.01**

7. Performance under actual operating conditions at Sita NL

Performance data were collected from a full scale (200 MT per day) waste incinerator at the Municipal Waste Incineration Plant, owned by Sita ReEnergie Roosendaal, The Netherlands. The total flue gas flow is about 70,000 Nm3/h.
A picture of the Sita plant is given (slide 11,12).
The normal process flow scheme **(including active carbon injection)** is shown below (slide 13).
In 1997 it was agreed to do a special test for dioxin conversion and therefore **the injection of active carbon was stopped for one week.** After one week the dioxin levels were measured at various locations. As can be seen (slide 14) the very high levels of dioxins (32 ng/Nm3 TEQ) at the inlet of the catalyst were easily removed to levels far below 0.1 ng/Nm3 TEQ.
Sampling of the catalyst demonstrated that even after a significant operating period no dioxins were adsorbed on the catalyst.

	Temp. °C	Dioxins at inlet ng/Nm3 (TEQ)	Dioxin at outlet ng/Nm3 (TEQ)
No AC injection	**240**	**30 - 40**	**< 0.03**
With AC injection	**240**	**0.3 – 0.4**	**< 0.01**

During Q2 of 2001 Sita faced unexpected problems with carbon injection while they had already contracted to do the regulatory dioxin emission measurements. On the basis of the previous test Sita felt confident to do the emission tests anyway, which resulted in levels of around 0.03 ng/Nm3 TEQ (see slide 15).

8. Removal of other Dioxin related compounds

During another test at the Umea Sweden test facility the removal and destruction of dioxin precursors and related compounds have been determined at 240oC.
See slide 16.
Results showed that :

- PCP's (Poly Chloro Phenols) are removed and destructed (>99%)
- PCBzs (Poly Chloro Benzenes) are partially (> 32%) removed and destructed
- PCB's (Poly Chloro Biphenyls) are removed (> 87%) and destroyed (> 69%)

9. Summary

Dioxins and NOx can be simultaneously removed in a small, compact, light weight unit in a cost-effective way using CRI's DeNOx / Dioxin Destruction technology.
A dimensional comparison is given for a Shell System and a honeycomb reactor (slide 17).
Performance guarantee for dioxin destruction is given for waste incineration flue gas

with a minimum temperature of 165oC (see slide 18).

10. Reference list of waste incineration plants for dioxin destruction

see slide 19/20.

11. Acknowledgements

The author would like to acknowledge the invaluable help from and co-operation with:
Sita ReEnergie Roosendaal The Netherlands, Mr.C.Stuart
Umea University Sweden , Dr.P. Liljelind, Dr.S. Marklund
Shell Global Solutions (UK) Chesire Innovation Park, Chester, UK. , Dr.J.F.Unsworth.

ZEN-NOH GRAIN CORPORATION

December 12, 2008

Louisiana Department of Environmental Quality
Attention: Ms. Soumaya Ghosn
Public Participation Group
P.O. Box 4313
Baton Rouge, Louisiana 70821

Re: AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

SECOND SET OF COMMENTS ON PROPOSED PERMITS AND EAS FOR NUCOR-STEEL, LOUISIANA

Dear Ms. Ghosn:

We are pleased to present the following additional comments to PSD Permit No. PSD-LA-740 (the "PSD Permit"), Part 70 Permit No. 2560-00281-VO (the "Part 70 Permit") (collectively, the "Permits"), and the environmental assessment statement ("EAS") issued to and for Consolidated Environmental Management, Inc.-Nucor Steel, Louisiana's ("Nucor") proposed new pig iron manufacturing plant in Convent, Louisiana.[1] Zen-Noh Grain Corporation ("Zen-Noh") previously submitted comments regarding the permits on November 24, 2008 and incorporates those comments herein by reference. Zen-Noh now submits its second set of comments below (with numbering continued from Zen-Noh's first set of comments).

Air Quality Dispersion Modeling Source Data Is Inconsistent and Unreasonable

88. The data relied on by Nucor in its air quality dispersion modeling is inconsistent and unreasonable. The vertical stack exit velocities input by Nucor are not consistent with the stack gas volumetric flow rates and stack diameters that were used to calculate these exit velocities. *See* Second Affidavit of Dr. Paolo Zannetti ("Zannetti Second Aff."), attached hereto as Exhibit 13. Nucor did not provide an

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[1] The Permits are found in the public record in EDMS Document No. 38131069. The EAS is found in the public record in EDMS Document No. 36847130. Both EDMS documents are incorporated herein by reference.

CORPORATE OFFICE
P. O. BOX 39 • MANDEVILLE, LA 70470-0039
TEL. (985) 867-3500 • FAX (985) 867-3506

CONVENT TERMINAL
8886 LA HWY 44 • CONVENT, LA
TEL. (225) 562-3571 • FAX (225) 56

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EXHIBIT
4

explanation for the inconsistent source data. As a result of these inconsistencies, this data is unreliable and Nucor's use of the data in its modeling is inappropriate. 40 C.F.R. § 51, App. W, at 8.0 ("The most appropriate source data available should always be selected for use in modeling analyses."); EPA New Source Review Manual ("NSR Manual") at C.44 (same). Nucor should provide additional information regarding its calculation of the emission parameters VE, QE, and d. If Nucor is unable to provide this additional information, it should be required to perform new air quality dispersion modeling with appropriate and accurate data, including stack exit velocity data that is consistent.

89. LDEQ failed to properly evaluate the air quality dispersion modeling data submitted by Nucor. It is LDEQ's responsibility to determine whether Nucor used appropriate input data and followed recommended procedures to complete its air quality analysis. NSR Manual at C.25. The inconsistent and unreasonable stack exit velocities demonstrate that LDEQ failed to ensure that Nucor used appropriate input data and potentially failed to follow recommended procedures. Zannetti Second Aff. ¶¶ 11, 12 (inconsistent and unreasonable stack exit velocities prevent Zen-Noh's experts or LDEQ from undertaking reasonable and reliable evaluation). In this respect, LDEQ also failed to perform its duties as public trustee of the environment under Louisiana law. La. Const. art. 9, §1; *Save Ourselves, Inc. v. Louisiana Environmental Control Commission*, 452 So. 2d 1152 (La. 1984).

Please feel free to contact me should you have any questions.

Sincerely,

John Williams

John Williams
President, Zen-Noh Grain Corporation

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY (LDEQ)
CONSOLIDATED ENVIRONMENTAL MANAGEMENT, INC.
NUCOR STEEL LOUISIANA

AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

SECOND AFFIDAVIT OF DR. PAOLO ZANNETTI, QEP

Update on EnviroComp Request and Receipt of ERM/Nucor Modeling Files

The May 2008 initial ERM/Nucor modeling files were received by EnviroComp on the afternoon of Thursday, November 20, 2008. The original request for all ERM/Nucor modeling files was made on November 6, 2008. Further details are contained in Dr. Zannetti's first affidavit.

Subsequently, on the morning of November 24, 2008, Dr. Frank Freedman, a colleague of Dr. Zannetti, received a phone call from LDEQ saying through voice-message that CDs containing additional modeling files were sent to him by LDEQ late the week before. These CDs were received by Dr. Freedman on either November 24 or 25, 2008. The contents of the CDs were the August 2008 "Addendum No. 1" modeling files, and the September 2008 "Addendum No. 2" modeling files. The results of these modeling efforts were the subject of the September 11, 2008 Addendum 2 letter from ERM/NUCOR to LDEQ. Since these files were obtained after the November 24, 2008 deadline for public comments, Dr. Zannetti and his Associates did not have an opportunity to review these files and comment on them in the first affidavit.

Comments on Vertical Exit Velocities of Gasses from Nucor's Stacks as Specified in ERM/Nucor Air Dispersion Modeling

1. The vertical exit velocity of gasses from stacks is a very important emission parameter. The higher the vertical velocity, the higher the plume rise, and the lower the concentration at ground level. Therefore, vertical exit velocities need to be correctly calculated for the modeling to be acceptable for regulatory purposes.

2. The exit velocities input by ERM/Nucor for each Nucor source in their air dispersion modeling files are listed in "Appendix B: Revised Emission Inventory Questionnaire" (contained in electronic file 38093615.pdf from the LDEQ EDMS web server) and in "Inventories" (contained in electronic file 38131069.pdf from the LDEQ EDMS web server).

3. The exit velocity (V_E) is related to stack gas volumetric flow rate (Q_E) and stack diameter (d) through the following equation:

$$V_E = 4Q_E / (\pi d^2) \qquad (1)$$

If only 2 of the 3 parameters (V_E , Q_E , and d) are known, the third one can be calculated by Equation (1) above. If all 3 parameters are specified, they need to be consistent with Equation (1) above.

4. The volumetric flow rates and stack diameter for each Nucor source are listed in "Appendix B: Revised Emission Inventory Questionnaire" (contained in electronic file 38093615.pdf from the LDEQ EDMS web server) and in "Inventories" (contained in electronic file 38131069.pdf from the LDEQ EDMS web server).

5. The exit velocity for each source reported in the ERM/Nucor tables and used in their modeling runs is tabulated by us below in Table 1 under the column "Reported Velocity". The exit velocity for each source was calculated by us from Equation (1) using the volumetric flow rate and stack diameter values reported in the ERM/Nucor tables. The calculated exit velocity for each source is listed below in Table 1 under the column "Calculated Velocity".

6. The ratio of the reported to the calculated exit velocity for each source is listed below in Table 1 under the column "Ratio (Reported to Calculated)". The value of this ratio for a given source should be exactly one in order for the exit velocity used by ERM/Nucor to be consistent with their reported stack diameter and volumetric flow rate. A value other than one for a given source, on the other hand, signifies an inconsistency between the exit velocity, stack diameter and volumetric flow rate values listed in the ERM/Nucor tables for that source.

7. As shown in Table 1, the exit velocities and volumetric flow rates for nearly all sources in the ERM/Nucor tables are inconsistent, i.e. the ratio of the reported to calculated exit velocity is some other value than one. In many instances, the inconsistencies are enormous, for example reported values are more than a hundred times larger than calculated values. Also, in general, we noted that several of the sources in the ERM/Nucor tables are modeled with unreasonably high exit velocities.

8. Of particular concern in Table 1 are those sources for which the reported exit velocity is much greater that the calculated exit velocity (e.g., 20.70 m/s versus 0.16 m/s). In fact, an overestimation of the exit velocity in the ERM/Nucor modeling runs leads to possibly serious underestimation of the ground level concentrations. There appear to be serious input data errors in ERM/Nucor modeling runs. These errors need to be fully understood and corrected.

9. Calculations and/or references providing the basis/justification for the values of exit velocity and volumetric flow rate in the ERM/Nucor tables are not contained in any of the ERM/Nucor documents available through LDEQ EDMS. In order to fully understand and correct these inconsistencies, we need ERM/Nucor to provide more information (e.g., worksheets) of their calculation of the emission parameters V_E , Q_E , and d.

10. Item II-5 and Item III of Dr. Zannetti's first affidavit raise further concerns about the stack parameters applied to model Nucor sources in ERM/Nucor's modeling.

11. An air pollution modeling expert would rely on and require consistent and reasonable stack exit velocities and volumetric flow rates while performing PSD dispersion modeling.

12. The inconsistencies and unreasonable stack exit velocities and volumetric flow rates provided by ERM/Nucor prohibit a reasonable and reliable evaluation, by us or the Louisiana DEQ, of the dispersion modeling results submitted by ERM/Nucor.

13. Concerning non-Nucor sources in ERM/Nucor's modeling, we noted that several of the sources are modeled with unreasonably high exit velocities. Examples of these are listed in Table 2, which is a printout of the year 2001 PM10 modeling output file for NAAQS compliance provided on May 2008 ERM/Nucor modeling CD. This file is the latest, since this NAAQS modeling was not updated in either the August 2008 Addendum No. 1 or September 2008 Addendum No. 2 modeling. Note that many of the sources have exit velocities much greater than 20 m/s, and several are even greater than 100 m/s. On the first page of the printout, several warning messages are printout by the model, which warn the user of these excessively high exit velocities. There are also two warning messages for unreasonable values of stack diameter.

I hereby certify under penalties of perjury that the foregoing representations are true to the best of my knowledge.

11 December 2008

Date

Dr. Paolo Zannetti, QEP
President, EnviroComp Consulting, Inc.

"SEE ATTACHED ACKNOWLEDGEMENT"

ACKNOWLEDGMENT

State of California
County of ALAMEDA)

On Dec. 11, 2008 before me, CHARLOTTE K. MAGNONE - NOTARY PUBLIC
(insert name and title of the officer)

personally appeared Dr. Paolo Zannetti —,
who proved to me on the basis of satisfactory evidence to be the person(~~s~~) whose name(~~s~~) [✓ is]/~~are~~ subscribed to the within instrument and acknowledged to me that [✓ he]/she/~~they~~ executed the same in [✓ his]/~~her/their~~ authorized capacity(~~ies~~), and that by [✓ his]/~~her/their~~ signature(~~s~~) on the instrument the person(~~s~~), or the entity upon behalf of which the person(~~s~~) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

CHARLOTTE K. MAGNONE
COMM. #1775193
NOTARY PUBLIC - CALIFORNIA
ALAMEDA COUNTY
My Comm. Expires Oct. 22, 2011

Signature Charlotte K. Magnone **(Seal)**

Table 1: Comparison of Reported vs. Calculated Exit Velocities for Emission Sources in Nucor's proposed Pig Iron Facility

Source ID	Source Description	Reported Flow Rate (acfm)	Reported Diameter (ft)	Reported Velocity (ft/sec)	Reported Velocity (m/s)	Calculated Velocity (m/s)	Ratio (Reported over Calculated)
COK100	Coke Ovens Coal Handling, Crushing, Compacting	100046	4.2	60	18.29	36.68	0.50
COK101	Coke Battery 1 Coal Charging	2350	4.5	68.25	20.80	0.75	27.71
COK102	Coke Battery 1 Coke Pushing	2350	5	70	21.34	0.61	35.09
COK103	Coke Battery 1 Coke Quench Tower	1107000	40.2	9.84	3.00	4.43	0.68
COK104	Coke Battery 1 Coke Handling	9424	2	50	15.24	15.24	1.00
COK112	Coke Battery 1 FGD Lime Silo Unloading	2350	1	32.8	10.00	15.20	0.66
COK113	Coke Battery 1 FGD Waste Loading	2350	1	32.8	10.00	15.20	0.66
COK201	Coke Battery 2 Coal Charging	2350	4.5	68.25	20.80	0.75	27.71
COK202	Coke Battery 2 Coke Pushing	2350	5	70	21.34	0.61	35.09
COK203	Coke Battery 2 Coke Quench Tower	1107000	40.2	9.84	3.00	4.43	0.68
COK204	Coke Battery 2 Coke Handling	9424	2	50	15.24	15.24	1.00
COK212	Coke Battery 2 FGD Lime Silo Unloading	2350	1	32.8	10.00	15.20	0.66
COK213	Coke Battery 2 FGD Waste Loading	2350	1	32.8	10.00	15.20	0.66
COK214	Coke Bin Tower	29430	1	32.8	10.00	190.35	0.05
COK215	Coke Screening	29430	1	32.8	10.00	190.35	0.05
COK110	Coke Battery 1 HRSG Bypass Vents Cap	436277	9	68.9	21.00	34.84	0.60
COK210	Coke Battery 2 HRSG Bypass Vents Cap	436277	9	68.9	21.00	34.84	0.60
COK105	Coke Battery 1 HRSG Bypass Vents Stack 1	436277	9	68.9	21.00	34.84	0.60
COK106	Coke Battery 1 HRSG Bypass Vents Stack 2	436277	9	68.9	21.00	34.84	0.60
COK107	Coke Battery 1 HRSG Bypass Vents Stack 3	436277	9	68.9	21.00	34.84	0.60
COK108	Coke Battery 1 HRSG Bypass Vents Stack 4	436277	9	68.9	21.00	34.84	0.60
COK109	Coke Battery 1 HRSG Bypass Vents Stack 5	436277	9	68.9	21.00	34.84	0.60
COK111	Coke Battery 1 Flue Gas Desulfurization Stack	629000	13	75.5	23.01	24.07	0.96
COK205	Coke Battery 2 HRSG Bypass Vents Stack 1	436277	9	68.9	21.00	34.84	0.60
COK206	Coke Battery 2 HRSG Bypass Vents Stack 2	436277	9	68.9	21.00	34.84	0.60
COK207	Coke Battery 2 HRSG Bypass Vents Stack 3	436277	9	68.9	21.00	34.84	0.60
COK208	Coke Battery 2 HRSG Bypass Vents Stack 4	436277	9	68.9	21.00	34.84	0.60
COK209	Coke Battery 2 HRSG Bypass Vents Stack 5	436277	9	68.9	21.00	34.84	0.60
COK211	Coke Battery 2 Flue Gas Desulfurization Stack	629000	13	75.5	23.01	24.07	0.96
SIN101	MEROS System Sinter Vent Stack	947600	11.3	66	20.12	48.00	0.42
SIN102	Sinter Plant Main Dedusting Baghouse Vent	29430	2.5	60	18.29	30.46	0.60
SIN103	Coke and Petcoke Crushing Baghouse Vent	300881	11.3	50	15.24	15.24	1.00
SIN105	Sinter FGD Lime Silo Unloading	2350	1	32.8	10.00	15.20	0.66
SIN106	Sinter FGD Waste Loading	2350	1	32.8	10.00	15.20	0.66
SLG104	Blast Funace 1 Slag Pit 1	nr	nr	3.3	1.01	·	·
SLG105	Blast Funace 1 Slag Pit 2	nr	nr	3.3	1.01	·	·
SLG106	Blast Funace 1 Slag Pit 3	nr	nr	3.3	1.01	·	·
SLG204	Blast Funace 2 Slag Pit 1	nr	nr	3.28	1.00	·	·
SLG205	Blast Funace 2 Slag Pit 2	nr	nr	3.28	1.00	·	·
SLG206	Blast Funace 2 Slag Pit 3	nr	nr	3.28	1.00	·	·
SLG306	Air-Cooled Slag Processing Stockpiles	1116480	75.33	3.28	1.00	1.27	0.79
CST101	Cast House 1 Baghouse Vent	706268	2	32.81	10.00	1142.04	0.01
CST201	Cast House 2 Baghouse Vent	706268	2	32.81	10.00	1142.04	0.01
SLG101	Slag Granular 1 Granulation Tank 1	150	2.5	67.91	20.70	0.16	133.34
SLG102	Slag Granular 1 Granulation Tank 2	150	2.5	67.91	20.70	0.16	133.34
SLG201	Slag Granular 2 Granulation Tank 1	150	2.5	67.91	20.70	0.16	133.34
SLG202	Slag Granular 2 Granulation Tank 2	150	2.5	67.91	20.70	0.16	133.34
SLG301	Air-Cooled Slag Processing Load Bin	59400	14.14	3.28	1.00	1.92	0.52
SLG302	Air-Cooled Slag Processing Primary Crusher	59400	14.14	3.28	1.00	1.92	0.52
SLG303	Air-Cooled Slag Processing Primary Screening	9425	2	50	15.24	15.24	1.00
SLG304	Air-Cooled Slag Processing Secondary Crusher	9425	2	50	15.24	15.24	1.00
SLG305	Air-Cooled Slag Processing Secondary Screen	9425	2	50	15.24	15.24	1.00
SLG401	Slag Mill Wet Slag Feed Bin	59400	2.5	67.91	20.70	61.47	0.34
SLG403	Slag Mill Dryer Baghouse Vent	100046	2.5	67.91	20.70	103.54	0.20
SLG404	Slag Mill Dry Slag Feed Bin Baghouse Vent	100046	2.5	67.91	20.70	103.54	0.20
SLG405	Slag Mill Crushers/Screens Baghouse Vent	100046	2.5	67.91	20.70	103.54	0.20
SLG406	Slag Mill Building Baghouse Vent	100046	2.5	67.91	20.70	103.54	0.20
SLG407	Slag Mill Transfer Points Baghouse Vent	100046	2.5	67.91	20.70	103.54	0.20
SLG408	Slag Mill Product Silo Baghouse Vent	2350	2.5	67.91	20.70	2.43	8.51
SLG409	Slag Mill Loading Collector Baghouse Vent	2350	2.5	67.91	20.70	2.43	8.51
SLG103	Slag Granulator 1 Cap	150	8.717	0.03	0.01	0.01	0.72
SLG107	Blast Funace 1 Slag Pits Cap	22140	82.16	3.28	1.00	0.02	47.13
SLG203	Slag Granulator 2 Cap	150	8.717	0.03	0.01	0.01	0.72
SLG207	Blast Funace 2 Slag Pits Cap	22140	82.16	3.28	1.00	0.02	47.13
SLG402	Slag Mill Dryer Stack	172400	2.5	67.91	20.70	178.41	0.12
FUG101	Unpaved Road Fugitive Dust	nr	nr	3.28	1.00	·	·
FUG102	Paved Road Fugitive Dust	nr	nr	3.28	1.00	·	·
FUG103	Conveyor Fugitives	nr	nr	3.28	1.00	·	·
DOC101	Dock 1 Loading/Unloading Gantry Crane	78720	20	3.28	1.00	1.27	0.79

