December 7, 2006

Robert Hodanbosi, Chief
Division of Air Pollution Control
Ohio Environmental Protection Agency
122 South Front Street
Columbus, Ohio 43215

VIA OVERNIGHT MAIL

Re: Petition to establish an Ohio RACT for composites manufacturing, based on the U.S. EPA Reinforced Plastic Composites Production NESHAP

Dear Mr. Hodanbosi,

On October 2, 2006, the American Composites Manufacturers Association, on behalf of the many composites manufacturing companies in Ohio, submitted a petition to the Ohio Joint Committee on Agency Rule Review, asking that Ohio EPA Rule 3745-21-07 be returned to the agency without approval, because the rule failed to provide an accurate assessment of the costs that would be imposed on the composites industry.

In an October 6 e-mail to Bill Juris and Edward Kitchen, Ohio EPA, and William Hills, JCARR staff, we suggested that Ohio EPA could address our concerns without modifying the rule, if your agency worked with industry to 1) adopt the US EPA NESAHP (MACT standard) for our industry as an Ohio EPA RACT rule under 21-09, and 2) establish under 21-10 cost-effective emission estimation techniques for SMC manufacturing.

We are submitting this petition and the attached document in support of the first of these two initiatives, i.e., establishing an Ohio RACT for our industry. We expect to submit information on emission factors for SMC manufacturing in early 2007.

In brief, EPA's MACT standard, promulgated in 2003, limits emissions of organic hazardous air pollutants from reinforced plastic composites (RPC) production. Emitted HAPs are also volatile organic compounds, and therefore RPC sources in Ohio, in addition to controlling HAP emissions under MACT, may also be required to identify and install VOC control technology under BAT and RACT.

ACMA retained Environmental Compliance and Risk Management Inc. (ECRM) to evaluate whether RPC plants in Ohio at which all VOC sources comply with the RPC MACT would also satisfy the VOC control requirements. The attached report documents the findings and conclusions of the ECRM study.

Our petition is that, since the RPC MACT requires the highest feasible level of HAP reduction for affected operations, and virtually all VOCs from such sources are HAPs, Ohio EPA should acknowledge in OAC 3745-21-09 that sources complying with the RPC MACT have met VOC RACT requirements. This would avoid needless site-specific RACT determinations and would also properly recognize MACT as providing BAT for affected Ohio sources.

I will contact Bill Juris next week to see if you have any comments or questions regarding this petition. We would be pleased to meet with your staff in Columbus to further explain our analysis and why granting our request would provide important benefits to both your agency and the industry.

Thank you for considering this petition.

Sincerely,

John Schweitzer
Senior Director of Government Affairs
jschweitzer@acmanet.org
phone (734) 622.0162

cc: bill.juris@epa.state.oh.us
edward.kitchen@epa.state.oh.us
bhills@jcarr.state.oh.us

attachment: “Reinforced Composites NESAP vs. Cost-Based Control Technology Requirements For Voc In Ohio: Evaluation Of Technical Equivalence,” Environmental Compliance & Risk Management Inc., December 2006

REINFORCED COMPOSITES NESHAP VS COST-BASED CONTROL TECHNOLOGY REQUIREMENTS FOR VOC IN OHIO: EVALUATION OF TECHNICAL EQUIVALENCE

Prepared for

American Composites Manufacturers Association

Prepared by

David J. Lipiro
Principal Consulting Scientist
Environmental Compliance & Risk Management Inc.

December 2006

ECRM

409 Woodside Drive
Sagamore Hills, OH 44067
216-215-3921
dlipiro@ecrminc.com

Executive Summary

On April 21, 2003, EPA published a “Maximum Achievable Control Technology” (“MACT”) standard limiting emissions of organic hazardous air pollutants (“HAPs”) from reinforced plastic composites (RPC) production (40 CFR 63 Subpart WWWW) 68 Fed. Reg. 19375. This rule regulates an estimated 40-50 sources in Ohio.

Emitted HAPs are also Volatile Organic Compounds (VOC) that contribute to ozone formation. Accordingly, RPC sources in Ohio may also be required to identify and install VOC control technology deemed cost-effective under regulatory programs specifying two levels of control: BAT and RACT.

