

Florida Department of Environmental Protection

Memorandum

TO: Mallika Muthiah, P.E., Chief
Air Facilities Section
Miami-Dade County DERM

FROM: A. A. Linero, P.E. Administrator
New Source Review Section

DATE: August 27, 2002

SUBJECT: Tarmac/Pennsuco Kiln No. 2

We received a copy of the letter dated August 8, 2002 from Tarmac to Miami-Dade DERM requesting a new interim NO_x emission limit and changes to a 1998 Consent Agreement between Tarmac and DERM. Yesterday we received a copy of the report by EQM evaluating for Tarmac the feasibility of options to reduce NO_x emissions from the No. 2 Kiln.

There are a number of overlapping issues affecting this facility. Most of them will not be reviewed here. The issues include:

1. Applicability of the Cement Plant NESHAP that went into effect in June of this year.
2. A determination of Best Available Control Technology (BACT) for nitrogen oxides (NO_x) issued in 1992 for Kiln 2, which Tarmac has not met.
3. A construction permit issued by the Department in 1999 to implement "indirect firing" on Kiln 2 for the purpose of NO_x control.
4. A Title V Permit that requires compliance with the mentioned NESHAP and includes a NO_x compliance plan with "dates certain" that would be affected by the proposal.
5. The inability of the clinker cooler serving Kiln 2 to comply with the particulate emission limit given in the NESHAP.
6. A permit issued by DERM to modernize the entire facility by shutting down the wet process kilns and installing a larger and more efficient dry process kiln.
7. The Consent Order between Tarmac and Miami-Dade DERM that Tarmac seeks to modify.

Because of the complexity of the issues, this analysis is primarily limited to a review of the technical details contained in the letter and how they square with the state of the technology for NO_x control for wet process cement manufacturing.

According to Tarmac, the two key approaches applicable to wet process cement kiln operations (identified in the EQM study and the EPA report) are Process Control Modification and Combustion Control. We believe that there are additional measures available under the overall heading of combustion controls as well as other measures beyond combustion control.

In early 1999, the Department issued a permit to Tarmac to convert the kiln to "indirect firing." We note that according to the EQM Study (Page 47), the "modified indirect-firing" strategy can reduce NO_x emissions by 830 tons in a little over one year. Because the strategy was not implemented soon after the permit was issued, it is now claimed that it is not cost-effective because it will take time to construct and will be used for only about one year until the new kiln begins operation.

The revised proposal is for a conversion to "semi-indirect firing" that has apparently already been undertaken. We note that Tarmac did not advise the Department of this change in strategy. The proposed combustion modifications consisting of semi-indirect firing coupled with the described "Annular Nozzle Burner" represent an improvement compared with historical operation.

The proposed semi-indirect firing is not theoretically as effective as the previously approved indirect firing scheme. The indirect firing scheme would not reinject the separated "primary" air back into the kiln. Instead the loss would be made up by using more of the hotter and less humid air from the kiln hood/clinker cooler area. This means that the indirect scheme previously approved by the Department would tend to further reduce NO_x because less fuel would be needed.

Whether semi-indirect or indirect firing is implemented, these arrangements represent "primary" measures to effect NO_x emissions at old existing kilns. It is hard to see how these "primary" measures described will actually lead to the claimed reduction of 50 percent in NO_x emissions (given in the letter) based on the literature. Usually it takes additional measures to achieve such a level of reduction at an existing kiln.

We do not agree with the statement given in Tarmac's letter that "the installed system could represent the best available control for a wet process cement kiln." It appears to be a better candidate for a Reasonable Available Control Technology (RACT) proposal such as might be implemented pursuant to a typical Attainment Maintenance Plan.

The EPA report and the bulk of the literature describe additional measures that are feasible at wet or dry kilns. For example, virtually all new precalciner kiln projects incorporate some kind of sub-stoichiometric combustion at some point in the calciner. The proposed new kiln at Tarmac will include the so-called "stageless combustion" whereby the fuel in the calciner is burned under reducing conditions to convert NO_x from the kiln burner to molecular nitrogen. Additional "tertiary" air is staged in afterwards to effect complete burnout.