'nr' – value not reported

Blue – values of ratio 'reported-to-calculated' less than 0.5

Orange – values of ratio 'reported-to-calculated' greater than 2

Table 2: Printout of year 2001 PM10 modeling output file for NAAQS compliance contained on the May 2008 ERM/Nucor modeling CD.

```
**BEE-Line Software: BEEST for Windows  (Version 9.73) data input file
**  Model: AERMOD.EXE     Input File Creation Date: 4/26/2008  Time: 12:55:55 PM
NO ECHO


 BEE-Line AERMOD "BEEST" Version ****


 Input File - S:\Nucor\0062737-Louisiana\AERMOD\NAAQS\PM10_2001_PM10.DTA

Output File - S:\Nucor\0062737-Louisiana\AERMOD\NAAQS\PM10_2001_PM10.LST

   Met File - S:\Nucor\0062737-Louisiana\AERMET\BTRLCH01.SFC



 *** Message Summary For AERMOD Model Setup ***

 --------- Summary of Total Messages --------

A Total of           0 Fatal Error Message(s)
A Total of          19 Warning Message(s)
A Total of           0 Informational Message(s)


   ******** FATAL ERROR MESSAGES ********
              ***  NONE  ***


   ********   WARNING MESSAGES   ********
SO W320  1777 PPARM :Input Parameter May Be Out-of-Range for Parameter       DS
SO W320  3921 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  4753 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  5105 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  5585 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  5649 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  6417 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  7825 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  9233 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  9745 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  9777 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320  9809 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320 10545 PPARM :Input Parameter May Be Out-of-Range for Parameter       DS
SO W320 10609 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320 11153 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320 11217 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320 11313 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320 11345 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS
SO W320 12113 PPARM :Input Parameter May Be Out-of-Range for Parameter       VS

***********************************
*** SETUP Finishes Successfully ***
***********************************
```

```
 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                                           ***
04/26/08
                                   ***                                                                           ***
12:56:01
**MODELOPTs:
PAGE   1
CONC                       DFAULT ELEV

                                           ***     MODEL SETUP OPTIONS SUMMARY       ***
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - -

**Model Is Setup For Calculation of Average CONCentration Values.

  --  DEPOSITION LOGIC  --
**Model Uses NO DRY DEPLETION.  DDPLETE =  F
**Model Uses NO WET DEPLETION.  WDPLETE =  F
**NO GAS DRY DEPOSITION Data Provided.

**Model Uses RURAL Dispersion Only.

**Model Uses Regulatory DEFAULT Options:
           1. Stack-tip Downwash.
           2. Model Accounts for ELEVated Terrain Effects.
           3. Use Calms Processing Routine.
           4. Use Missing Data Processing Routine.
           5. No Exponential Decay

**Model Assumes No FLAGPOLE Receptor Heights.

**Model Calculates  1 Short Term Average(s) of:  24-HR
    and Calculates PERIOD Averages

**This Run Includes:   388 Source(s);      1 Source Group(s); and    2466 Receptor(s)

**The Model Assumes A Pollutant Type of:  PM10

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:
         Model Outputs Tables of PERIOD Averages by Receptor
         Model Outputs Tables of Highest Short Term Values by Receptor (RECTABLE Keyword)
         Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =    19.50 ;  Decay Coef. =    0.000     ;  Rot. Angle =
0.0
                 Emission Units = GRAMS/SEC                               ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =     1.7 MB of RAM.

**Input Runstream File:          PM10_2001_PM10.DTA
**Output Print File:             PM10_2001_PM10.LST
```

```
 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                                ***
04/26/08
                                   ***                                                                ***
12:56:01
**MODELOPTs:
PAGE   2
CONC                          DFAULT ELEV

                                            *** POINT SOURCE DATA ***

              NUMBER EMISSION RATE                     BASE     STACK   STACK     STACK     STACK    BLDG   URBAN  CAP/
EMIS RATE
   SOURCE      PART.  (GRAMS/SEC)     X         Y      ELEV.    HEIGHT  TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
     ID   .    CATS.                (METERS)  (METERS) (METERS) (METERS) (DEG.K)  (M/SEC)   (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - -

   COK100        0   0.47500E+00  706366.7 3330434.0     5.0    30.50   305.40     18.30      1.28   YES     NO    NO
   COK101        0   0.10800E+00  706490.8 3330327.2     5.0     9.20   422.00     20.80      1.37   NO      NO    NO
   COK102        0   0.22700E+00  706490.7 3330278.2     5.0     9.20   478.00     21.20      1.52   YES     NO    NO
   COK103        0   0.75000E+00  706787.8 3330222.0     5.0    30.00   367.00      3.00     12.25   YES     NO    NO
   COK111        0   0.37740E+01  706736.9 3330161.5     5.0    65.00   373.20     23.00      3.96   YES     NO    NO
   COK112        0   0.13000E-02  706749.0 3330164.0     5.0     5.00   310.00     10.00      0.31   YES     NO    NO
   COK113        0   0.26500E-01  706757.0 3330163.0     5.0     5.00   310.00     10.00      0.31   YES     NO    NO
   COK201        0   0.10800E+00  706501.0 3330350.2     5.0     9.20   422.00     20.80      1.37   YES     NO    NO
   COK202        0   0.22700E+00  706510.7 3330398.0     5.0     9.20   478.00     21.20      1.52   YES     NO    NO
   COK203        0   0.75000E+00  706821.5 3330326.5     5.0    30.00   367.00      3.00     12.25   YES     NO    NO
   COK211        0   0.37740E+01  706791.7 3330375.0     5.0    65.00   373.20     23.00      3.96   YES     NO    NO
   COK212        0   0.13000E-02  706804.9 3330367.2     5.0     5.00   310.00     10.00      0.31   YES     NO    NO
   COK213        0   0.26500E-01  706811.6 3330365.5     5.0     5.00   310.00     10.00      0.31   YES     NO    NO
   COK214        0   0.25000E-02  706338.0 3330235.0     5.0    28.00   367.00     10.00      0.31   NO      NO    NO
   COK215        0   0.27600E+00  706399.0 3330220.0     5.0    27.60   367.00     10.00      0.31   NO      NO    NO
   CST101        0   0.20300E+00  707003.4 3329579.5     5.0    40.00   353.20     10.00      0.61   YES     NO    NO
   CST102        0   0.20300E+00  707240.8 3329566.0     5.0    40.00   353.20     10.00      0.61   YES     NO    NO
   DST101        0   0.33000E-01  707085.0 3329579.0     5.0     6.00   313.20     10.00      0.31   YES     NO    NO
   DST102        0   0.33000E-01  707112.0 3329571.0     5.0     6.00   313.20     10.00      0.31   YES     NO    NO
   PCI101        0   0.97398E-01  706930.1 3329719.2     5.0    20.00   350.00     14.55      0.61   YES     NO    NO
   PIG101        0   0.89200E+00  706869.4 3329267.8     5.0    20.00   350.00     20.70      0.76   NO      NO    NO
   PIG102        0   0.20540E+01  706869.4 3329267.8     5.0    20.00   350.00     20.70      0.76   NO      NO    NO
   PWR101        0   0.10800E+01  707289.6 3330231.2     5.0    65.00   463.70     20.31      3.44   YES     NO    NO
   PWR102        0   0.10800E+01  707287.4 3330223.5     5.0    65.00   463.70     20.31      3.44   YES     NO    NO
   PWR103        0   0.10800E+01  707285.3 3330215.0     5.0    65.00   463.70     20.31      3.44   YES     NO    NO
   PWR104        0   0.10800E+01  707283.2 3330206.5     5.0    65.00   463.70     20.31      3.44   YES     NO    NO
   SIN101        0   0.91000E+00  706675.8 3329536.5     5.0    75.00   338.70     20.31      3.44   YES     NO    NO
   SIN102        0   0.17500E+00  706518.3 3329611.0     5.0    20.00   350.00     18.30      0.77   YES     NO    NO
   SIN103        0   0.13370E+01  706535.0 3329607.0     5.0    30.00   310.00     10.00      0.31   YES     NO    NO
   SIN105        0   0.30000E-03  706690.0 3329605.0     5.0     5.00   310.00     10.00      0.31   YES     NO    NO
   SIN106        0   0.50000E-02  706686.0 3329591.0     5.0     5.00   310.00     10.00      0.31   YES     NO    NO
   SLG101        0   0.37500E+00  707043.4 3329502.2     5.0    15.00   363.20     20.70      0.76   YES     NO    NO
   SLG102        0   0.37500E+00  707084.1 3329491.2     5.0    15.00   363.20     20.70      0.76   YES     NO    NO
   SLG201        0   0.37500E+00  707083.2 3329408.0     5.0    15.00   363.20     20.70      0.76   YES     NO    NO
   SLG202        0   0.37500E+00  706890.0 3329256.0     5.0    15.00   363.20     20.70      0.76   NO      NO    NO
   SLG401        0   0.13000E-02  707530.8 3329276.5     5.0    20.00   350.00     20.70      0.76   NO      NO    NO
   SLG402        0   0.13000E+00  707530.8 3329276.5     5.0    20.00   350.00     20.70      0.76   NO      NO    NO
   SLG403        0   0.69000E-01  707530.8 3329276.5     5.0    20.00   350.00     20.70      0.76   NO      NO    NO
   SLG404        0   0.13000E-02  707530.8 3329276.5     5.0    20.00   350.00     20.70      0.76   NO      NO    NO
   SLG405        0   0.14000E-01  707530.8 3329276.5     5.0    20.00   350.00     20.70      0.76   NO      NO    NO
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 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                                     ***
04/26/08
                                   ***                                                                     ***

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**MODELOPTs:
PAGE   3
CONC                        DFAULT ELEV


                                                   *** POINT SOURCE DATA ***

             NUMBER EMISSION RATE                    BASE     STACK    STACK     STACK     STACK    BLDG   URBAN  CAP/
EMIS RATE
   SOURCE     PART.  (GRAMS/SEC)     X         Y      ELEV.    HEIGHT   TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
     ID       CATS.              (METERS)  (METERS)  (METERS)  (METERS)  (DEG.K)   (M/SEC)   (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - -

  SLG406        0   0.21000E+00  707530.8 3329276.5     5.0     20.00    350.00     20.70      0.76    NO      NO     NO
  SLG407        0   0.13000E-02  707530.8 3329276.5     5.0     20.00    350.00     20.70      0.76    NO      NO     NO
  SLG408        0   0.76000E-02  706869.3 3329272.5     5.0     20.00    350.00     20.70      0.76    NO      NO     NO
  SLG409        0   0.24000E-01  706869.3 3329272.5     5.0     20.00    350.00     20.70      0.76    NO      NO     NO
  STC101        0   0.47000E-02  707232.7 3330054.5     5.0     40.00    305.40     10.00      0.61    YES     NO     NO
  STC201        0   0.47000E-02  707474.0 3329985.0     5.0     40.00    305.40     10.00      0.61    YES     NO     NO
  STV101        0   0.13180E+01  707077.2 3329651.5     5.0     65.00    463.70     20.31      3.44    YES     NO     NO
  STV102        0   0.62600E-03  706976.4 3329578.2     5.0     70.00   1273.00     20.00      0.50    YES     NO     NO
  STV201        0   0.13180E+01  707273.8 3329610.5     5.0     65.00    463.70     20.31      3.44    YES     NO     NO
  STV202        0   0.62600E-03  707344.3 3329605.5     5.0     70.00   1273.00     20.00      0.50    YES     NO     NO
  TRN101        0   0.12600E-01  705572.0 3329638.0     5.0      5.00    367.00     10.00      0.31    NO      NO     NO
  TWR101        0   0.61000E+00  707116.0 3329614.0     5.0     12.00    313.00      9.16      6.17    YES     NO     NO
  TWR102        0   0.80000E-01  706172.0 3329415.0     5.0     12.00    313.00      9.16      6.17    YES     NO     NO
  TWR103        0   0.50000E-01  707254.0 3330190.0     5.0     12.00    313.00      9.16      6.17    YES     NO     NO
  1800003       0   0.94900E+00  687700.0 3344800.0     5.0     22.79    421.80     13.04      2.44    NO      NO     NO
  1800005       0   0.76900E+00  696700.0 3332400.0     5.0      0.60    310.70      1.00     30.44    NO      NO     NO
  1800006       0   0.13200E+01  692000.0 3342600.0     5.0      9.10    373.00     29.29      0.21    NO      NO     NO
  1800008       0   0.16200E+02  691500.0 3343300.0     5.0     12.10    727.40      2.20      0.91    NO      NO     NO
  1800009       0   0.49800E+01  698000.0 3331000.0     5.0      7.60    298.00      7.23      1.04    NO      NO     NO
  1800010       0   0.63800E+01  694100.0 3341100.0     5.0     30.39    408.00      6.11      1.40    NO      NO     NO
  1800011       0   0.92900E+00  694700.0 3341000.0     5.0      9.10    533.00     28.22      0.91    NO      NO     NO
  1800012       0   0.62600E+01  691600.0 3342600.0     5.0      8.50    321.89      0.00      1.13    NO      NO     NO
  1800013       0   0.53300E+01  692400.0 3340000.0     5.0     18.19    352.40      8.30      0.46    NO      NO     NO
  1800015       0   0.17800E+01  691200.0 3342300.0     5.0      4.20    255.22      0.00      1.00    NO      NO     NO
  1800016       0   0.27000E+00  689300.0 3344100.0     5.0     15.20    433.00     14.40      0.88    NO      NO     NO
  1800017       0   0.16100E+01  688100.0 3333100.0     5.0     18.19    488.50     10.20      1.92    NO      NO     NO
  1800018       0   0.30000E+00  689300.0 3344700.0     5.0      6.10    533.00      1.54      1.49    NO      NO     NO
  1800021       0   0.40000E+00  705400.0 3336900.0     5.0     12.10   1033.00     19.99      0.30    NO      NO     NO
  1800028       0   0.94100E+01  687100.0 3344500.0     5.0     12.80    370.70     17.88      0.40    NO      NO     NO
  1800029       0   0.69300E+01  700600.0 3335000.0     5.0     30.99    313.50     14.13      0.67    NO      NO     NO
  1800030       0   0.47400E+01  687600.0 3345900.0     5.0     30.39    421.80     24.39      1.43    NO      NO     NO
  1800034       0   0.30000E-01  714000.0 3341000.0     5.0      9.10    533.00      2.08      0.30    NO      NO     NO
  1800036       0   0.29000E+00  693800.0 3340500.0     5.0     30.39    458.00     17.99      0.15    NO      NO     NO
  1800069       0   0.41000E+00  693400.0 3343100.0     5.0     11.80    316.30      1.94      0.61    NO      NO     NO
  1800073       0   0.24700E+01  693200.0 3343200.0     5.0     15.20    430.20     13.70      1.07    NO      NO     NO
  1800082       0   0.88900E+00  690600.0 3342400.0     5.0     15.20    419.10      0.40      0.73    NO      NO     NO
  1800086       0   0.60900E+00  689000.0 3344600.0     5.0     36.49    449.60      1.07      7.62    NO      NO     NO
  1800101       0   0.51500E+01  700600.0 3335400.0     5.0     35.29    549.10     14.00      2.44    NO      NO     NO
  1800102       0   0.51500E+01  700800.0 3335400.0     5.0     35.29    549.10     14.00      2.44    NO      NO     NO
  1800103       0   0.91900E+00  700500.0 3335400.0     5.0     21.59    327.40     12.20      0.70    NO      NO     NO
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 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                                            ***
04/26/08
                                   ***                                                                            ***

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**MODELOPTs:
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CONC                       DFAULT ELEV


                                               *** POINT SOURCE DATA ***

              NUMBER EMISSION RATE                       BASE     STACK    STACK     STACK      STACK    BLDG   URBAN  CAP/
EMIS RATE
  SOURCE       PART.  (GRAMS/SEC)      X         Y       ELEV.    HEIGHT   TEMP.   EXIT VEL.  DIAMETER  EXISTS SOURCE HOR
SCALAR
    ID         CATS.                (METERS)  (METERS)  (METERS)  (METERS)  (DEG.K)   (M/SEC)    (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - -

  1800104        0    0.91900E+00  700500.0 3335400.0     5.0     21.59    327.40     12.20      0.70    NO      NO     NO
  1800105        0    0.91900E+00  700500.0 3335400.0     5.0     21.59    327.40     12.20      0.70    NO      NO     NO
  1800106        0    0.89900E-01  700600.0 3335300.0     5.0     19.19    495.20     13.10      1.52    NO      NO     NO
  1800107        0    0.89900E-01  700600.0 3335300.0     5.0     13.70    495.20     13.20      1.52    NO      NO     NO
  1800108        0    0.89900E-01  700600.0 3335300.0     5.0     13.70    495.20     13.20      1.52    NO      NO     NO
  1800109        0    0.18400E+01  700700.0 3335000.0     5.0      2.10    305.20      8.80      0.85    NO      NO     NO
  1800121        0    0.12000E+00  700600.0 3335200.0     5.0      7.30    564.10     16.30      1.16    NO      NO     NO
  1800122        0    0.12000E+00  700600.0 3335200.0     5.0      7.30    564.10     16.30      1.16    NO      NO     NO
  1800123        0    0.40000E+00  700900.0 3335300.0     5.0      7.30    369.60     15.01      0.70    NO      NO     NO
  1800401        0    0.77900E+00  696800.0 3331300.0     5.0     31.99    394.10     15.26      3.20    NO      NO     NO
  1800405        0    0.77900E+00  696900.0 3331200.0     5.0     31.99    394.10     15.26      3.20    NO      NO     NO
  1800408        0    0.20000E+00  696900.0 3331000.0     5.0     30.39    421.80     17.43      1.52    NO      NO     NO
  1800410        0    0.13200E+01  696800.0 3331000.0     5.0     24.29    310.70     13.14      1.52    NO      NO     NO
  1800411        0    0.13200E+01  696800.0 3331000.0     5.0     24.29    310.70     13.14      1.52    NO      NO     NO
  1800412        0    0.13200E+01  696800.0 3331000.0     5.0     24.29    310.70     13.14      1.52    NO      NO     NO
  1800416        0    0.80900E+00  697000.0 3330300.0     5.0     36.79    427.40     10.70      3.96    NO      NO     NO
  1800419        0    0.80900E+00  697200.0 3330100.0     5.0     36.79    427.40     10.70      3.96    NO      NO     NO
  1800422        0    0.17000E+00  697100.0 3330400.0     5.0     30.39    421.80     11.70      2.29    NO      NO     NO
  1800423        0    0.17000E+00  697100.0 3330400.0     5.0     30.39    421.80     11.70      2.29    NO      NO     NO
  1800425        0    0.13800E+01  697000.0 3330400.0     5.0     31.69    316.30     13.76      2.29    NO      NO     NO
  1800426        0    0.13800E+01  697000.0 3330400.0     5.0     31.69    316.30     13.76      2.29    NO      NO     NO
  1800427        0    0.13800E+01  697000.0 3330400.0     5.0     31.69    316.30     13.76      2.29    NO      NO     NO
  1800428        0    0.13800E+01  697000.0 3330400.0     5.0     31.69    316.30     13.76      2.29    NO      NO     NO
  1800494        0    0.89900E-01  697100.0 3330500.0     5.0     30.39    394.10     29.12      1.04    NO      NO     NO
  1800495        0    0.43000E+00  697100.0 3330500.0     5.0     54.78    333.00      6.50      0.73    NO      NO     NO
  2000002        0    0.30000E-01  679500.0 3321800.0     5.0     11.80    724.60     24.59      0.24    NO      NO     NO
  2000003        0    0.57900E+00  682500.0 3321200.0     5.0     22.79    514.60     13.98      2.29    NO      NO     NO