The American Composite Manufacturers Association retained Environmental Compliance and Risk Management Inc. (ECRM) to evaluate whether RPC plants in Ohio at which all VOC sources comply with the RPC MACT would also satisfy these VOC requirements. This report documents the findings and conclusions of that study, which are summarized below.

1. The technology evaluation procedure EPA used to set MACT for the reinforced plastic composites industry addressed the essential factors on which well-founded VOC control technology decisions in Ohio will depend.

2. That evaluation enabled EPA to identify two distinct MACT classes within the industry: those few sources for which add-on control is achievable in practice, and the majority for which it is not. As MACT for the latter class, EPA selected pollution prevention (P2), including modification of raw materials, equipment, and work practices.

3. For MACT-affected RPC operations, virtually all VOC emissions are the unreacted HAP monomers styrene and MMA. Hence HAP reductions under the RPC MACT are equivalent to VOC reductions.

4. For RPC operations where P2 was selected as MACT, EPA determined the average HAP control cost per ton ranged from $12,551 to $70,416, and the incremental cost of controls over P2 ranged from $13,093 to $137,096. These are too high for controls to qualify as BAT or RACT in Ohio by any reasonable standard. Case studies not only corroborate EPA estimates, but also indicate that controls would be unaffordable and would have excessive adverse noneconomic impact.

5. Since the RPC MACT requires the highest feasible level of HAP reduction for affected operations, and virtually all VOCs from such sources are HAPs, Ohio EPA should acknowledge in OAC 3745-21-09 that sources complying with the RPC MACT have met VOC RACT requirements. This would avoid needless site-specific RACT determinations and would also properly recognize MACT as providing Best Available Technology (BAT) for affected Ohio sources.

Introduction

On April 21, 2003, EPA published a “Maximum Achievable Control Technology” (“MACT”) standard limiting emissions of organic hazardous air pollutants (“HAPs”) from reinforced plastic composites (RPC) production (40 CFR 63 Subpart WWWW) 68 Fed. Reg. 19375. This rule regulates an estimated 40-50 sources in Ohio.

Emitted HAPs are also Volatile Organic Compounds (VOC) that contribute to ozone formation. Accordingly, RPC sources in Ohio may also be required to identify and install VOC control technology deemed cost-effective under regulatory programs specifying two levels of control: BAT and RACT. Ohio EPA (OEPA) is currently revising these programs to meet Federal requirements, and to streamline Ohio’s air permitting process.

The American Composite Manufacturers Association (ACMA) is working with OEPA on rule revisions affecting the RPC industry, and has retained Environmental Compliance and Risk Management Inc. (ECRM) to develop relevant information for the agency on RPC emission control. Specifically, this report evaluates whether RPC plants at which all VOC sources comply with the RPC MACT would also satisfy these Ohio VOC control requirements.

This report first presents a brief overview of the reinforced plastic composites industry, processes and emission sources. The derivation of the RPC MACT is then explored in detail, including the HAP control evaluations developed by EPA. BAT and RACT requirements are next summarized and the associated VOC control analyses are compared to those developed by EPA to set MACT. On that basis, ECRM recommends revisions to OEPA rules that will satisfy Federal VOC requirements and promote efficient permitting for RPC sources.

Reinforced Plastic Composites Production: a Regulatory Overview

Processes Regulated

Reinforced plastic composites (RPC) consist of fibrous or bulk reinforcement that provides strength and plastic matrix that binds and protects the reinforcement. Fiberglass is by far the dominant fibrous material used as reinforcement, though the use of plastic, carbon fiber and natural fibers is expanding. Reinforcement may be incorporated within products in three forms: as randomly oriented chopped fibers, woven cloth, or fiber bundles (roving). Plastic matrix is formed from the curing (chemical reaction) of liquid resin mixture, which contain a blend of resins (unconnected plastic subunits), monomers (connecting links between subunits), and various agents that promote curing and affect the properties of the resin mix. During the curing process, the resins polymerize (connect through monomer crosslinks) to form a tough solid plastic.

The RPC industry produces finished goods ranging from small handheld parts to room-sized structures. Based on survey data published by ACMA, in 2004 there were approximately 150 RPC facilities in Ohio employing approximately 11,000 workers and generating $1.4 billion in direct revenue. The market for composites is expanding due to their low weight, high strength, and durability. A wide variety of production processes are employed, which may be classified as follows.