The "analogue" for a wet kiln is mid-kiln firing of fuel such as tires, lump coal, etc. One of the most interesting variations is described by one of Tarmac's consultants, Mr. Eric Hansen.¹ In this case, introduction of fuel at mid-kiln in a wet process kiln would have the same effect as burning fuel under reducing conditions in the dry process calciner. The additional air to promote burnout would be added "uphill" of mid-kiln in the wet process. Most interestingly, according to Hansen's data, the scheme greatly reduces sulfur dioxide (SO₂) emissions. This type of arrangement might even be a candidate for a BACT determination at an existing wet kiln project.

¹ Paper. Hansen, E.R., Cadence Environmental Energy. "Staged Combustion for NO_x Reduction Using High Pressure Air Injection. IEEE Conference. May 2002.

A final measure mentioned in the EPA report is the possibility of selective non-catalytic reduction (SNCR). SNCR involves addition of some form of ammonia into the pyroprocessing system within a temperature window favoring conversion of the ammonia and NO_x to nitrogen and water. The technology has been demonstrated at dry process preheater and precalciner kilns.

Although the EPA report did not cite SNCR as a technique applicable to long kilns such as wet process kilns, there is at least one long kiln in Canada that practices (or practiced) SNCR by adding urea via dust scoops. Also, in theory, Hansen's description of high-pressure air injection could be modified to introduce ammonia into the kiln at the correct temperatures and the requisite oxidizing conditions to effect NO_x removal.

The point of this discussion is not to propose SNCR at Tarmac, but rather to point out that their proposal is very basic compared to the possible measures. We do not agree with the statement in EQM's report that "minimal NO_x reduction would be expected" by SNCR. Also it is possible that claimed kiln opacity problems could be avoided, especially if Hanson's mid-kiln air injection process also ties up the SO₂.

We also point out that SCR was demonstrated at a full-sized cement plant in Solnhofen, Germany. Perhaps EQM is not yet aware of that development. According to the head of the section in the German Umwelt Bundesamt that regulates the cement industry, "the SCR in Solnhofen works in an excellent manner." Again, this is not to suggest SCR is needed at Tarmac. However it is closer to "proven technology" than claimed by EQM.

The final comment is to note that Tarmac has ordered shipments of coal with a higher volatility from a new supplier. They believe it will help reduce NO_x emissions and we do not dispute that claim. However different coals have different properties for other constituents (besides volatile matter) such as chlorides.

The type of coal used ties in with Issue 1 above that will be specifically addressed by the Department under separate correspondence. We understand that Rinker used to have a plugging problem at their new dry process kiln related to high chlorides in their fuel supply. If Tarmac uses the same type of coal that Rinker used, hydrogen chloride (HCl) emissions might be higher than reported by Tarmac during recent tests. For that reason, it is important to know the characteristics of the coal used during testing when reviewing the results of recent HCl testing at Tarmac.

Obviously our preference is that Tarmac meets the BACT NO_x limits given in the relevant permits. This should have occurred already regardless of modernization plans. Thank you for providing us with the opportunity to comment on the letter. If you have any questions, please call me at 850/921-9523.

Cc: Patrick Wong, DERM
Clair Fancy, DEP BAR
Jim Pennington, DEP BAR
Tom Tittle, DEP SED
Sharon Crabtree, DERM