  2000004        0    0.48600E+01  685000.0 3318200.0     5.0     13.70    533.00     15.90      1.16    NO      NO     NO
  2000006        0    0.46700E+01  686200.0 3325300.0     5.0     16.10    355.20      6.70      2.62    NO      NO     NO
  2000007        0    0.71500E+01  688800.0 3314800.0     5.0     15.20    488.50     13.53      1.52    NO      NO     NO
  2000012        0    0.89900E-01  687200.0 3309200.0     5.0     10.30    783.00      1.40      3.05    NO      NO     NO
  2000019        0    0.64900E+00  684100.0 3284200.0     5.0      9.10    298.00      1.20      0.09    NO      NO     NO
  2000027        0    0.16000E+01  684500.0 3285900.0     5.0      7.60    299.60      8.50      0.85    NO      NO     NO
  2000044        0    0.59900E-01  683100.0 3321600.0     5.0     12.10    720.70     31.99      1.34    NO      NO     NO
  2560012        0    0.20000E+00  703200.0 3332700.0     5.0     53.28    433.00      6.90      1.68    NO      NO     NO
  8400001        0    0.17700E+01  674200.0 3372500.0     5.0      7.00    538.50      6.46      0.91    NO      NO     NO
  8400002        0    0.38100E+01  674000.0 3375000.0     5.0     30.39    318.00      6.57      0.55    NO      NO     NO
  8400008        0    0.46000E+00  675400.0 3375400.0     5.0      2.40    310.70     33.40      0.09    NO      NO     NO
  8400009        0    0.29300E+01  674900.0 3375900.0     5.0     18.19    294.10     13.35      0.30    NO      NO     NO
  8400014        0    0.15800E+02  674600.0 3372900.0     5.0     30.39    380.70      6.77      0.73    NO      NO     NO
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 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                                 ***
04/26/08
                                   ***                                                                 ***
12:56:01
**MODELOPTs:
PAGE   5
CONC                        DFAULT ELEV

                                          *** POINT SOURCE DATA ***

              NUMBER EMISSION RATE                      BASE     STACK    STACK     STACK     STACK    BLDG   URBAN  CAP/
EMIS RATE
   SOURCE      PART.   (GRAMS/SEC)     X          Y       ELEV.    HEIGHT   TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
     ID        CATS.                (METERS)  (METERS)  (METERS)  (METERS)  (DEG.K)   (M/SEC)   (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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  8400016       0   0.38000E+00  674100.0 3374700.0     5.0     45.69   418.50    13.30      3.35    NO       NO     NO
  8400018       0   0.53000E+00  674700.0 3381000.0     5.0     30.39   977.40    19.99      0.04    NO       NO     NO
  8400033       0   0.12000E+00  674200.0 3376500.0     5.0     18.19   296.80   240.47      0.03    NO       NO     NO
  8400048       0   0.41000E+00  680400.0 3374500.0     5.0      9.10   255.22     0.00      1.00    NO       NO     NO
  8400128       0   0.35000E+00  674700.0 3365500.0     5.0     12.10   419.60    32.11      0.76    NO       NO     NO
  8400168       0   0.21000E+00  675300.0 3373800.0     5.0     25.29   255.22     8.20      1.52    NO       NO     NO
  8400171       0   0.59900E-01  675400.0 3369800.0     5.0     10.00   366.30     3.60      0.37    NO       NO     NO
  8400181       0   0.83700E+01  674100.0 3374700.0     5.0     45.99   410.70    12.96      3.35    NO       NO     NO
  8400182       0   0.30000E-01  688400.0 3379000.0     5.0     12.10   644.10     5.20      0.46    NO       NO     NO
  12800002      0   0.17100E+02  674600.0 3348600.0     5.0      7.60   293.00     0.02      0.61    NO       NO     NO
  12800004      0   0.87000E+01  679400.0 3338800.0     5.0     16.10   355.20     5.90      0.34    NO       NO     NO
  12800007      0   0.16000E+01  682900.0 3346300.0     5.0     39.59   298.00     7.52      0.21    NO       NO     NO
  12800008      0   0.10900E+01  669000.0 3351000.0     5.0     38.09   810.70     0.32      0.30    NO       NO     NO
  12800009      0   0.52000E+00  675300.0 3348900.0     5.0     22.79   475.20     0.00      0.34    NO       NO     NO
  12800010      0   0.19900E+03  681100.0 3350600.0     5.0     63.98   399.60    30.47      5.49    NO       NO     NO
  12800013      0   0.15000E+00  685900.0 3345200.0     5.0     51.78   455.20     5.10      1.65    NO       NO     NO
  12800015      0   0.66900E+00  679600.0 3332200.0     5.0      2.40   755.20    31.26      0.15    NO       NO     NO
  12800019      0   0.59900E-01  683100.0 3341900.0     5.0     12.80   570.70    42.09      0.52    NO       NO     NO
  12800020      0   0.28000E+00  684200.0 3348200.0     5.0     24.29   455.20     3.74      2.13    NO       NO     NO
  12800023      0   0.59900E-01  677500.0 3351800.0     5.0      8.80   421.80    17.40      0.61    NO       NO     NO
  12800036      0   0.15000E+00  685900.0 3345300.0     5.0      6.10  1255.20     3.31      0.70    NO       NO     NO
  12800040      0   0.41000E+00  683000.0 3346200.0     5.0     70.08   324.60     0.10      0.30    NO       NO     NO
  12800044      0   0.51000E+00  669500.0 3351500.0     5.0     11.20   644.10    34.90      0.61    NO       NO     NO
  12800049      0   0.89900E-01  669400.0 3345900.0     5.0     15.20   462.40    25.16      1.52    NO       NO     NO
  12800050      0   0.14200E+01  682300.0 3346800.0     5.0     10.90   555.20    18.49      0.64    NO       NO     NO
  12800082      0   0.30000E-01  683200.0 3347300.0     5.0     12.10   298.00    10.41      0.76    NO       NO     NO
  12800096      0   0.17000E+02  669800.0 3355700.0     5.0     45.69   370.70    16.59      0.61    NO       NO     NO
  12800101      0   0.77900E+00  668000.0 3355000.0     5.0     15.50   298.00     0.00      1.00    NO       NO     NO
  13400004      0   0.75900E+01  763100.0 3317300.0     5.0     12.10   298.00   174.55      0.06    NO       NO     NO
  13400140      0   0.12000E+01  764000.0 3312000.0     5.0      8.50  1033.00    12.40      0.24    NO       NO     NO
  15600005      0   0.45700E+01  733000.0 3301600.0     5.0     18.19   505.20    18.59      1.58    NO       NO     NO
  15600020      0   0.54400E+01  707300.0 3298200.0     5.0     18.19   488.50    13.15      1.92    NO       NO     NO
  15600021      0   0.89900E-01  711700.0 3296600.0     5.0     18.19   380.20    10.00      1.83    NO       NO     NO
  15600028      0   0.38400E+01  705100.0 3301400.0     5.0     21.29   344.10     6.01      3.05    NO       NO     NO
  17400003      0   0.14700E+01  697400.0 3374100.0     5.0      1.20   255.22    20.49      0.37    NO       NO     NO
  17400013      0   0.30000E-01  724500.0 3379000.0     5.0      8.50   560.70    12.36      0.91    NO       NO     NO
  17400015      0   0.13400E+01  726700.0 3377400.0     5.0      6.10   374.60     7.23      1.28    NO       NO     NO
  25200001      0   0.16900E+02  746400.0 3319900.0     5.0     63.98   425.20    13.43      2.44    NO       NO     NO
  25200002      0   0.12800E+02  750200.0 3322300.0     5.0     59.38   660.20     0.01      2.23    NO       NO     NO
  25200003      0   0.50700E+01  750900.0 3321600.0     5.0     15.20   360.20    65.88      0.55    NO       NO     NO
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 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                                ***
04/26/08
                                   ***                                                                ***
12:56:01
**MODELOPTs:
PAGE   6
CONC                         DFAULT ELEV


                                                 *** POINT SOURCE DATA ***

           NUMBER EMISSION RATE                    BASE     STACK    STACK     STACK     STACK    BLDG   URBAN  CAP/
EMIS RATE
  SOURCE    PART.  (GRAMS/SEC)    X         Y      ELEV.    HEIGHT   TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
    ID      CATS.               (METERS)  (METERS) (METERS) (METERS) (DEG.K)   (M/SEC)   (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - -

  25200005     0   0.37900E+01  755500.0 3313300.0      5.0    12.10   383.00     24.94      0.09    NO       NO     NO
  25200006     0   0.21900E+01  745200.0 3320100.0      5.0    28.89   324.10     13.88      1.83    NO       NO     NO
  25200007     0   0.10100E+02  745100.0 3320100.0      5.0    16.99   307.40     20.89      0.37    NO       NO     NO
  25200008     0   0.16400E+01  748300.0 3321800.0      5.0    21.29   327.40     37.35      0.15    NO       NO     NO
  25200009     0   0.10500E+02  744800.0 3321900.0      5.0    15.50   591.30     16.08      1.89    NO       NO     NO
  25200010     0   0.14600E+01  756000.0 3315200.0      5.0     3.00   321.80     25.85      0.61    NO       NO     NO
  25200014     0   0.42300E+02  743400.0 3321500.0      5.0     7.00   564.10     14.08      0.98    NO       NO     NO
  25200016     0   0.14700E+02  750700.0 3320900.0      5.0     7.60   555.20      0.04      0.91    NO       NO     NO
  25200018     0   0.84900E+00  745700.0 3319100.0      5.0     3.00   293.00      3.00      0.15    NO       NO     NO
  25200019     0   0.72900E+00  751100.0 3321900.0      5.0     0.60   305.20      0.16      0.15    NO       NO     NO
  25200028     0   0.23000E+00  757700.0 3316300.0      5.0    27.39   517.40      4.80      1.52    NO       NO     NO
  25200043     0   0.22800E+01  757500.0 3316400.0      5.0     3.90   760.70      0.70      0.15    NO       NO     NO
  25200078     0   0.27000E+00  750300.0 3323200.0      5.0    18.89   502.40      5.01      1.07    NO       NO     NO
  25200079     0   0.33100E+02  750100.0 3321600.0      5.0    91.37  1273.00     19.99      0.06    NO       NO     NO
  25200088     0   0.19800E+01  748300.0 3321800.0      5.0     2.40   599.60     56.43      0.15    NO       NO     NO
  25200090     0   0.13200E+01  746000.0 3305700.0      5.0     6.10   309.60      7.29      7.32    NO       NO     NO
  25600002     0   0.18200E+02  724772.0 3327823.0      5.0     1.20   774.60    374.07      0.09    NO       NO     NO
  25600004     0   0.18800E+01  709100.0 3325000.0      5.0    19.79   671.80     22.08      1.83    NO       NO     NO
  25600006     0   0.89900E-01  707500.0 3323500.0      5.0     7.60   505.20      7.24      0.61    NO       NO     NO
  25600007     0   0.38000E+01  700800.0 3329400.0      5.0    16.69   458.00     11.90      1.68    NO       NO     NO
  25600012     0   0.32800E+01  707800.0 3319800.0      5.0    12.80   355.20     23.17      1.92    NO       NO     NO
  25600015     0   0.94100E+01  724600.0 3327200.0      5.0    15.24   358.00      9.81      1.52    NO       NO     NO
  25600018     0   0.22600E+01  718300.0 3323100.0      5.0     2.10   298.00     20.10      1.16    NO       NO     NO
  25600021     0   0.24300E+01  708100.0 3327500.0      5.0    22.79   341.80      4.00      0.91    NO       NO     NO
  25600049     0   0.30000E-01  707300.0 3325000.0      5.0     6.10   527.40     35.49      0.15    NO       NO     NO
  25600054     0   0.31400E+01  709200.0 3326300.0      5.0    71.88   294.10      0.02      5.00    NO       NO     NO
  25600101     0   0.26000E+00  702600.0 3332600.0      5.0    47.19   310.70      9.41      2.83    NO       NO     NO
  25600102     0   0.14000E+00  702600.0 3332600.0      5.0    47.19   774.60      9.41      2.83    NO       NO     NO
  25600103     0   0.59900E-01  702600.0 3332500.0      5.0    39.59   755.20      3.12      1.83    NO       NO     NO
  25600104     0   0.89900E-01  702600.0 3332500.0      5.0    54.48   499.60      7.23      4.88    NO       NO     NO
  25600106     0   0.17500E+01  702500.0 3332500.0      5.0    34.99   477.40     12.10      4.57    NO       NO     NO
  25600107     0   0.30000E-01  702600.0 3332600.0      5.0     1.50   696.80     10.50      4.57    NO       NO     NO
  25600108     0   0.17000E+00  702600.0 3332600.0      5.0    48.69   665.20     12.72      2.35    NO       NO     NO
  25600109     0   0.55000E+00  702600.0 3332500.0      5.0    53.88   549.60      5.20      3.35    NO       NO     NO
  25600110     0   0.55000E+00  702700.0 3332500.0      5.0    53.88   549.60      5.20      3.35    NO       NO     NO
  25600111     0   0.55000E+00  702700.0 3332500.0      5.0    53.88   549.60      5.20      3.35    NO       NO     NO
  25600112     0   0.55000E+00  702700.0 3332500.0      5.0    17.29   505.20     14.40      2.13    NO       NO     NO
  25600113     0   0.30000E-01  703000.0 3332800.0      5.0    35.29   394.10     15.52      1.07    NO       NO     NO
  25600114     0   0.30000E-01  703000.0 3332800.0      5.0    35.29   388.50     15.20      0.73    NO       NO     NO
  25600115     0   0.30000E-01  702800.0 3332600.0      5.0    60.88   477.40     18.52      1.34    NO       NO     NO
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 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                              ***
04/26/08
                                   ***                                                              ***

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**MODELOPTs:
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                                           *** POINT SOURCE DATA ***


          NUMBER EMISSION RATE                      BASE     STACK   STACK    STACK     STACK    BLDG   URBAN  CAP/
EMIS RATE
  SOURCE   PART.  (GRAMS/SEC)    X         Y        ELEV.    HEIGHT  TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
    ID     CATS.               (METERS) (METERS) (METERS) (METERS) (DEG.K)  (M/SEC)   (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - -

  25600116     0   0.11100E+02  702700.0 3332500.0     5.0    70.08   544.10    58.73      1.98    NO       NO    NO
  25600124     0   0.12000E+00  702600.0 3332600.0     5.0     1.50   299.60    10.22      0.30    NO       NO    NO
  25600127     0   0.20000E+00  703200.0 3332700.0     5.0    53.28   433.00     6.90      1.68    NO       NO    NO
  25600129     0   0.30000E-01  703200.0 3332700.0     5.0    49.88   671.80    12.30      0.70    NO       NO    NO
  25600130     0   0.12000E+00  703200.0 3332700.0     5.0    49.88   671.80    12.30      0.70    NO       NO    NO
  25600138     0   0.40000E+00  702700.0 3332600.0     5.0    73.08   421.80    11.00      2.16    NO       NO    NO
  25600142     0   0.10400E+01  702600.0 3332600.0     5.0    30.39   466.30    11.90      2.74    NO       NO    NO
  25600146     0   0.30000E-01  703100.0 3332800.0     5.0    60.88   644.10    28.91      1.37    NO       NO    NO
  25600147     0   0.30000E-01  702600.0 3332600.0     5.0    44.19   555.20    14.90      1.52    NO       NO    NO
  25600148     0   0.30000E-01  703400.0 3332900.0     5.0    36.49   421.80    15.20      1.46    NO       NO    NO
  25600161     0   0.30000E-01  701400.0 3332900.0     5.0    18.19   921.80     3.81      3.66    NO       NO    NO
  25600164     0   0.12000E+00  703200.0 3332700.0     5.0    53.28   433.00     6.90      1.68    NO       NO    NO
  25600165     0   0.89900E-01  703200.0 3332700.0     5.0    53.28   433.00     6.90      1.68    NO       NO    NO
  25600166     0   0.23000E+00  702500.0 3332500.0     5.0    34.99   477.40    12.10      4.88    NO       NO    NO
  25600167     0   0.23000E+00  702500.0 3332400.0     5.0    36.27   298.00     0.00      1.00    NO       NO    NO
  25600168     0   0.23000E+00  702500.0 3332400.0     5.0    32.00   477.40     0.00      1.00    NO       NO    NO
  25600169     0   0.23000E+00  702500.0 3332400.0     5.0    36.27   477.40     0.00      1.00    NO       NO    NO
  25600170     0   0.23000E+00  702500.0 3332500.0     5.0    36.27   298.00     0.00      1.00    NO       NO    NO
  25600171     0   0.23000E+00  702500.0 3332500.0     5.0    36.27   298.00     0.00      1.00    NO       NO    NO
  25600172     0   0.23000E+00  702600.0 3332500.0     5.0    36.27   298.00     0.00      1.00    NO       NO    NO
  25600173     0   0.23000E+00  702500.0 3332500.0     5.0    36.27   298.00     0.00      1.00    NO       NO    NO
  25600174     0   0.23000E+00  702600.0 3332500.0     5.0    36.27   298.00     0.00      1.00    NO       NO    NO
  25600175     0   0.12000E+00  702700.0 3332600.0     5.0    73.08   421.80    11.00      2.16    NO       NO    NO
  25600176     0   0.59900E-01  703400.0 3332900.0     5.0    36.49   421.80    15.20      1.46    NO       NO    NO
  25600177     0   0.89900E-01  702600.0 3332500.0     5.0    54.48   499.60     7.23      4.88    NO       NO    NO
  25600179     0   0.59900E-01  703000.0 3332800.0     5.0    35.29   394.10    15.52      1.07    NO       NO    NO
  25600196     0   0.30000E-01  702600.0 3332600.0     5.0    44.19   555.20    14.90      1.52    NO       NO    NO
  25600197     0   0.30000E-01  702600.0 3332600.0     5.0    44.19   555.20    14.90      1.52    NO       NO    NO
  25600500     0   0.59900E-01  700700.0 3329700.0     5.0     4.50   255.22     0.00      0.91    NO       NO    NO
  25600501     0   0.59900E-01  700800.0 3329600.0     5.0    16.99   444.10     7.34      1.52    NO       NO    NO
  25600503     0   0.18100E+01  700900.0 3329700.0     5.0    31.99   446.30    24.82      3.20    NO       NO    NO
  25600506     0   0.21900E+01  700700.0 3329800.0     5.0    39.59   354.10     9.82      1.46    NO       NO    NO
  25600507     0   0.21900E+01  700700.0 3329800.0     5.0    39.59   349.10     7.67      1.68    NO       NO    NO
  25600508     0   0.20700E+01  700700.0 3329800.0     5.0    39.59   331.80    12.86      1.77    NO       NO    NO
  25600509     0   0.20700E+01  700700.0 3329800.0     5.0    39.59   336.30    13.00      1.68    NO       NO    NO
  25600512     0   0.15000E+01  700700.0 3329800.0     5.0    24.29   326.80     8.93      1.07    NO       NO    NO
  25600513     0   0.15000E+01  700700.0 3329800.0     5.0    24.29   324.60    17.33      1.07    NO       NO    NO
  25600522     0   0.41400E+01  700600.0 3329800.0     5.0    34.99   333.00     1.77      2.74    NO       NO    NO
  25600525     0   0.17000E+00  700500.0 3330000.0     5.0    12.80   394.10     5.49      0.30    NO       NO    NO
  25600526     0   0.17000E+00  700500.0 3330000.0     5.0    12.80   394.10     5.49      0.30    NO       NO    NO
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 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                                  ***
04/26/08
                                   ***                                                                  ***

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**MODELOPTs:
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CONC                          DFAULT ELEV


                                                  *** POINT SOURCE DATA ***

            NUMBER EMISSION RATE                     BASE     STACK   STACK    STACK     STACK    BLDG   URBAN  CAP/
EMIS RATE
  SOURCE     PART.  (GRAMS/SEC)     X         Y      ELEV.    HEIGHT  TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
    ID       CATS.                (METERS)  (METERS) (METERS) (METERS) (DEG.K)  (M/SEC)   (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - -

  25600527     0   0.30000E-01  700500.0 3329900.0     5.0     33.49   294.10      7.83      0.24    NO      NO     NO
  25600538     0   0.19300E+01  701200.0 3330400.0     5.0      4.50   255.22      0.00      0.91    NO      NO     NO
  25600539     0   0.31900E+01  701200.0 3330100.0     5.0      4.57   255.22      0.00      0.91    NO      NO     NO