- <u>Mixing</u> of resins with fillers and other ingredients to form resin paste formulations, and bulk molding compound (BMC) for production.
- <u>Sheet molding compound (SMC) production</u>, where resin paste is combined with fiber reinforcement sandwiched between impervious carrier films in specialized linear compounding machines.
- <u>Closed Molding</u> of SMC and BMC in compression or injection presses.
- <u>Open Molding</u>, where reinforcement and resin mix are applied to a mold either by hand or by spray gun. For many parts, a gelcoat resin layer is first sprayed onto the mold to produce a smooth part surface. There are many processes under this category.
- <u>Pultrusion</u>, where reinforcement is continuously pulled through a resin bath and a closed die to form linear parts of constant cross-section.
- <u>Hybrid Processes</u>, such as continuous casting/lamination, centrifugal casting, polymer casting, and resin transfer molding, which share characteristics of mixing, open molding and closed molding.

Emissions and Sources of Interest

All RPC processes emit a portion of the monomers contained in liquid resin mixtures. The primary monomer is styrene, although some processes also employ methyl methacrylate (MMA). Each of these monomers is classified and regulated under the Clean Air Act as both a Hazardous Air Pollutant (HAP) and a Volatile Organic Compound (VOC). Hence RPC production plants may be required to reduce monomer emissions under distinct regulations targeting each type of pollutant.

A common theme of these regulations is that they either specify or require determination of a minimum level of emission control technology to be employed. Such technology may involve an end-of-pipe system to capture and destroy pollutants from downstream processes, but may also include *pollution prevention* (P2) measures - material content, application, and/or operating standards - that reduce pollutants at the source. Of concern here for plants in Ohio are three such levels of control that may be imposed, which will be identified here and discussed further in proceeding report sections. As HAP sources, RPC processes may be subject to recently promulgated Maximum Achievable Control Technology (MACT) standards. As VOC sources, they must implement at least Best Available Technology (BAT), and may be required to install Reasonably Available Control Technology (RACT).

At any RPC plant, the source subject to these control technology requirements may be an individual process unit, a group of units installed or modified as a common project, or the entire plant itself. Of interest here are sources subject to a VOC control technology level that are also subject to the RPC MACT standards. <u>Specifically, would such sources complying with RPC MACT also meet the applicable VOC control level?</u> To answer this question, we must first understand how the RPC MACT standards were developed.

Derivation of RPC MACT Requirements

The Clean Air Act requires the United States Environmental Protection Agency (EPA) to regulate “major” emission sources of 189 listed hazardous air pollutants (HAPs). A major source is one with the potential to emit more than ten tons a year of any one HAP, or more than 25 tons a year of all HAPs taken together. EPA has divided HAP emitters into source categories, for which the agency must issue MACT standards to reduce HAP emissions. EPA further divides these categories into subcategories where that is necessary to reflect technical differences. EPA designated the RPC industry as an affected source category due to emissions of the HAP monomers styrene and methyl methacrylate.

EPA is required to set MACT at levels that reflect the status of well-controlled industry sources at the time of rulemaking. Accordingly, EPA compiled an affected source database for the RPC industry to identify the *MACT floor:* the minimum allowable level of control that may be set as MACT. By "control" we really mean "reduction." Pollution prevention measures that reduce HAP emissions at the source are MACT candidates, and must be considered along with add-on controls.

The MACT floor was set differently for facilities where RPC sources were in existence when the MACT standard was proposed (*existing* sources), and for facilities where construction of their first RPC sources began after that date (*new* sources). The MACT floor for existing sources is the average level of control achieved by the best 12% of sources in the relevant category or subcategory. The MACT floor for new sources is set irrespective of cost at the level of the best-controlled "similar" source.

The MACT floors represent minimum stringency, but EPA always considers further HAP reductions "above the floors" based on a comprehensive analysis of technical feasibility, cost, affordability and adverse noneconomic impacts. After performing this analysis, EPA concluded that above-floor requirements could not be justified for any sector of the RPC industry, and therefore set MACT in the final rule [1] at the subcategory floors. Table 1 below summarizes MACT requirements for the primary source sectors of concern here.