Summary of Maximum Sulfur Dioxide Air Quality Impacts^a, Kiln 2 Coal Conversion

Averaging Time	SO ₂ Emission Rate				Ambient Air Quality Standard	
	lb/hr	400	321	275	195	
	lb/ton	16.0	12.84	11.0	7.80	Dade
	lb/MX Btu	2.46	2.14	1.83	1.20	Florida County
<u>Kiln 2 Only Maximum Impact</u>						
Annual Average ($\mu\text{g}/\text{m}^3$)	4.1	3.2	2.8	2.0	-	-
24-hour maximum ($\mu\text{g}/\text{m}^3$)	61	49	42	30	-	-
3-hour maximum ($\mu\text{g}/\text{m}^3$)	183	147	126	89	-	-
<u>Florida AAQS^b</u>						
Annual Average ($\mu\text{g}/\text{m}^3$)	14	13	12	12	60	25
24-hour maximum ($\mu\text{g}/\text{m}^3$)	73	66	66	66	260	110
3-hour maximum ($\mu\text{g}/\text{m}^3$)	254	254	254	254	1,300	350
<u>PSD Class II Increments^c</u>						
Annual Average ($\mu\text{g}/\text{m}^3$)	5.1	4.8	4.0	3.3	20	-
24-hour maximum ($\mu\text{g}/\text{m}^3$)	55	53	46	33	91	-
3-hour maximum ($\mu\text{g}/\text{m}^3$)	162	126	105	69	512	-
<u>PSD Class I Increments^c</u>						
Annual Average ($\mu\text{g}/\text{m}^3$)	0.6	0.5	0.5	0.5	2	-
24-hour maximum ($\mu\text{g}/\text{m}^3$)	4.7	4.4	4.3	4.2	5	-
3-hour maximum ($\mu\text{g}/\text{m}^3$)	18	18	18	18	25	-

^aResults are maximums based on maximum emission rate occurring every hour of every year.

^bIncludes impacts due to all sources, plus background.

^cIncludes impacts due to all increment consuming sources.

Source Contribution to Maximum 24-Hour Impacts ($\mu\text{g}/\text{m}^3$) in Class I Area

Source	Tarmac Kiln 2 SO ₂ Emission Rate (lb/hr)			
	400	321	275	195
Tarmac Kiln 2	1.31	0.49	0.37	0.26
Tarmac Kiln 3	0.70	0.43	0.40	0.43
Metro Dade Resource Recovery	2.29	3.38	3.44	3.38
South Broward Resource Recovery	0.26	0.05	0.05	0.05
North Broward Resource Recovery	0.01	0.01	0.01	0.01
FPL Lauderdale Cts (proposed)	2.87	0.72	0.78	0.72
FPL Units 4 and 5 Offset (proposed)	-2.73	-0.68	-0.75	-0.68
Total	4.7	4.4	4.3	4.2

Note: Class I PSD increment is $5.0 \mu\text{g}/\text{m}^3$ for 24-hour averaging time.

decrease for firing coal instead of residual oil should be similar for all three kilns. Based on this the expected efficiency of SO₂ absorption when firing coal would be a minimum of 69.4% instead of the proposed 36 percent for kiln 2.

A sulfur dioxide reduction of 69.4 percent is more representative of previous BACT determinations. In terms of pounds emitted per heat input, a 69.4 percent reduction equates to 1.18 lb/MMBtu which also better represents BACT. In addition, 1.18 lb/MMBtu is consistent with the New Source Performance Standard (NSPS) for fuel burning equipment of similar size. For coal fired industrial-commercial-institutional steam generating units with heat input capacities between 100 and 250 million Btu per hour the least stringent NSPS requires that SO₂ emissions not exceed 1.2 lb/MMBtu.

For nitrogen oxides the level of control proposed by the applicant also exceeds what has been previously established as BACT. Here again, the Department believes that there is evidence to suggest that cement kilns can meet a lower than proposed emission limitation.

Taking into consideration the applicant's proposed NO_x emission rate of 169.3 lb/hr with the proposed clinker production rate of 25 tons per hour, the NO_x emissions are equivalent to 6.77 pounds per ton of clinker produced. This level greatly exceeds the uncontrolled NO_x emission factor of 2.8 lb/ton of clinker that is given in EPA AP-42 for both dry and wet process kilns.

The AP-42 emission factor, equivalent to 1.74 lb/ton of feed, is more representative of previous BACT determinations. In terms of heat input, the AP-42 emission factor equates to 0.43 lb/MMBtu. This emission level is within the range of precious BACT determinations, though it is on the stringent side.