  25600546     0   0.32000E+00  700500.0 3329800.0     5.0      3.00   255.22      0.16      0.30    NO      NO     NO
  25800001     0   0.70600E+01  739000.0 3327400.0     5.0      4.50   796.80     67.48      0.12    NO      NO     NO
  25800008     0   0.30000E+00  728400.0 3326200.0     5.0     10.60   310.70     33.39      0.30    NO      NO     NO
  25800015     0   0.13000E+01  744500.0 3325500.0     5.0     12.10   366.30      1.62      1.22    NO      NO     NO
  25800016     0   0.89900E-01  726500.0 3327200.0     5.0      7.60   449.60      6.70      0.24    NO      NO     NO
  25800030     0   0.59900E-01  730600.0 3328700.0     5.0     15.20   318.00      7.34      0.64    NO      NO     NO
  25800041     0   0.40000E+00  739000.0 3327400.0     5.0     36.49   316.30     35.24      0.46    NO      NO     NO
  26200011     0   0.30000E-01  671600.0 3303600.0     5.0     15.20   810.70     19.99      0.15    NO      NO     NO
  26600069     0   0.24500E+01  675200.0 3285800.0     5.0     10.00   477.40     30.66      0.76    NO      NO     NO
  26600190     0   0.40000E+00  675200.0 3285800.0     5.0     10.00   477.40      0.30      0.76    NO      NO     NO
  28800008     0   0.62900E+00  701600.0 3279400.0     5.0     12.10   449.60     11.22      1.28    NO      NO     NO
  28800019     0   0.14700E+01  720700.0 3274300.0     5.0     18.89   755.20     18.99      2.13    NO      NO     NO
  28800059     0   0.10400E+01  722300.0 3270600.0     5.0      2.40   710.70     39.19      0.09    NO      NO     NO
  31200006     0   0.13400E+03  665400.0 3356300.0     5.0     27.39   266.40      1.50      0.03    NO      NO     NO
  31200008     0   0.40600E+01  670200.0 3363200.0     5.0     53.28   519.10      2.50      0.30    NO      NO     NO
  31200010     0   0.28000E+01  672600.0 3372700.0     5.0     16.69   627.40      8.50      1.22    NO      NO     NO
  31200015     0   0.24200E+01  668000.0 3358500.0     5.0      1.80   355.20     18.89      0.46    NO      NO     NO
  31200044     0   0.11100E+01  670300.0 3375200.0     5.0     10.30   345.70     22.89      0.15    NO      NO     NO
  31200045     0   0.30000E-01  668300.0 3376300.0     5.0     13.70   921.80      0.09      3.66    NO      NO     NO
  31200059     0   0.41000E+00  670500.0 3374600.0     5.0     13.70   302.40      2.90      0.18    NO      NO     NO
  31200062     0   0.86900E+00  671800.0 3368100.0     5.0      3.00   298.00      5.08      0.91    NO      NO     NO
  31200065     0   0.47000E+00  672600.0 3373500.0     5.0      8.50   408.00     10.70      1.62    NO      NO     NO
  31200070     0   0.22200E+01  667200.0 3355900.0     5.0     30.39   361.30     14.90      0.37    NO      NO     NO
  77770054     0   0.52000E+00  700200.0 3335400.0     5.0      6.70   705.20      3.70      0.09    NO      NO     NO
  77770094     0   0.52000E+00  700200.0 3335400.0     5.0      6.70   705.20      3.70      0.09    NO      NO     NO
  77770103     0   0.46000E+00  700200.0 3335400.0     5.0      6.70   705.20      3.70      0.09    NO      NO     NO
  77770107     0   0.46000E+00  700200.0 3335400.0     5.0      6.70   705.20      3.70      0.09    NO      NO     NO
  77770134     0   0.32000E+00  700200.0 3335400.0     5.0      9.10   705.20     27.93      0.37    NO      NO     NO
  77770334     0   0.57900E+00  716000.0 3372500.0     5.0      1.80   410.70     30.09      0.40    NO      NO     NO
  77770346     0   0.59900E-01  700200.0 3335400.0     5.0      6.70   705.20      3.70      0.09    NO      NO     NO
  77770347     0   0.59900E-01  700200.0 3335400.0     5.0      4.20   713.50     44.80      0.03    NO      NO     NO
  77770371     0   0.60900E+00  716200.0 3372300.0     5.0      4.20   449.60      1.56      0.30    NO      NO     NO
  77770389     0   0.41000E+00  704000.0 3390500.0     5.0      9.40   394.10     26.16      1.16    NO      NO     NO
  18004A6      0   0.33800E+01  696500.0 3330600.0     5.0     64.88   309.10     20.00      3.35    NO      NO     NO
  18004B2      0   0.32000E+00  696600.0 3330500.0     5.0     35.89   435.20     20.46      1.83    NO      NO     NO
  256001B1     0   0.35000E+00  702800.0 3332500.0     5.0     76.18   421.80     20.49      2.23    NO      NO     NO
  256001FC     0   0.12000E+00  702800.0 3333200.0     5.0     76.18  1199.60     19.99      0.91    NO      NO     NO
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 *** AERMOD - VERSION 07026 ***     *** Nucor Louisiana                                                  ***
04/26/08
                                    ***                                                                  ***

12:56:01
**MODELOPTs:
PAGE   9
CONC                     DFAULT ELEV


                                              *** POINT SOURCE DATA ***


            NUMBER EMISSION RATE                     BASE     STACK   STACK    STACK     STACK    BLDG   URBAN  CAP/
EMIS RATE
   SOURCE    PART.  (GRAMS/SEC)      X         Y       ELEV.    HEIGHT  TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
     ID      CATS.               (METERS)  (METERS)  (METERS)  (METERS) (DEG.K)  (M/SEC)   (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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  25600522     0   0.46000E+00  700700.0 3329700.0     5.0      4.50   255.22      0.00      0.91     NO      NO     NO
  25600526     0   0.26800E+01  700400.0 3329800.0     5.0      9.10   255.22      0.00      1.00     NO      NO     NO
  25600527     0   0.20000E+00  700700.0 3329600.0     5.0     16.99   444.10      0.01      1.52     NO      NO     NO
  A14090E      0   0.26964E+01  669000.0 3355000.0     5.0     33.49   405.35     24.89      4.27     NO      NO     NO
  A14090G      0   0.26964E+01  669000.0 3355000.0     5.0     33.49   405.35     24.89      4.27     NO      NO     NO
  A14091V      0   0.91349E+00  669000.0 3355000.0     5.0     14.60   333.15     13.40      0.61     NO      NO     NO
  A14092C      0   0.35279E+00  669000.0 3356000.0     5.0     18.20   462.55     16.90      2.44     NO      NO     NO
  A14092D      0   0.35279E+00  669000.0 3356000.0     5.0     18.20   462.55     16.40      2.44     NO      NO     NO
  A14092H      0   0.18900E+00  668000.0 3355000.0     5.0     28.89   449.75     62.78      1.22     NO      NO     NO
  A14093P      0   0.26900E-04  669000.0 3351000.0     5.0     21.29   313.15      6.50      0.61     NO      NO     NO
  A140972      0   0.33559E-01  668000.0 3356000.0     5.0     22.79   449.75      3.40      1.22     NO      NO     NO
  A140973      0   0.56966E-01  668000.0 3356000.0     5.0     38.09   810.85      0.30      0.30     NO      NO     NO
  A140975      0   0.50021E+00  670000.0 3355000.0     5.0     25.89   314.25     21.40      0.61     NO      NO     NO
  A140976      0   0.50021E+00  670000.0 3355000.0     5.0     25.89   314.25     21.40      0.61     NO      NO     NO
  A140977      0   0.70559E-01  670000.0 3355000.0     5.0     16.40   523.15     19.80      0.91     NO      NO     NO
  A140978      0   0.70559E-01  670000.0 3355000.0     5.0     16.40   523.15     19.80      0.91     NO      NO     NO
  A140979      0   0.54179E-01  670000.0 3355000.0     5.0      1.00   450.85      9.52      1.00     NO      NO     NO
  A140981      0   0.70559E-01  670000.0 3355000.0     5.0     16.40   523.15     19.80      0.91     NO      NO     NO
  A140982      0   0.70559E-01  670000.0 3355000.0     5.0     16.40   523.15     19.80      0.91     NO      NO     NO
  A140984      0   0.38303E+00  669000.0 3356000.0     5.0     36.49   499.75     18.71      3.66     NO      NO     NO
  A140985      0   0.38303E+00  669200.0 3356100.0     5.0     36.49   499.75     18.59      3.66     NO      NO     NO
  A140989      0   0.10458E+00  669200.0 3356100.0     5.0     57.89   554.75      6.32      1.83     NO      NO     NO
  A140990      0   0.10458E+00  669200.0 3356100.0     5.0     57.89   571.95     22.95      1.83     NO      NO     NO
  A140994      0   0.46367E+00  670000.0 3355000.0     5.0     30.48   333.15     14.48      1.22     NO      NO     NO
  A1409A4      0   0.45359E+00  669000.0 3355000.0     5.0     33.49   405.35     54.79      3.05     NO      NO     NO
  A1409A5      0   0.45359E+00  669000.0 3355000.0     5.0     33.49   405.35     54.79      3.05     NO      NO     NO
  A1409B1      0   0.45359E+00  669000.0 3355000.0     5.0     33.49   394.25     54.79      3.05     NO      NO     NO
  A1409B2      0   0.45359E+00  669000.0 3355000.0     5.0     33.49   405.35     49.69      3.05     NO      NO     NO
  A1409B3      0   0.45359E+00  669000.0 3355000.0     5.0     33.49   405.35     49.69      3.05     NO      NO     NO
  A1409B4      0   0.45359E+00  669000.0 3355000.0     5.0     33.49   405.35     49.69      3.05     NO      NO     NO
  A1409EO      0   0.81899E-01  670000.0 3355000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409EP      0   0.81899E-01  670000.0 3355000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409EQ      0   0.81899E-01  669000.0 3355000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409ER      0   0.81899E-01  669000.0 3355000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409ES      0   0.81899E-01  668000.0 3356000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409ET      0   0.81899E-01  669000.0 3356000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409EU      0   0.81899E-01  668000.0 3357000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409EV      0   0.81899E-01  668000.0 3355000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409EW      0   0.81899E-01  669000.0 3355000.0     5.0      3.60   557.55     36.89      0.30     NO      NO     NO
  A1409G8      0   0.25200E-01  669000.0 3356000.0     5.0     53.29   921.95     11.70      1.22     NO      NO     NO
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 *** AERMOD - VERSION 07026 ***     *** Nucor Louisiana                                                     ***
04/26/08
                                    ***                                                                     ***

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**MODELOPTs:
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CONC                        DFAULT ELEV


                                                   *** POINT SOURCE DATA ***


               NUMBER EMISSION RATE                          BASE     STACK    STACK     STACK     STACK    BLDG   URBAN  CAP/
EMIS RATE
   SOURCE       PART.  (GRAMS/SEC)       X         Y         ELEV.    HEIGHT   TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
     ID         CATS.                 (METERS) (METERS) (METERS) (METERS) (DEG.K)  (M/SEC)   (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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  A1409HA       0   0.53900E-04  669000.0 3355000.0     5.0    22.79    321.45      3.90      0.91    NO      NO     NO
  A1409HI       0   0.34397E+00  663000.0 3367000.0     5.0    30.39    403.15      6.80      1.52    NO      NO     NO
  A1409HK       0   0.35279E+01  670000.0 3355000.0     5.0     3.66    644.26      0.52      5.09    NO      NO     NO
  A1409HT       0   0.83592E-02  668000.0 3356000.0     5.0    33.49    449.75      2.60      1.22    NO      NO     NO
  A1409HV       0   0.68039E-01  670000.0 3355000.0     5.0    34.39    416.45     15.20      0.91    NO      NO     NO
  A1409IF       0   0.15750E+01  670000.0 3355000.0     5.0    10.30    299.75      3.00      2.74    NO      NO     NO
  A1409JB       0   0.73079E+00  669000.0 3355000.0     5.0     3.00    299.75      7.10      0.30    NO      NO     NO
  A1409LD       0   0.11718E+00  669000.0 3355000.0     5.0    37.39    423.15     14.70      1.22    NO      NO     NO
  A1409QM       0   0.14591E+01  669400.0 3355500.0     5.0    12.10    298.00      0.00      1.00    NO      NO     NO
  A1409YC       0   0.39059E+00  669200.0 3356800.0     5.0     6.10    313.15      0.00     30.44    NO      NO     NO
  A2425102      0   0.66905E+00  700700.0 3329800.0     5.0    21.95    310.93      6.10     18.29    NO      NO     NO
  A2425123      0   0.83159E-01  700700.0 3329800.0     5.0    27.43    333.15     61.57      0.52    NO      NO     NO
  A2425124      0   0.83159E-01  700700.0 3329800.0     5.0     3.05    477.59     48.54      0.31    NO      NO     NO
  A2425125      0   0.73079E-01  700700.0 3329800.0     5.0     3.05    477.59     48.54      0.31    NO      NO     NO
  A2425E05      0   0.13860E-02  701100.0 3329500.0     5.0    41.39   1273.15     20.00      0.21    NO      NO     NO
  A2425E07      0   0.42839E-01  701100.0 3329500.0     5.0    26.97   1144.26     10.36      0.71    NO      NO     NO
  A2425E10      0   0.25452E+00  700700.0 3329800.0     5.0    27.43    298.00      0.01      0.91    NO      NO     NO
  A2425E18      0   0.52897E-02  700500.0 3330000.0     5.0    12.80    394.26      5.49      0.31    NO      NO     NO
  A2425E19      0   0.52897E-02  700500.0 3330000.0     5.0    12.80    394.26      5.49      0.31    NO      NO     NO
  A2425E22      0   0.37799E-02  700700.0 3329800.0     5.0     3.05    298.00      0.16      0.31    NO      NO     NO
  A2425E83      0   0.47135E-01  700400.0 3329600.0     5.0    17.07    444.26     11.67      1.52    NO      NO     NO
  A2425E95      0   0.14848E+01  700700.0 3329800.0     5.0    39.62    353.15     19.51      1.40    NO      NO     NO
  A2425E96      0   0.40500E+00  700700.0 3329800.0     5.0    39.62    353.15     14.33      0.74    NO      NO     NO
  A2425G28      0   0.35153E+00  700700.0 3329800.0     5.0     3.05    477.59     48.54      0.31    NO      NO     NO
  A245514       0   0.83033E+00  674378.0 3348515.0     5.0    44.20    308.15     14.02      0.46    NO      NO     NO
  A245515       0   0.71819E-01  674393.0 3348531.0     5.0    36.58    310.93      9.14      0.76    NO      NO     NO
  A24555        0   0.71819E-01  674399.0 3348572.0     5.0    36.58    310.93      9.14      0.76    NO      NO     NO
  A2532A04      0   0.51029E+00  710300.0 3325000.0     5.0    10.06    298.00      0.00      0.81    NO      NO     NO
  A2532E04      0   0.37799E-01  709400.0 3325000.0     5.0     3.05    477.59     68.65      0.31    NO      NO     NO
  A2532E66      0   0.60479E-01  709400.0 3325100.0     5.0     3.05    477.59     48.54      0.31    NO      NO     NO
  A2532E68      0   0.11088E+00  709300.0 3324900.0     5.0    10.36    366.48     55.78      0.76    NO      NO     NO
  A2532E72      0   0.87471E-01  709400.0 3324900.0     5.0    19.81    672.04     21.95      1.83    NO      NO     NO
  A2532E73      0   0.87471E-01  709400.0 3324800.0     5.0    19.81    672.04     21.95      1.83    NO      NO     NO
  A2532E75      0   0.11088E+00  709400.0 3324700.0     5.0     9.14    355.37     54.86      0.76    NO      NO     NO
  A2532E77      0   0.11088E+00  709300.0 3324700.0     5.0    15.24    355.37     72.24      0.76    NO      NO     NO
  A2532E78      0   0.12600E-03  709600.0 3325200.0     5.0     4.57    394.26      0.00      1.00    NO      NO     NO
  A2532E82      0   0.48146E-01  709200.0 3324800.0     5.0    13.05    405.37      0.00      0.40    NO      NO     NO
  A2532E83      0   0.48146E-01  709200.0 3324900.0     5.0    12.77    405.37      0.00      0.40    NO      NO     NO
  A2532E84      0   0.35279E-01  709600.0 3325100.0     5.0     7.32    405.37      0.00      0.76    NO      NO     NO
  A2532E85      0   0.12600E-03  709200.0 3324900.0     5.0     5.79    394.26      0.00      0.31    NO      NO     NO
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 *** AERMOD - VERSION 07026 ***    *** Nucor Louisiana                                                      ***
04/26/08
                                   ***                                                                      ***

12:56:01
**MODELOPTs:
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CONC                          DFAULT ELEV


                                                  *** POINT SOURCE DATA ***

             NUMBER EMISSION RATE                BASE     STACK   STACK     STACK     STACK    BLDG  URBAN  CAP/
EMIS RATE
   SOURCE     PART.  (GRAMS/SEC)     X        Y     ELEV.    HEIGHT  TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR
SCALAR
     ID       CATS.             (METERS)  (METERS) (METERS) (METERS) (DEG.K)  (M/SEC)  (METERS)
VARY BY
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- - - - -

  A2532E86      0   0.99538E-01  709500.0 3323100.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A2532E87      0   0.66779E-01  709500.0 3323100.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A2532E88      0   0.62999E-01  712100.0 3325100.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A2532E89      0   0.50399E-01  709500.0 3323100.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A2532E90      0   0.86939E-01  709500.0 3323100.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A2532E91      0   0.51029E+00  709500.0 3324800.0     5.0     7.01   298.00     0.00     0.81    NO      NO    NO
  A3732100      0   0.44099E-01  687256.0 3345056.0     5.0    23.77   866.48     7.01     1.31    NO      NO    NO
  A3732109      0   0.37799E-02  687500.0 3345000.0     5.0    24.29   810.85    40.08     0.30    NO      NO    NO
  A3732E02      0   0.37799E-02  687200.0 3345400.0     5.0    41.09  1273.15    20.00     1.83    NO      NO    NO
  A3732E40      0   0.10458E+00  687256.0 3345056.0     5.0    60.96   355.37    16.89     2.29    NO      NO    NO
  A3732E47      0   0.25326E-01  687256.0 3345056.0     5.0    12.80   298.00     0.00     1.00    NO      NO    NO
  A3732E48      0   0.75599E-03  687256.0 3345056.0     5.0     7.62   298.00     0.00     1.00    NO      NO    NO
  A3732E55      0   0.16632E+00  687100.0 3344700.0     5.0     9.14   298.00     0.00     1.00    NO      NO    NO
  A3732E62      0   0.54179E-01  687800.0 3347400.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A3732E63      0   0.13860E-01  687256.0 3345056.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A3732E64      0   0.41579E-01  687256.0 3345056.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A3732E65      0   0.15120E-01  687256.0 3345056.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A3732E66      0   0.41579E-01  687800.0 3347400.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A3732E71      0   0.33263E+00  687000.0 3344500.0     5.0     3.05   477.59    68.58     0.31    NO      NO    NO
  A3732E72      0   0.10080E-01  687000.0 3344500.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A3732E73      0   0.12474E+00  687000.0 3344500.0     5.0     3.05   477.59    48.54     0.31    NO      NO    NO
  A3732E74      0   0.46619E-01  687100.0 3344500.0     5.0    24.29   316.48    13.46     1.83    NO      NO    NO
  A3732E75      0   0.15876E+00  687000.0 3344500.0     5.0     9.91   324.82     0.00     2.44    NO      NO    NO
  A3732E84      0   0.37800E-03  687256.0 3345056.0     5.0     8.53   308.15     0.00     0.46    NO      NO    NO
  A3732E85      0   0.94304E-01  687000.0 3344500.0     5.0     8.99   298.00     0.00     1.00    NO      NO    NO
  A3732E86      0   0.25200E-02  687000.0 3344500.0     5.0    22.86   338.71     0.14     2.13    NO      NO    NO
  A3732E93      0   0.52572E+00  687200.0 3345300.0     5.0    31.99   389.75    11.19     3.44    NO      NO    NO
  A3732E99      0   0.37333E+01  687700.0 3345500.0     5.0    13.40   298.00     0.00     1.00    NO      NO    NO
```

ZEN-NOH GRAIN CORPORATION

January 28, 2009

Louisiana Department of Environmental Quality
Attention: Ms. Soumaya Ghosn
Public Participation Group
P.O. Box 4313
Baton Rouge, Louisiana 70821

Re: AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

THIRD SET OF COMMENTS ON PROPOSED PERMITS AND EAS FOR NUCOR-STEEL, LOUISIANA

Dear Ms. Ghosn:

We are pleased to present the following additional comments to PSD Permit No. PSD-LA-740 (the "PSD Permit"), Part 70 Permit No. 2560-00281-VO (the "Part 70 Permit") (collectively, the "Permits"), and the environmental assessment statement ("EAS") issued to and for Consolidated Environmental Management, Inc.-Nucor Steel, Louisiana's ("Nucor") proposed new pig iron manufacturing plant in Convent, Louisiana.[1] Zen-Noh Grain Corporation ("Zen-Noh") previously submitted comments regarding the permits on November 24, 2008 and December 12, 2008 and incorporates herein those comments, and the exhibits attached thereto, by reference. Zen-Noh now submits its third set of comments and exhibits below (with numbering continued from Zen-Noh's second set of comments). Each of Zen-Noh's comments relates equally to the PSD Permit, the Part 70 Permit, the EAS and LDEQ's duties as public trustee for the environment.

90. Nucor should be required to submit ambient impact analyses that conform to EPA guidelines and the standard practice among air pollution dispersion modeling professionals. The standard practice among air pollution modelers is to include all emission sources -- including those at the permitted facility and those from the surrounding area -- in a single input file. *See* Third Affidavit of Dr. Paolo Zannetti, QEP ("Third Zannetti Affidavit"), attached as Exhibit 14 hereto, ¶ 6. The reason for this is simple. The plume from a stack in one location, with a certain stack height and

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[1] The Permits are found in the public record in EDMS Document No. 38131069. The EAS is found in the public record in EDMS Document No. 36847130. Both EDMS documents are incorporated herein by reference.

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EXHIBIT
5

exit velocity, will behave differently under given meteorological conditions than will the plume from another stack in a different location, or with a different stack height or exit velocity. Thus, the maximum impacts from two stacks could, and probably will, occur on different days and at different downwind locations. If the modeler does not include every air pollution emission source in each model run, the only way to identify the highest impact at any particular receptor is to obtain and add the modeled concentrations at that location, for each emission source, for each hour of each day for five years. For PSD increment and NAAQS standards longer than one-hour, it would also be necessary to calculate the average concentrations over the longer averaging times. It is inappropriate to expect the public to perform these additional calculations, particularly given that the EPA-approved models will perform these calculations internally and produce the necessary output. *Id.*, ¶ 7. The model input/output files submitted by a new facility, like Nucor, must enable the reviewing agencies and the public to verify whether the new facility will cause or contribute to an NAAQS or PSD increment exceedance, without requiring the agency or public to perform additional calculations. *Id.*, ¶ 4.

The modeling files Nucor submitted to LDEQ do not include all emission sources in any single file. *Id.*, ¶ 5. The input/output files Nucor submitted to LDEQ in August and September 2008 include emission sources at the Nucor facility but does not include any emission sources from the surrounding area. *Id.* Emission sources from the surrounding area are included only in the input/out files Nucor submitted to LDEQ in May 2008. *Id.*[2] Nucor's failure to follow the standard practice makes it difficult for even a dispersion modeling expert to readily verify the results Nucor and LDEQ presented in the September 11 air quality impact report and the Statement of Basis, and therefore the air quality impact analysis is inappropriate for public review and comment under PSD. *Id.*, ¶¶ 6-7. Nucor should be required to submit all air quality impact analyses, including the September 2008 air quality impact analyses, the revised modeling Nucor promised to submit to EPA during a November 17, 2008 telephone conference, and any future air quality impact modeling results, in a form that conforms to the standard practice. All input/output files for a given modeling submission should be contained in a single complete report containing all necessary modeling results, and on a complete CD(s) in which all input files contain both the Nucor sources and surrounding area sources. *Id.*, ¶ 8. LDEQ should make every modeling report and input/output files available for public review and comment at an additional public hearing.

91. Nucor should be required to provide a full PSD impact analysis for carbon monoxide. The LDEQ Air Quality Modeling Procedures provide the standard for conducting a

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[2] The May 2008 input/output file includes Nucor's initial estimates of emissions from some of its sources, but those estimates were incorrect and were revised before the August and September 2008 modeling was performed. *See* Third Zannetti Aff., ¶ 5.

significant impact analysis ("SIA") to determine whether a full PSD impact analysis is required for emissions from a major source:

"The SIA determines if a proposed project requires NAAQS and PSD Increment models to demonstrate compliance with 40 CFR 52.21 regulations. Table 2-1 presents the significance level for compounds that may be subject to PSD review due to a proposed project. The net emission increase as determined for the PSD applicability analysis should be modeled for the SIA. The SIA compares the maximum concentration from the significance model to the appropriate Table 2-1 significance level. If the modeled concentration is less than the significance level, the project's impact is insignificant (i.e., the project increases will not cause or significantly contribute to an exceedance of the NAAQS or PSD Increment standards); therefore, no further analysis is required. If the modeled concentration is greater than or equal to the significance level, PSD regulations require a full impact analysis (i.e., NAAQS and PSD Increment models)." *See* LDEQ Air Quality Modeling Procedures, § 2.2; *see also* NSR Manual (Draft 1990).