By comparison, the least stringent NSPS for NO_x from coal fired (except lignite) industrial-commercial-institutional steam generating units is 0.70 lb/MMBtu. This level, equivalent to a 2.84 lb/ton of feed for the Tarmac facility is representative of the least stringent BACT determination both in terms of emission per ton of feed and lb/MMBtu. As this is the case, this level (0.7 lb/MMBtu) does not appear to be unreasonable as BACT for the Tarmac facility.

Conclusion

Based on the information presented, the Department has determined that BACT for the Tarmac facility is equivalent to limiting the sulfur dioxide and nitrogen oxide emissions to the least stringent NSPS for coal fired industrial-commercial-institutional steam generating units. This decision is consistent with the requirements that all BACT determinations be at least as

METROPOLITAN DADE COUNTY, FLORIDA



April 30, 1990

MAY 11 1990
ENVIRONMENTAL RESOURCES MANAGEMENT
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(305) 375-3376

C.H. Fancy, P.E.
Bureau of Air Regulations
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399

RE: Tarmac Florida, Inc., Kiln 2 Coal Conversion AC-13-169901; PSD-FL-142

Dear Mr. Fancy:

DERM has reviewed Tarmac's comments to the Best Available Control Technology Determination for the subject application issued by FDER. On April 26, 1990 Barry Andrews, FDER and Ewart Anderson of our staff discussed Tarmac's rebuttal points contained in their comments and was in general agreement with the significant positions outlined in the determination.

Our primary areas of disagreement with the applicant's arguments are as follows:

1. Tarmac has not provided documentation to demonstrate that Kilns 2 and 3 are different from each other, nor have their arguments substantiated this assertion. Tarmac is now challenging the FDER position that Kiln 2 can achieve a 69 percent SO₂ reduction efficiency when burning coal, however this was a basic ingredient in the Kiln 3 permit review when that unit was converted to coal fuel.
2. In order to support their claim that the most stringent alternative(s) pursuant to Top-Down Best Available Control Technology is unreasonable and can therefore be set aside, Tarmac must provide a detailed analysis, economic or otherwise, to establish a basis for DER's reversal of its current determination.
3. Finally, the proposal by Tarmac to conduct a 1-year testing program to collect data in order to determine the BACT limit is inconsistent with the BACT process. We feel that Kiln 3's performance can in fact be used as the basis for this determination. EPA, FDER and other authorized agencies are empowered to make educated appraisals and determinations of BACT.

With regard to the BACT determination for Nitrogen Oxides, DERM fully agrees with the determination of the FDER and the emission levels established.

If you should have further questions regarding the information provided in this letter, please call Mr. Ewart Anderson or myself of the Air Section at (305) 858-0601.

Sincerely,

H. Patrick Wong
Chief, Air Section
Environmental Monitoring Division

copy to...
ELA/aas

PERMITTEE:
Tarmac Florida, Inc.

Permit Number: AC 13-169901
PSD-FL-142
Expiration Date: June 30, 1992

GENERAL CONDITIONS:

- b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.
- c. Records of monitoring information shall include:
- the date, exact place, and time of sampling or measurements;
 - the person responsible for performing the sampling or measurements;
 - the dates analyses were performed;
 - the person responsible for performing the analyses;
 - the analytical techniques or methods used; and
 - the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS:

1. The construction and operation of the subject modification of kiln No. 2 shall be in accordance with the capacities and specifications stated in the application.
2. The maximum clinker production rate of kiln No. 2 shall not exceed 25 tons per hour and 197,100 tons per year. Kiln No. 2 shall operate only on coal firing for up to 7,884 hours per year at a maximum firing rate of 162.5 MMBtu per hour. The coal used for firing kiln No. 2 shall have a maximum sulfur content of 2.0 percent by weight, with the rolling 30-day average sulfur content not exceeding 1.75 percent by weight.
3. Sulfur dioxide emissions from kiln No. 2 shall not exceed 7.8 lbs/ton of clinker produced, 195.0 lbs/hr, 768.7 tons/yr.