Even with all the defects and inconsistencies Dr. Zannetti identified that cause Nucor's modeling to underpredict ambient impacts, Nucor's modeling output files nonetheless demonstrate that full NAAQS and PSD modeling is required for carbon monoxide emissions from Nucor. The Level of Significant Impact for carbon monoxide, 8-hour average, is 500 mg/m^3. According to the Nucor SIA model output files Dr. Zannetti obtained from LDEQ, the maximum 8-hour carbon monoxide concentration was 511.2 mg/m^3 and occurred in 2005. Therefore, Nucor should have conducted a full PSD increment and NAAQS analysis for carbon monoxide; however, Nucor did not do so. Nucor's report and the Statement of Basis incorrectly identified the maximum 8-hour carbon monoxide concentration as a 475.7 mg/m^3 result from 2002. This defect is cumulative with all the other defects in Nucor's impact analyses; that is, if Nucor accounts for fugitives and maintenance emissions, corrects the receptor grids, and so on, the failure to use accurate stack parameters will still cause the model to underestimate the true impacts from Nucor. Therefore, all the other defects aside, Nucor's impact analysis does not demonstrate that Nucor will not cause or contribute to an exceedance of a PSD increment or NAAQS for carbon monoxide. Nucor should be required to submit a full source impact analysis for carbon monoxide, and LDEQ should make the analysis, including the supporting input and output files, available for public review and comment at an additional public hearing.

92. The dispersion model input files underlying Nucor's source impact analyses contain inconsistent and unreasonable stack data, including exit velocities and release heights that are inaccurate and unreasonably high. *See* Second Affidavit of Paolo Zannetti, QEP, attached as Exhibit 13 to Zen-Noh's Second Set of Comments on Proposed Permits and EAS for Nucor-Steel, Louisiana. The general effect of the inaccurate

stack velocity and exit height data is to cause the plumes to rise higher into the atmosphere, which causes the plumes to travel farther downwind before they impact the surface. Each plume disperses, i.e. the pollution concentrations decrease, as it travels downwind. Therefore, the net effect of Nucor's inaccurate input data is to underestimate the downwind pollution concentrations. If Nucor corrects the inaccurate data, the models will almost certainly demonstrate that Zen-Noh and other neighbors will be exposed to higher concentrations of air pollution than reported by Nucor, possibly exceeding a PSD increment or NAAQS. This defect is cumulative with all the other defects in Nucor's impact analyses; that is, Nucor corrects the defective stack parameters, receptor grids, and so on, the failure to account for fugitive emissions will still cause the model to underestimate the true impacts from Nucor. Notwithstanding all the other modeling defects, Nucor has not demonstrated that it will not cause or contribute to an exceedance of a PSD increment or NAAQS. Nucor should be required to provide impact analyses with correct data, include stack parameters, and LDEQ should make the revised analyses available for public review and comment at an additional public hearing.

93. Many particulate matter ("PM" and "PM10") fugitive emission sources are not included in any of Nucor's air quality impact modeling, including the dock loading/unloading gantry cranes (sources DOC-101 and DOC-102), paved and unpaved roads (sources FUG-101 and FUG-102), various material conveyors (FUG-103), and coal, iron ore, flux, pig iron, granulated slag, sinter, coke breeze and mill scale storage piles (sources PIL-101 to PIL-108). *See* Third Zannetti Aff., ¶ 9. This omission leads to significant underestimation of PM10 emissions and downwind concentrations. *Id.* Fugitive emissions are released near ground level with practically zero vertical release velocity, and therefore settle relatively close to the emitting facility, i.e. Nucor. *Id.* This will cause a pollution impact, which could be significant, at the Zen-Noh grain export facility, because Zen-Noh is adjacent to and often downwind of Nucor. *Id.* In Dr. Zannetti's expert opinion, Nucor's failure to model the impact of fugitive PM10 emission sources makes it impossible for the public, LDEQ and EPA to reliably determine whether Nucor's emissions will cause or contribute to an exceedance of a PM10 NAAQS or PSD increment. *Id.* Moreover, federal PSD regulations require proposed iron and steel mills, coke ovens and sinter plants, include fugitive emissions in every aspect of the PSD analyses, including the air quality impact analyses, BACT analyses, source descriptions and other source impact analyses. *See, e.g.*, 40 C.F.R. § 52.21(b)(20)(vii) (Dec. 19, 2008). LDEQ does not have discretion to excuse Nucor from the requirement to consider fugitive emissions in its air quality impact analyses. Nucor should be required to provide air quality impact analyses, top-down BACT analyses, and other impact analyses accounting for all sources, including fugitive emissions, and LDEQ should make the revised analyses available for public review and comment at an additional public hearing.

94. Nucor's air quality impact modeling does not account for emissions of sulfur dioxide ("SO2"), PM10 or any other pollutant during heat recovery steam generating ("HRSG") unit maintenance events or flue gas desulfurization ("FGD") unit maintenance events. *See* Third Zannetti Aff., ¶ 10. The coke ovens associated with a particular HRSG will emit through the HRSG bypass vent when that HRSG unit is down for maintenance. In addition to HRSG maintenance events, all coke ovens in a given battery will vent through the five HRSG bypass vents in that battery when the FGD unit associated with that battery is down for maintenance. The heat recovery coke oven process -- the type Nucor proposes to construct -- "exhibit very unique and challenging conditions" that require enhanced preventative maintenance to combat the damaging and corrosive effects of high temperatures and "abnormally high levels of SO3 and HCl acid gases." *See* May 12, 2007 e-mail from Mark Dutchess, Hamon Research-Cottrell, Inc., to Alan P. Christopher, attached as Exhibit 15 hereto. Based on its experience with this type of installation, the FGD vendor recommends that heat recovery coke oven FGD units be taken out of service for up to seven days of preventative maintenance every year. *Id.* Air pollution control authorities in Illinois and Ohio -- two states with much more experience with coal-fed coke ovens than LDEQ has -- require emissions during FGD maintenance events to be specifically addressed in PSD permits and accounted for in air quality impact modeling. *See* PSD Permit No. 06070020, issued to Gateway Energy & Coke Company, LLC, attached in relevant part as Exhibit 16 hereto (limiting FGD maintenance emissions to 120 hours -- 5 days -- per year); report of Revised Air Quality Dispersion Modeling for the Proposed SunCoke Energy Middletown Coke Company, July 2008, attached in relevant part as Exhibit 17 hereto.

There are five HRSG units per coke oven battery, and each will be shut down for at least 12 days per year for scheduled maintenance. During an HRSG maintenance event, the HRSG bypass vent is permitted to emit 752.49 pounds per hour of SO2, 373.7 pounds per hour of PM10, and 153.7 pounds per hour of nitrogen oxides ("NOx"). During an FGD unit maintenance event, the coke battery will vent uncontrolled through the five HRSG bypass vents a total of 3,762.45 pounds per hour SO2, 1,868.5 pounds per hour PM10, 768.5 pounds per hour NOx, and other pollutants Nucor did not fully characterize. Each HRSG bypass vent will emit between 108.35 tons per year ("TPY") SO2 and 53.81 TPY PM10 -- if the HRSG maintenance shutdown coincides with a five-day FGD maintenance shutdown -- and 153.51 TPY SO2 and 76.23 TPY PM10 if the HRSG shutdown does not coincide with the FGD shutdown. Therefore, each coke oven battery at Nucor will emit 541.75 to 767.55 TPY SO2, 269.05 to 381.15 TPY PM10, and 110.66 to 156.77 TPY NOx, while the HRSG units or FGD unit are shutdown for maintenance. Each HRSG bypass vent is a major source for maintenance emissions.

Initial -- incorrect -- emission estimates from a single HRSG bypass vent were included in the May 2008 modeling analysis but were not included in the September

2008 modeling analysis. *See* Third Zannetti Aff., ¶ 10. Nucor did not consider the HRSG bypass vent emissions in the September 2008 air quality impact analysis. *Id.*, ¶¶ 5, 10. In effect, therefore, Nucor never considered the impact of maintenance emissions from the HRSG bypass vents. Nucor also never modeled emissions from the HRSG bypass vents during an FGD maintenance shutdown. *Id.*, ¶ 10. These omissions lead to significant underestimation of SO2, PM10, and lead emissions and downwind concentrations. *Id.* These emissions will cause an air pollution impact, which could be significant, at the Zen-Noh grain export facility because Zen-Noh is adjacent to and often downwind of Nucor. *Id.* In Dr. Zannetti's expert opinion, Nucor's failure to model the impact of these maintenance emissions makes it impossible for the public, LDEQ and EPA to reliably determine whether Nucor's emissions will cause or contribute to an exceedance of an SO2, PM10 or lead NAAQS or PSD increment. *Id.* Nucor should be required to model and report the air quality impact of all sources, including all fugitive emissions and all maintenance emissions, and LDEQ should make the revised analyses available for public review and comment at an additional public hearing.

95. The receptor grids in Nucor's source impact analyses do not conform to EPA and LDEQ PSD modeling guidance. According to EPA, "Receptor sites for refined modeling should be utilized in sufficient detail to estimate the highest concentrations and possible violations of a NAAQS or a PSD increment. In designing a receptor network, the emphasis should be placed on receptor resolution and location, not total number of receptors. The selection of receptor sites should be a case-by-case determination taking into consideration the topography, the climatology, monitor sites, and the results of the initial screening procedure." 40 C.F.R. Part 51, Appendix W, § 7.2.2. LDEQ's Air Quality Modeling Procedures, § 5.6, further provides: "If the maximum concentrations are located in areas where the receptor spacing is greater than 100-m, *a 100-m receptor grid should be placed around the maximum concentration to ensure the maximum concentration location is accurately identified*." (emphasis added). Notwithstanding all the other defects in Nucor's air quality impact modeling, Nucor did not design the receptor grids to unsure that the maximum concentration location is accurately identified. According to the model output files Nucor submitted to EPA, the maximum concentrations are located in areas where the receptor spacing is greater than 100-m and as much as 1,000-m. If Nucor had designed the receptor grids to identify the maximum ambient concentrations of each pollutant, Nucor's own defective modeling could have demonstrated that Nucor will cause an exceedance of an NAAQS or PSD increment. This defect is cumulative with all the other defects in Nucor's impact analyses; that is, if Nucor corrects the defective stack parameters, and accounts for fugitives and maintenance emissions, and so on, the failure to design receptor grids to identify maximum impacts will still cause the model to underestimate the true impacts from Nucor. In addition, if Nucor corrects all the defects, the model could demonstrate that maximum impacts for one or more pollutants occur on or near Zen-Noh's

property. Nucor has not demonstrated that its emissions will not cause or contribute to an exceedance of a PSD increment or NAAQS. Nucor should be required to provide impact analyses accounting for all sources, including fugitive emissions and maintenance emissions, and LDEQ should make the revised analyses available for public review and comment at an additional public hearing.

95. The permits should be revised to incorporate limits on the maximum number of hours per year that the coke ovens may emit through each HRSG bypass vent when the HRSG unit is shut down and, separately, when the FGD unit is shut down, similar to the operating limits incorporated into the Gateway Energy and Coke Company permit. *See* Exhibit 16.

96. The applicant must "1. have no history of environmental violation(s) that demonstrates to the department an unwillingness or inability to achieve and maintain compliance with the permit for which the application is being made, *unless the department determines* that the applicant's history of environmental violations can be adequately addressed by permit conditions; . . . and 4. if under a compliance schedule, be making satisfactory progress in meeting the conditions of the compliance scheduled." La. Admin. Code § 33:I.1701(A) (emphasis added). LDEQ may also deny the application. La. Admin. Code § 33:I.1701(B). For major sources of toxic air pollutants that, like Nucor, have not been operating in Louisiana for at least five years, the permit application must include "a listing of all enforcement actions taken against the owner or operator for violations of United States federal or state environmental laws or regulations." La. Admin. Code §§ 33:III.517(D)(12; 33:III.5111(B)(3)(e). This statement must be certified by a responsible corporate officer, and the applicant has a duty to supplement or correct an incomplete or inaccurate compliance certification "upon becoming aware of such failure [to submit any relevant facts] of incorrect submittal," and to provide additional information to address issues that become applicable after the application becomes final but before the proposed permit is issued. La. Admin. Code §§ 33:III.517(B)-(C). Based on information available on compliance databases maintained by EPA and state environmental authorities, Nucor's certification on May 12, 2008 was not accurate at that time or when LDEQ issued the draft permits on October 15, 2008, and is not accurate now.

a. Stack testing conducted May 8, 2008 at Nucor's steel mill in Crawfordsville, Indiana indicated that emissions of hydrogen chloride ("HCl") and the collection efficiency of the HCl scrubber violate conditions in the mill's Part 70 permit and 40 CFR 63 Subpart CCC, resulting in the issuance of Notice of Violation No. 2008-18075-A on November 3, 2008.

b. According to EPA's ECHO database, the Nucor Steel Kankakee plant in Bourbonnais, Illinois violated (i) PSD during every quarter between April

2007 and December 2008, for which EPA has lead enforcement, and (ii) the Clean Water Act ("CWA") during every quarter between October 2007 and December 2008.

c. According to EPA's ECHO database, the Nucor Steel – Jewett plant in Jewett, Texas violated (i) the Texas state implementation plan during every quarter between January 2006 and December 2008, and (ii) the Resource Conservation & Recovery Act ("RCRA") during every quarter between January 2006 and December 2008.

d. According to EPA's ECHO database, the Nucor's Vulcraft plant in Norfolk, Nebraska violated the Emergency Planning and Community Right to Know Act ("EPCRA") by failing to file toxic chemical release forms for 2004, 2005 and 2006, which resulted in an enforcement action that was not closed until a final order was issued on September 3, 2008.

e. The Texas Port Recycling LP scrap processing plant, a division or subsidiary of Nucor's David J. Joseph subsidiary, was the subject of a formal CAA new source review enforcement action in 2008, TECQ docket number 2008-0008-AIR-E, which was not resolved until an order was mailed on December 1, 2008.

f. According to EPA's ECHO database, the Western Metals Recycling scrap processing plant in Salt Lake City, Utah, a division or subsidiary of Nucor's David J. Joseph subsidiary, is the subject of formal enforcement action number CAA-08-2008-0029, issued September 30, 2008.

g. According to EPA's ECHO database, the Nucor Steel – Arkansas plant in Blytheville, Arkansas, violated the CWA during every quarter between January 2007 and March 2008 and between July 2008 and September 2008.

h. According to EPA's ECHO database, the Nucor Steel Marion plant in Marion, Ohio was the subject of four formal and two informal enforcement actions between July 2004 and November 2007.

i. Nucor was fined $13,750 by the state of South Carolina in 1999 for violating state air pollution limits for sulfur dioxide at its Berkley County, South Carolina plant.

i. According to the Nebraska Department of Environmental Quality, the Nucor Steel plant near Norfolk, Nebraska violated the CAA between May 1995 and February 1999 because Nucor constructed a major modification without obtaining a PSD permit. By applying for and obtaining a permit for a minor modification instead of a PSD permit, Nucor avoided the requirements to install BACT, demonstrate that NAAQS would not be violated by the modifications, analyze air quality in the area of the Nucor facility, analyze in detail the Nucor facility and its design and operation, and analyze impacts, other than air quality, to the surrounding area. To resolve these violations, Nucor agreed to pay a $750,000 civil penalty, to contribute $200,000 for a supplemental environmental project, and to install, maintain, and operate an air quality monitoring network in the area.

j. In 2000, Nucor entered into a consent decree with the U.S. Department of Justice, EPA and the states of Nebraska, Arkansas, Utah and South Carolina to resolve numerous alleged violations, including violations of PSD permit requirements and hazardous waste management laws, and contamination of soil and groundwater. The settlement involved Nucor facilities in seven states. Nucor agreed to pay a penalty of $9 million and to test and -- if successful, install-- control technologies Nucor proposes not to install at the proposed pig iron plant.

Even if Nucor had disclosed all these violations and enforcement actions in its application, and there is no disclosure in the public record, they demonstrate that Nucor is not qualified to receive any environmental permits in Louisiana. Nucor's incorrect certification and failure to submit a revised certification when violations and enforcement actions ensued after May 12, 2008, further discredit Nucor's compliance demonstrations and highlight Nucor's unfitness to receive a permit. LDEQ might not have known about any or all of Nucor's noncompliance history, and certainly did not put Nucor's history in the public record. However, if LDEQ did know, LDEQ nonetheless failed to explain its rationale for determining that Nucor is qualified to receive the permits, despite Nucor's on-going history of noncompliance. Either way, Nucor should be required to fully and in good faith disclose its compliance history, and LDEQ should explain its rationale for finding that Nucor is or is not qualified to receive the permits. Last, the public should be given an opportunity to review and comment on Nucor's compliance history and LDEQ's determination at a public hearing.

97. LDEQ's has no discretion to determine that compacted coal and flat car pushing are BACT for coke oven charging and pushing emissions. LDEQ cannot set a MACT standard that is less stringent than those promulgated by EPA. 42 U.S.C. § 7412(l)(1). The discretion to determine that an "inherently lower emitting process" is BACT does not authorize LDEQ to circumvent an applicable MACT standard. In other words, an inherently lower emitting process cannot be BACT if there is an applicable MACT standard, unless the inherently lower emitting process complies with all the requirements of the MACT standard. "The fact that a given production technology may be 'inherently' lower polluting than other technologies does not end

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a BACT analysis; nothing in the CAA or PSD regulations indicate that facilities utilizing lower polluting technologies should not be required to meet all applicable BACT requirements." *In re General Motors, Inc. Permit No. MI-209-00*, 10 E.A.D. 360 (E.A.B. 2002); *see also* NSR Manual. The MACT standards for non-recovery coke oven batteries are set forth in 40 C.F.R. 63 Subparts L and CCCCC. Nucor may not construct -- and LDEQ may not authorize -- the pig iron plant unless LDEQ determines that the source will comply with those standards. 42 U.S.C. § 7412(i). Nucor and LDEQ have no experience with nonrecovery coke ovens to support any request or determination to apply any standard or work practice less stringent than the standards promulgated by EPA. The Part 70 Permit should be revised, for the coke battery charging operations, to reflect the applicable requirements, in 40 C.F.R. § 63.303(b)(2), that the owner or operator install, operate and maintain an emission control device for the capture and collection of emissions in a manner consistent with good air pollution control practices for minimizing emissions from the charging operation. The Part 70 Permit should be revised, for the coke battery pushing operations, to reflect the applicable requirements, in 40 C.F.R. § 63.7290(a), that a mobile control device that captures emissions during travel will be used, and the applicable operating limits in § 63.7290(b).