PERMITTEE:
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Permit Number: AC 13-169901
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SPECIFIC CONDITIONS:

4. Sulfuric acid mist emissions from kiln No. 2 shall not exceed 0.23 lb/ton of clinker produced, 5.86 lbs/hr, 23.06 tons/yr.
5. Nitrogen oxides emissions from kiln No. 2 shall not exceed 4.55 lbs/ton of clinker produced, 113.8 lbs/hr, 448.4 tons/yr.
6. Carbon monoxide emissions from kiln No. 2 shall not exceed 346 lbs/hr, 1363.9 tons/yr.
7. VOC emissions from kiln No. 2 shall not exceed 28.8 lbs/hr, 113.5 tons/yr.
8. Particulate matter emissions from kiln No. 2 shall not exceed 14.40 lbs/hr, 56.76 tons/yr.
9. PM₁₀ emissions from kiln No. 2 shall not exceed 12.24 lbs/hr, 48.25 tons/yr. Compliance for PM₁₀ shall be determined by applying a factor of 0.85 to the measured particulate matter emissions.
10. All reasonable precautions that apply under F.A.C. Rule 17-2.610(3) shall be implemented to limit unconfined emissions of particulate matter from any activity associated with this project. Adequate watering of the coal pile area shall be conducted whenever visible emissions occur in that area. The frequency of watering shall be no more than every half hour.
11. Initial and annual compliance tests shall be conducted using the following test methods:
 - EPA Method 5 for particulate matter
 - EPA Method 7 for nitrogen oxides
 - EPA Method 8 for sulfur dioxide and acid mist
 - EPA Method 25 for VOC
 - EPA Method 10 for carbon monoxide
12. Tarmac shall conduct a series of compliance tests for SO₂, H₂SO₄ mist, and NO_x emissions every two months for up to one year to allow representative sampling during different times of the year. The tests shall be performed in accordance with the compliance test methods specified in this permit. In the event that this series of tests results in SO₂ emissions in the range of 195 to 275 lbs/hr (up to 11 lbs/ton clinker, 1,084.1 TPY), NO_x emissions in the range of 113.8 to 169.3 lbs/hr (up to 6.77 lbs/ton clinker, 667.2 TPY), or H₂SO₄ mist emissions in the range

PERMITTEE:
Tarmac Florida, Inc.

Permit Number: AC 13-169901
PSD-FL-142
Expiration Date: June 30, 1992

SPECIFIC CONDITIONS:

of 5.86 to 8.25 lbs/hr (up to 0.33 lbs/ton clinker, 32.52 TPY), the Department, if requested by the permittee, shall re-evaluate BACT and consider upward adjustments of the emission limitations for the indicated constituents based on available data. During this testing and evaluation period, the permittee shall make reasonable efforts to limit air emissions, and the Department shall not initiate enforcement proceedings. Any upward adjustment of emission limitations pursuant to this paragraph shall be the subject of public notice in a local newspaper pursuant to Department rules. The Department's determination based on the data produced under this paragraph shall be a point of entry for purposes of Section 120.57, Florida Statutes.


13. The compliance tests shall be conducted within 30 days after operation on coal begins. The Department's Southeast District office and the Dade County Department of Environmental Resources Management (DCDERM) shall be notified in writing at least 15 days prior to source testing and at least 5 days prior to initial startup. Written reports of the tests shall be submitted to those offices within 45 days of test completion.

14. The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Bureau of Air Regulation prior to 60 days before the expiration of the permit (F.A.C. Rule 17-4.090).

15. An application for an operation permit must be submitted to the Department's Southeast District office and the DCDERM at least 90 days prior to the expiration date of this construction permit or within 45 days after completion of compliance testing, whichever occurs first. To properly apply for an operation permit, the applicant shall submit the appropriate application form, fee, certification that construction was completed noting any deviations from the conditions in the construction permit, and compliance test reports as required by this permit (F.A.C. Rule 17-4.220).

Issued this 25 day
of February, 1991

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION


Carol M. Browner, Secretary

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