98. The Part 70 Permit should be revised, for the coke battery charging operations, to reflect the applicable requirement, in 40 C.F.R. § 63.303(d)(4), that the owner or operator shall develop and implement written procedures for adjusting the coke oven uptake damper to maximize oven draft during charging and for monitoring the oven damper setting during each charge to ensure that the damper is fully open.

99. The Part 70 Permit should be revised, for the coke battery pushing operations, to reflect the applicable requirements, in 40 C.F.R. § 63.7293, that ovens must be visually inspected prior to pushing and that ovens not be pushed unless the visual inspection indicates that there is no smoke in the open space above the coke bed and that there is an unobstructed view of the door on the opposite side of the oven.

100. The Part 70 Permit should be revised, for the MEROS sinter vent stack, to reflect the applicable requirements, in 40 C.F.R. § 63.7810(b), that the owner or operator must prepare and operate at all times according to a written operation and maintenance plan for each capture system or control device subject to an operating limit in § 63.7790(b), and must include the listed elements.

101. The Part 70 Permit should be revised, for the MEROS sinter vent stack, to reflect the applicable requirements, in 40 C.F.R. § 63.7790(d) and § 63.7831(e), regarding control of oil content in the feedstock or VOC emissions from the windbox.

102. The Part 70 Permit should be revised, for the coke quench towers, to indicate the sources of "acceptable makeup water" for use in the coke quenching operations. 40

C.F.R. § 63.7295(a)(2) defines "acceptable makeup water" to include river water, stormwater runoff, non-contact cooling water, scrubber water from coke pushing operations, and wastewater that has been treated and complies with the categorical pretreatment standard. Nucor has committed to zero discharge of wastewater, and to reuse all wastewater generated by the facility, but not every wastewater generated by the facility will be "acceptable makeup water," for example blowdown from the MEROS system or blast furnace wet scrubbers. The presence of unacceptable makeup water, and the plant's commitment to re-use all wastewater, creates the inference that unacceptable makeup water may be used in the coke quenching operations. To measure and ensure continuous compliance, and to facilitate enforcement with this provision, the Part 7 Permit should be revised to identify the acceptable sources of makeup water for the coke quenching operations.

103. The PSD and Part 70 Permits indicate LDEQ's determination that BACT for SO2 emissions from the coke oven flue gas desulfurization stacks should be ≥ 90% capture efficiency when the 6-month rolling average concentration of sulfur in the coking coal is ≤ 1%, and ≥ 91% capture efficiency when the 6-month rolling average concentration of sulfur is > 1%, to be recorded on a weekly basis. The PSD Permit indicates that BACT should also include a limit of no more than 1.3% sulfur in the coal, but the Part 70 Permit does not incorporate this requirement. BACT is ordinarily expressed as a numeric emissions limit, such as pounds of pollutant per unit of production. A design, equipment, work practice, or operational standard, or combination thereof, may be prescribed as BACT only if LDEQ determines that it is "not feasible to prescribe or enforce an emission standard," 42 U.S.C. §§ 7412(g)(2)(B) and (h), i.e. that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible. *See* La. Admin. Code § 33:III.509(B). LDEQ did not make any findings necessary to prescribe a BACT standard composed in part on the 6-month rolling average sulfur content in the coal. Rather, this standard reflects only Nucor's request for flexibility to purchase coal with varying sulfur contents. There is no reason why BACT for coke oven FGD stack SO2 emissions should not be expressed as a numeric emissions limit applicable at all times. This numeric emission limit should also incorporate, i.e. be based on, a maximum allowable sulfur content in the coal. The numeric emission limit should be based on no more than 1.0% sulfur in the coal and no less than 92% control efficiency by the FGD system. A numeric emission limit calculated thusly will provide Nucor operational flexibility to balance coal quality and FGD efficiency without exposing the surrounding area to unknown SO2 emission rates, and will allow continuous compliance assurance. Compliance with the emissions limit should be based on direct measurement, not an estimated control efficiency and a 6-month rolling average that cannot be known until months later.

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104. As noted in comment 94 above, an entire coke oven battery will vent through the HRSG bypass vents during the four to seven day annual FGD maintenance shutdowns recommended by an FGD vendor based on the operating conditions and the experience with FGD systems at heat recovery coke plants. During an FGD unit maintenance event, the coke battery will vent uncontrolled through the five HRSG bypass vents a total of 3,762.45 pounds per hour SO2, 1,868.5 pounds per hour PM10, 768.5 pounds per hour NOx, and other pollutants Nucor did not fully characterize. Standing alone, FGD maintenance events will be major sources of SO2, PM10 and NOx emissions and require full PSD treatment. In addition to an analysis of control technologies to reduce emissions during HRSG maintenance events, the BACT analysis for the coke ovens should include an analysis of control technologies to reduce emissions during FGD maintenance events. The economic feasibility analysis for technically feasible control options should be based on the total cost to remove pollutants from the coke oven exhaust, not the cost to remove the incremental emissions during HRSG and FGD maintenance events.

105. The Environmental Assessment Statement should address Nucor's decision to relocate a state-of-the-art, "clean" direct reduction iron ("DRI") facility from Convent, Louisiana to Trinidad, and less than three years later replace the Convent DRI facility with a much, much dirtier integrated pig iron facility with coke ovens and blast furnaces. American Iron Reduction constructed the Convent DRI facility in 1997 and started production in 1998. The plant was located southeast of Romeville, less than one-half mile from the proposed Nucor pig iron property. The facility had a capacity of 1.2 million tons of DRI per year, and was permitted to emit 79.01 TPY PM10 and 28.52 TPY SO2. *See* PSD Permit No. PSD-LA-596(M-1). Nucor's proposed pig iron plant will produce five times as much iron but will emit **21 times** more PM10 and **175 times** more SO2 than did the DRI facility. After moving the Convent DRI production equipment to Trinidad, Nucor expanded the capacity of the facility from 1.2 million tons per year to 1.6 million tons per year. As recently as November 3, 2008, Nucor appeared at an industry conference, Scrap Substitutes & Alternative Ironmaking V, to boast about the money Nucor saved by relocating the Convent DRI production equipment to Trinidad, and the production records set by the Trinidad facility. The "IT Questions" require LDEQ to evaluate alternative locations and processes for a new facility. Nucor found an alternative location for the clean DRI process -- Trinidad -- and an alternative process for Convent, but this integrated pig iron process is two orders of magnitude dirtier than the DRI process that Nucor took out of Convent. This is not the direction LDEQ should take to fulfill its role as the public trustee for the environment.

105. EPA and the United States Fish and Wildlife Service ("FWS") are of the same opinion as Dr. Zannetti, that Nucor's air quality impact analyses do not demonstrate Nucor will not cause an exceedance of an NAAQS or PSD increment because, among other things, Nucor did not include maintenance emissions from the HRSG bypass

vents.[3] During a November 17, 2008 conference with EPA and LDEQ, Nucor committed to provide revised air quality impact analyses to LDEQ and EPA, which would include all maintenance emissions. EPA and FWS also strongly recommend that LDEQ provide a new comment period for FWS, EPA and the public to evaluate the revised air quality impact analyses, the revised air permit application, and the preliminary determination. Zen-Noh has been told that Nucor provided some revised air quality impact analyses to LDEQ and EPA in December 2008, but those analyses have never been made available to the public for review or comment. The CAA and SIP require an applicant for a PSD permit to provide, among other things, a source impact analysis demonstrating that the emissions from the new facility will not cause or contribute to air pollution in excess of any NAAQS or PSD increment. 42 U.S.C. § 7475(a)(3); 40 C.F.R. § 52.21(k); La. Admin. Code § 33:III.509(K). The results of the source impact analysis "shall be available at the time of the public hearing on the application for such permit." 42 U.S.C. § 7475(e)(2)-(3). The PSD permit may not be issued unless "a public hearing has been held with opportunity for interested persons . . . to appear and submit written or oral presentations on the air quality impact of such source, alternatives thereto, control technology requirements, and other appropriate considerations." 42 U.S.C. § 7475(a)(2); La. Admin. Code § 33:III.509(Q)(2)(e). The public, including Zen-Noh, did not have an opportunity to appear at the November 20 public hearing and present written or oral comments on the revised air quality impact analyses that takes into account all permitted maintenance emissions or the model input and output files that support the air quality impact analyses for the Mill. LDEQ should make **all** air quality impacts of the Mill, including the revised air quality impact analyses that take into account all maintenance emissions and all model input and output files supporting the air quality impact analyses, all revised or additional BACT analyses, and the revised preliminary determination, available for public review, and provide the public an opportunity to appear at a future public hearing to present written or oral comments.

106. As discussed in Zen-Noh's comments 8-10 submitted to LDEQ on November 24, 2008, Nucor did not properly quantify emissions of several toxic air pollutants, including sulfuric acid mist, hydrogen chloride, dioxins, furans, and hydrogen sulfide. Emissions of these TAPs are expected to exceed the minimum emission rate established by LDEQ. LDEQ should provide at least 30 days for public comment and at least 30-days notice of a public hearing before granting approval for construction or issuing any permit that would allow the construction of the sources that will emit these compounds. La. Admin. Code § 33:III.5109(D).

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[3] The FWS comments are found beginning at EDMS document #38731575 in the public record. The EPA comments are found beginning at EDMS document #39219904 in the public record. It is noteworthy that the FWS comments were embedded in a set of unrelated documents in EDMS and that LDEQ did not post the EPA comments to EDMS for over a month.

107. Carbon monoxide gases generated during operation of the blast furnace may not be emitted unless they are burned in a direct-flame afterburner or are controlled by other means as is approved by LDEQ. La. Admin. Code § 33:III.1703(A). The Part 70 Permit indicates that combustion of carbon monoxide gases generated during operation of the blast furnace in the top gas boilers (emission sources PWR-101 to PWR-108) is approved by LDEQ. Only a fraction of the carbon monoxide gases generated during operation of the blast furnace are burned in the top gas boilers. The remainder are burned in the hot blast stoves (STV-101 and STV-201) and the flare (STV-102 and STV-202). The hot blast stoves and flare are not "direct-flame afterburners." The Part 70 Permit should be revised to require either that all carbon monoxide gases from the blast furnace be burned in the top gas boilers, or to reflect a considered determination otherwise.

108. The emission standards for sulfur dioxide apply to "all . . . single point sources that emit or have the potential to emit 5 tons per year or more of sulfur dioxide into the atmosphere." La. Admin Code § 1502(A)(3). For any single point source that has the potential to emit 5+ tons per year of SO2, it is unlawful to discharge gases containing greater than 2,000 ppm SO2, averaged over three hours, or any applicable NSPS or NESHAP standard, whichever is more stringent. § 1503(C). "Single point sources that emit or have the potential to emit less than 250 tons per year of sulfur compounds measured as sulfur dioxide may be exempted from the 2,000 ppm(v) limitation by the administrative authority." *Id.* The facility must demonstrate at least initial compliance according to established methods, § 1503(D). The facility also must install, calibrate, maintain and operate a continuous emissions monitoring system to demonstrate continuous compliance, § 1511(A), except for single point sources that have the potential to emit less than 100 tons per year of sulfur dioxide. § 1511(D).

The coke pushing operations (COK-102 and COK-202) each have the potential to emit 84.5 TPY of SO2. The cast house dust collectors (CST-101 and CST-201) each have the potential to emit 75.8 TPY of SO2. The hot blast stove common stacks (STV-101 and STV-201) each have the potential to emit 61.1 TPY of SO2. LDEQ has not made a determination to exempt any of these sources from the 2,000 ppmv SO2 concentration limitation in § 1503(C), and it would be inappropriate to do so given the overall emissions of SO2 from the facility. The Part 70 Permit should be revised for each of these emission sources to reflect the SO2 concentration limitation and initial compliance determination applicable requirements in § 1503.

The coke battery FGD stacks (COK-111 and COK-211) each have the potential to emit 1,342.68 TPY of SO2. The HRSG bypass vents (COK-105 to COK-10 and COK-205 to COK-209) have the potential to emit 108.4 TPY over a 12-day annual maintenance shutdown, and 153.56 TPY if the annual FGD maintenance shutdown does not coincide with the HRSG maintenance shutdown; however, there are no federally enforceable limits on the number of days that each HRSG bypass vent may operate, so each must be treated as having the potential to emit greater than 250 TPY of SO2. The topgas boilers (PWR-101 to PWR-108) have the potential to emit 342 TPY of SO2; there is no federally enforceable limitation on what fraction of the 342 TPY may be emitted by each boiler, so all must be treated as having the potential to emit greater than 250 TPY of SO2. The MEROS system sinter vent stack (SIN-101) has the potential to emit 361.14 TPY of SO2. LDEQ has not made -- and given that each has the potential to emit greater than 250 TPY, may not make -- a determination to exempt any of these sources from the 2,000 ppmv SO2 concentration limitation in § 1503(C). Anyway, it would be inappropriate to do so given the overall emissions of SO2 from the facility. The Part 70 Permit should be revised for each of these emission sources to reflect the applicable SO2 concentration limitation and initial compliance determination applicable requirements in § 1503 and the continuous monitoring system requirements in § 1511(A).

Please feel free to contact me should you have any questions.

Sincerely,

John Williams

John Williams
President, Zen-Noh Grain Corporation

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY (LDEQ)
CONSOLIDATED ENVIRONMENTAL MANAGEMENT, INC.
NUCOR STEEL LOUISIANA

AI Number 157847
Permit Number 2560-00281-V0 and PSD-LA-740
Activity Number PER20080001 and PER20080002

THIRD AFFIDAVIT OF DR. PAOLO ZANNETTI, QEP

I, Dr. Paolo Zannetti QEP, state,

1. Based on my continuing review of available documents and the electronic air dispersion modeling files pertaining to the air permitting of the Nucor Steel Louisiana (hereafter Nucor) proposed pig iron manufacturing facility in St. James Parish, Louisiana, in my opinion:
   a) Nucor failed to follow standard practices of air pollution dispersion modeling professionals regarding the structure and disclosure of their dispersion modeling input/output (I/O) files. This makes it difficult to readily verify the results Nucor presented in their September 11 air quality impact report.
   b) Nucor failed to include a significant number of PM10 fugitive emissions and PM10, SO_2 and lead maintenance emissions in their modeling. Because of these omissions, the public, LDEQ and EPA cannot reliably determine whether Nucor's emissions will cause or contribute to an exceedance of a NAAQS or PSD increment.
2. The public hearing for Nucor's permitting effort was on November 20, 2008. The deadline for written public comment was on November 24, 2008. As mentioned in my first two affidavits, we did not have air dispersion modeling files prior to these dates to check Nucor's air dispersion modeling, although these files were first requested on November 6, 2008.
3. We have since received the modeling files that were provided to LDEQ by Nucor as of November 2008. These files are contained on three CDs:
   - May 2008 air permit modeling files (CD1)
   - August 2008 air permit modeling files (CD2)
   - September 2008 air permit modeling files (CD3)

   CD1 contains the modeling I/O files for Nucor's May 2008 Initial Title 70 Air Permit Report. The existence of this CD was noted in Appendix F-3 of this report. CD2 and CD3 contain the modeling I/O files relating to the results presented in the September 11, 2008 "Addendum No. 2" letter from Nucor to LDEQ. The existence of CD3 was noted in Appendix F of this letter, however the existence of CD2 was not mentioned in this letter in any publicly available document we have examined.

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4. In Class II NAAQS and PSD air permit modeling, a complete air dispersion permit modeling consists of modeled concentrations from two groups of emission sources. The first are the emission sources of the new facility applying for permit. The second are the emission sources from surrounding facilities. The model input file must enable the reviewer, upon re-running the model, to output both the pollutant concentrations due to the new facility alone and due to all sources collectively at all receptors in the modeling domain for the entire time period of interest (usually five years). This will enable the reviewer to determine whether the *new facility's contribution* to the total concentration exceeds the "Level of Significant Impact" at receptors where *the total concentration* exceeds an NAAQS or PSD increment[1]. The modeling I/O files submitted by the new facility must enable its contribution to any NAAQS or PSD exceedances to be verified by the reviewer without additional calculation.

5. My associates and I have reviewed the modeling files provided by Nucor to LDEQ. The Nucor emission sources and rates were revised by Nucor in September 2008, after Nucor's original May 2008 modeling files. No single modeling file provided by Nucor, however, accounts for the surrounding facility emissions and the revised emission rates used by Nucor in September 2008. Instead, the CD2 and CD3 modeling input files contain only the revised Nucor emission sources and rates. The emission sources for surrounding facilities are only contained in the original CD1 modeling input files.

6. The standard practice among air dispersion modelers is to include all the emission sources – the permitted facility emissions and the surrounding facility emissions – in a single input file. Nucor's failure to follow the standard practice makes it difficult for even a dispersion modeling expert to readily verify the results Nucor presented in their September 11 air quality impact report.

7. The form of the modeling I/O files provided by Nucor is therefore inappropriate for public review and comment under PSD.

8. Future submissions of modeling results and their corresponding I/O files by Nucor should be contained in a single complete report containing all necessary modeling results, and on a complete CD (or CDs) in which all input files contain both the appropriate Nucor and surrounding facility sources.

9. Many PM and PM10 fugitive source emissions are not included in Nucor's modeling, including the dock loading/unloading gantry cranes (sources DOC-101 and DOC-102), paved and unpaved roads (sources FUG-101 and FUG-102), various conveyor fugitives (FUG-103), and coal, iron ore, flux, pig iron, granulated slag, sinter, coke breeze and mill scale storage piles (sources PIL-101 to PIL-108). This omission leads to significant underestimation of PM10 emissions and downwind concentrations. Fugitive emissions are released near ground level at practically zero vertical release velocity, and therefore settle relatively close to the emitting facility. This will cause a pollution impact, which could be significant, at the Zen Noh grain export facility because Zen Noh is adjacent to and often downwind of Nucor. Because of the lack of

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[1] The value of the NAAQS standard, the PSD standard and Level of Significant Impact are listed for each criteria air pollutant in Table 2-1 of the LDEQ Air Modeling Guidance document "Air Quality Modeling Procedure", Louisiana Department of Environmental Quality, August 2006.

fugitive PM10 sources in Nucor's modeling, the public, LDEQ and EPA cannot reliably determine whether Nucor's emissions will cause or contribute to an exceedance of a PM10 NAAQS or PSD increment.

10. Emissions from coke oven HRSG by-pass vents were included in the May 2008 modeling analysis, but were not included in the September 2008 air quality impact analysis. Only the surrounding facility emissions from the May 2008 analysis were used in the September 2008 analysis. Furthermore, emissions from coke ovens during FGD maintenance events were never included in any of Nucor's modeling analysis. These omissions lead to significant underestimation of SO_2, PM10 and lead emissions and downwind concentrations. Maintenance emissions are large because they are uncontrolled by pollution control equipment. These emissions will cause an air pollution impact, which could be significant, at the Zen Noh grain export facility because Zen Noh is adjacent to and often downwind of Nucor. Because of the lack of complete and up-to-date inclusion of maintenance emissions in Nucor's modeling, the public, LDEQ and EPA cannot reliably determine whether Nucor's emissions will cause or contribute to an exceedance of a SO_2, PM10 or lead NAAQS or PSD increment.

I hereby certify under penalties of perjury that the foregoing representations are true to the best of my knowledge.

22 Jan. 2009
Date

Dr. Paolo Zannetti, QEP
President, EnviroComp Consulting, Inc.

State of California, County of Alameda
Subscribed and sworn to (or affirmed) before me on this 22 day of Jan., 2009 by Paolo Zannetti, ~~personally known to me~~ or proved to me on the basis of satisfactory evidence to be the person(s) who appeared before me.

R. Ruta Chaudhari

RUTA CHAUDHARI
COMM. # 1539277
NOTARY PUBLIC-CALIFORNIA
COUNTY OF ALAMEDA
My Comm. Exp. Jan. 26, 2009

PACK, DELAUNA

From: DUTCHESS Mark [Mark.Dutchess@hamonusa.com]
Sent: Saturday, May 12, 2007 11:42 AM
To: ALLEN, CHRISTOPHER P
Cc: PACK, DELAUNA; MOREY, STEVEN R; WIDICO Michael; PETERS James; MENEZES Vivek
Subject: RE: Typical Maintenance for the Hamon FGD System

Dear Chris

Based on HRC's extensive installed base of wet and dry Flue Gas Desulfurization systems, HRC typically takes its core operation and maintenance experiences and recommendations and customizes those requirements for each new project's O&M Manual. This approach allows HRC to adjust future project instructions for lessons learned from prior good and bad experiences and allows the operator to optimize the performance and service life of the equipment. Underlining this philosophy is the basic concept that all mechanical systems require routine inspection and maintenance services in order to achieve the maximum reliability for each facility's operating conditions.

As we have discussed on numerous occasions over the past four (4) years, the process and operating conditions encountered by the emissions control system installed on a heat recovery coke facility are very a-typical of those experienced at other applications such as on conventional coal fired boilers. Coke oven facilities of this type exhibit very unique and challenging operating conditions which require extra O&M considerations which typically are not present on other industry applications. In particular, the FGD system faces significant variances in cyclic load conditions on a 24/7 basis with swings in gas temperatures and flow rates and acid gas concentration levels. The presence of abnormally high levels of SO3 and HCl acid gases in addition to SO2 requires special attention towards monitoring of equipment for corrosion and unexpected by-product build-up and deposits.

In particular, HRC's experience at the Indiana Harbor HRCF and similar albeit not quite as severe applications on municipal solid waste incinerators, indicate that the presence of high levels of HCl in the gas stream produce a tendency for enhanced internal corrosion problems and also by-product dropout and deposits. Dropout material which takes place during the swing load operation is especially problematic because of the hygroscopic nature of the Calcium Chloride – CaCl2 – reaction by-product which is formed. Unlike conventional coal fired DFGD installations where coal fly ash dropout is light and easily re-entrained at design gas flow velocity, this CaCl2 material readily creates hardened deposits which are not re-entrained in the gas stream as gas flow rates increase. Overtime these deposits can alter the gas flow distribution exacerbating the dropout problem and eventually restricting the internal ductwork gas flow which will lead to other operating problems, including reductions in SO2 removal efficiency.

DFGD systems are designed for routine maintenance of critical operating components while the flue gas production process remains on-line; i.e. rotary atomizers can be exchanged on line; filter bags and cages can be inspected and replaced when necessary, and external components such as hopper heaters, level detectors, filter bag cleaning systems, can all be inspected and replaced during normal operation. However, critical internal system components such as dampers, flow distribution devices, corrosion effects and by-product dropout and deposits can only be determined by performing a complete internal inspection when the FGD system is removed from service.

For a coal fired power plant DFGD installation, this internal inspection is typically conducted on a yearly basis during annual plant outages. However, in between these annual outages, quick inspections are often performed during unexpected plant forced outages, particularly if known problems exist within an operating system. And, in the extreme where a major malfunction occurs, the complete power generation system can be temporarily shut down to facilitate emergency inspections and repairs. Over the past 25 plus years of DFGD system operation, these procedures have worked well for the much less challenging coal fired applications.

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Recognizing the extremely challenging service encountered by the DFGD system on coke oven emissions treatment, HRC endorses a very aggressive preventative maintenance program for this type of equipment. This preventative maintenance program should be geared to producing optimum performance for the remainder of the operating year, and maximum the effective service life of all components. HRC's recommendations include semi-annual and annual complete internal inspections. The semi-annual outage should encompass a minimum of one (1) or two (2) days to confirm proper operation, resolve small operating issues, and develop service plans for the annual outage time. The annual outage would likely encompass two (2) to five (5) days to perform a thorough internal inspection and complete maintenance work identified earlier or at the time of the outage.

Again, HRC views these planned outage events as realistic preventative maintenance procedures specific to this unique application which will maximum the overall operation and emissions performance of the DFGD system throughout its long service life.

Please give me a ring to discuss these recommendations at your earliest convenience.

Best regards,

Mark

Mark S. Dutchess

Hamon Research-Cottrell, Inc.

542 Cumberland Street

Suite 1E

Lebanon, PA 17042

Telephone: 717-274-7188

Mobile: 717-507-7293

FAX: 717-274-7085

From: ALLEN, CHRISTOPHER P [mailto:CPALLEN@sunocoinc.com]
Sent: Friday, May 11, 2007 9:42 AM
To: DUTCHESS Mark
Cc: PACK, DELAUNA; MOREY, STEVEN R
Subject: Typical Maintenance for the Hamon FGD System

Mark,

217/782-2113

CONSTRUCTION PERMIT - PSD APPROVAL
NESHAP SOURCE - NSPS SOURCE

PERMITTEE

Gateway Energy & Coke Company, LLC
c/o SunCoke Company
Attn: Delauna Pack
Parkside Plaza
11400 Parkside Drive
Knoxville, Tennessee 37934

Application No.: 06070020 I.D. No.: 119040ATN
Applicant's Designation: Date Received: July 11, 2006
Subject: Heat Recovery Coke Plant
Date Issued: March 13, 2008
Location: Edwardsville Road, Granite City

This Permit is hereby granted to the above-designated Permittee to CONSTRUCT emission source(s) and/or air pollution control equipment consisting of a heat recovery coke plant, as described in the above-referenced application. This Permit is subject to standard conditions attached hereto and the following special condition(s):

In conjunction with this permit, approval is given with respect to the federal regulations for Prevention of Significant Deterioration of Air Quality (PSD) for the above referenced project, as described in the application, in that the Illinois Environmental Protection Agency (Illinois EPA) finds that the application fulfills all applicable requirements of 40 CFR 52.21. This approval is issued pursuant to the federal Clean Air Act, as amended, 42 U.S.C. 7401 et. seq., the federal regulations promulgated thereunder at 40 CFR 52.21 for Prevention of Significant Deterioration of Air Quality (PSD), and a Delegation of Authority agreement between the United States Environmental Protection Agency and the Illinois EPA for the administration of the PSD Program. This approval becomes effective in accordance with the provisions of 40 CFR 124.15 and may be appealed in accordance with the provisions of 40 CFR 124.19. This approval is also based upon and subject to the findings and conditions which follow:

If you have any questions on this permit, please contact Jason Schnepp at 217/782-2113.

Edwin C. Bakowski, P.E. Date Signed: ________________
Acting Manager, Permit Section
Division of Air Pollution Control

ECB:JMS:jws

cc: Region 3
Lotus Notes
CES

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1.0 LIST OF ABBREVIATIONS AND ACRONYMS COMMONLY USED

BACT	Best Available Control Technology
CAAPP	Clean Air Act Permit Program
CFR	Code of Federal Regulations
CO	Carbon Monoxide
dscm	Dry Standard Cubic Meters
dscf	Dry Standard Cubic Feet
F	Fahrenheit
gr	Grains
H_2SO_4	Sulfuric Acid
HAP	Hazardous Air Pollutant
hr	Hour
HRSG	Heat Recovery Steam Generator
IAC	Illinois Administrative Code
I.D. No.	Identification Number of Source, assigned by Illinois EPA
Illinois EPA	Illinois Environmental Protection Agency
LAER	Lowest Achievable Emission Rate
lb	Pound
mg	Milligram
mo	Month
mmBtu	Million British Thermal Units
MSSCAM	Major Stationary Sources Construction and Modification (35 Part IAC 203), also known as Nonattainment New Source Review (NA NSR)
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_x	Nitrogen Oxides
NSPS	New Source Performance Standards
PM	Particulate Matter
PM_{10}	Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 microns as would be measured by applicable testing or monitoring methods
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 microns as would be measured by applicable testing or monitoring methods
PSD	Prevention of Significant Deterioration (40 CFR 52.21)
scf	Standard Cubic Feet
scm	Standard Cubic Meter
SO_2	Sulfur Dioxide
USEPA	United States Environmental Protection Agency
VOM	Volatile Organic Material
Yr	Year

A. Doors: The pressure in each oven or in a common battery tunnel shall be maintained at a negative pressure consistent with the NESHAP for doors.

B. Charging: Charging operations shall be controlled by a baghouse with traveling hood consistent with the NESHAP for charging operations (See also Condition 4.1.3-1(b).)

C. Pushing: Pushing operations shall be controlled by a mobile hood with a multicyclone consistent with the NESHAP for pushing operations. (See also Condition 4.1.3-2(a).)

D. Coking: Combustion gases from the coking process shall be routed to the HRSGs controlled by the spray dryer/fabric filter system, except (1) during inspection and maintenance of HRSGs, which shall comply with Condition 4.1.5(a)(i)(D)(1) below, (2) during inspection and maintenance of the spray dryer/fabric filter system, which shall comply with Condition 4.1.5(a)(i)(D)(2) below, and (3) monthly verification of operability of the lids for the waste heat stacks. The total duration of venting through waste heat stacks, with coking gases not controlled by the spray dryer/fabric filter system, shall not exceed 1872 stack-hours per 12-month rolling period (average 312 hours for the six waste heat stacks). These bypass periods and appropriate operation during periods of bypass shall also be addressed by the Startup Shutdown and Malfunction (SSM) Plan required for the plant by 40 CFR 63.6(e).

    1. Combustion gases shall not be vented to the waste heat stacks for more than 192 hours per calendar year per vent stack. There shall be no more than one waste heat vent stack in use at any time. For these periods, the charge rates to the ovens affected by the bypass shall be reduced in accordance with the SSM Plan.

    2. Combustion gases shall not be vented to the six individual waste heat stacks during inspection and maintenance of the spray dryer/fabric filter system for more than 120 hours per calendar year. During

this period, the charge rates to the ovens shall be reduced in accordance with the SSM Plan, which at a minimum shall provide that the average charge rate shall be no more than 42.5 tons wet coal per oven.

E. The filter material in the filter system for the main stack shall be a membrane material, micro-fiber material, micro-fiber capped composite material or other similar filter material that has enhanced performance for collection of fine particulate as compared to conventional woven or felt filter material. The filter material shall also have been demonstrated to provide greater than 99.99 percent reduction in emissions of filterable $PM_{2.5}$ or such better performance as the manufacturer will warrrant, as determined by the "Generic Verification Protocol for Baghouse Filtration Products," as used by USEPA's Environmental Technology Verification program for evaluation of filter materials or ASTM Standard D6830-02, Characterizing the Pressure Drop and Filtration Performance of Cleanable Filter Media, or other equivalent protocol.

F. Quenching: Quenching operations shall be controlled by a baffle system and clean quench water consistent with the NESHAP for quench operations. (See also Condition 4.1.3-2(b).)

ii. BACT/LAER Emission Limits

A. Emissions of particulate matter (filterable and condensable) from the charging baghouse shall not exceed 0.016 lb/ton of coal charged.

B. Emissions of particulate matter (filterable and condensable) from the pushing multicyclone shall not exceed 0.08 lb/ton of coke pushed.

C. Emissions of particulate matter from the main stack (coking baghouse) shall not exceed 0.0050 gr/dscf (filterable only) and 0.0110 gr/dscf (filterable and condensable).

D. Emissions of particulate matter (filterable and condensable) during bypass of the spray dryer/fabric filter control system shall not exceed 0.08 gr/dscf.

REVISED AIR QUALITY DISPERSION MODELING FOR THE PROPOSED SUNCOKE ENERGY MIDDLETOWN COKE COMPANY MIDDLETOWN, OHIO

Prepared for:

SunCoke Energy
Parkside Plaza
11400 Parkside Drive
Knoxville, TN 37934

Prepared by:

URS Corporation
1093 Commerce Park Drive, Suite 100
Oak Ridge, Tennessee 37830
0711211

July 2008

EXHIBIT
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Updated Ohio EPA Required Modeling for MCC

A netting analysis was performed for emissions increases from MCC and emissions decreases from shutdown of the Sinter Plant and the addition of flame management projects at AK Steel. The net emissions increases of all pollutants will be below major source modification thresholds. However, NO_X emissions potentially exceed the Ohio EPA 25 tons/year threshold, which requires a modeling demonstration.

The modeling assessment began by identifying the MCC emissions inventory to determine whether MCC emission units would return a significant impact to ambient air. That is, the maximum annual modeled NO_2 concentration was compared with the significant impact level of 1 $\mu g/m^3$ to determine whether the MCC sources could cause or contribute to a violation of the NAAQS. Similarly, the impacts of HCl and Hg were compared to the respective MAGLCs.

MCC typically will operate with all flue gases from the coke ovens going through the spray dryer and baghouse and exhausted through the main stack. However, when maintenance is performed at the facility, other operating modes increase emissions of some pollutants. These were considered for the dispersion modeling and are described below as Cases 1 through 3.

- Case 1 – One of the five individual waste heat stacks may be open up to 10 days/year for maintenance of the HRSG. Case 1 emissions correspond with maximum production and HRSG maintenance.
- Case 2 – Typically, 50 of the 100 ovens are charged with coal each day. If equipment problems cause delays, fewer than 50 ovens may be charged one day and more than 50 ovens may be charged the next day. Case 2 emissions correspond with maximum production, HRSG maintenance, and charging 75 ovens per day.
- Case 3 – The spray dryer/baghouse system may need to be offline for maintenance up to 5 days/year. During these days, all five waste heat stacks are open. Case 3 corresponds with maximum production, spray dryer/baghouse maintenance, and charging 75 ovens per day.

NO_X was modeled on an annual basis assuming that both HRSG maintenance and spray dryer/baghouse maintenance occurred during the year. HCl and Hg were modeled in the HRSG maintenance mode with maximum production (Case 1) and the spray dryer/baghouse maintenance mode with the maximum charging situation (Case 3). The modeled MCC emissions inventory is tabulated in Table 1. The maximum short-term emission rates shown in Table 1 (Case 3) were based on the few days per year period when maintenance and inspection of the spray dryer/baghouse system require coke oven flue gases to be exhausted to the atmosphere through the waste heat stacks. Maintenance is conducted when needed and not on a routinely scheduled basis; therefore, it could occur at any time of the year. To simulate this type of activity and the unknown schedule, modeling for this short-term event was conducted as if it could happen each day of the year so that each 24-hour period is evaluated similarly and a worst-case short-term impact can be evaluated.

The NO_X modeled concentrations were converted to downwind NO_2 concentrations for comparison with the standards and significant impact levels using the Ambient Ratio Method (ARM) value of 0.75.