Table 1: MACT STANDARDS FOR PRIMARY RPC INDUSTRY SECTORS

Sector Subcategory	Existing Sources	New (Greenfield) Sources	
		Actual emissions < 100 TPY across all Subcategories except Closed Molding	Actual Emissions >= 100 TPY across all Subcategories except Closed Molding
Open Molding	Reduce average emissions per ton of resin applied by changing materials used, application equipment, and/or work practices	Same as existing source MACT	Same as existing source MACT (large parts only), 95% capture and control otherwise
SMC Production	Close resin delivery system, use nylon-containing carrier film	Same as existing source MACT	95% capture and control
Pultrusion	Reduce emissions by 60% average by enclosures, resin injection, or airflow management (large parts)	Same as existing source MACT	Airflow management (large parts only), 95% capture and control otherwise
Mixing of Pastes and BMC	Install MACT-compliant covers, restrict active venting	Same as existing source MACT	95% capture and control
Closed Molding (Injection /Compression)	Leave no more than one mold charge uncovered at any time	Same as existing source MACT	Same as existing source MACT

There is really no doubt that reduction of VOC emissions by 95%, the highest technically feasible level for any RPC source, would satisfy all control requirements of concern here. Less obvious is the status of those sources that comply with MACT through pollution prevention rather than add-on controls; hence these *P2-MACT sources* are the primary subjects of this paper.

As previously noted, VOC rules set the procedures and criteria used by affected sources to identify the corresponding VOC reduction (control level) that must be provided. Accordingly, we will consider P2-MACT to be technically equivalent to a given VOC control level (BAT, or RACT) if the procedures and criteria used by EPA to identify MACT conform to the procedures and criteria required of sources to set the VOC control level, and yield the same endpoint.

EPA Analysis of Controls above the Existing MACT Floors

EPA followed a standardized methodology used by its Office of Air Quality Planning and Standards (OAQPS) to evaluate the feasibility and cost-effectiveness of alternative control scenarios.

Candidate emission reduction measures were identified. The floor evaluation determined that various P2 measures had been employed in the industry, and that regenerative thermal oxidizers (some fronted by concentrators) had been installed at several plants. Scrubbing/absorption, condensation, carbon canisters, and catalytic oxidation were also considered, since they have been employed in other industries.

Technically infeasible measures were eliminated. Scrubbing/absorption and condensation were eliminated due to low operating efficiencies on styrene-laden exhaust streams. Carbon canisters and catalytic oxidation were eliminated due to operability and safety issues caused by the high reactivity of styrene.

Annual costs were estimated for the two remaining feasible alternatives. The factored cost estimate procedure of the OAQPS Control Cost Manual was used to determine the capital cost of each measure, and the annual operating cost. Equipment was sized based on model facilities developed by EPA for each source subcategory. [EPA modified these models after rule proposal based on additional cost data submitted by ACMA.] The capital cost was annualized based on appropriate factors for assumed service life of equipment, and the annualized capital cost and annual operating cost were summed to estimate the total annual cost Cc for controls and Cp for P2. For controls, EPA assumed that regenerative thermal oxidizers would be fronted by concentrators in all cases. For the P2 floor options, EPA relied on data provided by material and equipment suppliers.

Cost-effectiveness of feasible options was determined in two ways. For P2 and control in each subcategory, the tons of emissions reduced Rp and Rc were determined. The *average cost* of each option was calculated as Cp/Rp and Cc/Rc respectively. The *incremental cost* was then calculated as (Cc-Cp)/(Rc-Rp), representing the additional cost per additional ton reduced by installing above-floor controls rather than P2.

The results of this analysis are summarized below.

Table 2: COST-EFFECTIVENESS OF CONTROL AND POLLUTION PREVENTION FOR THE RPC INDUSTRY

	MACT Floor: Pollution Prevention (P2)				**95% Control via PTE, Concentrator and RTO**			**INCREMENTAL: CONTROL VS P2**		
INDUSTRY SUBCATEGORY	P2 Measures	HAP Reduced, Rp tons/yr	Annual Cost, Cp $/yr	Average Cost, Cp/Rp $/ton	HAP Reduced, Rc tons/yr	Annual Cost, Cc $/yr	Average Cost, Cc/Rc $/ton	Net Reduction, NR = Rc-Rp tons/yr	Net Cost, NC = Cc-Cp $/yr	Incremental Cost, IC = NC/NR $/ton
Open Molding	Reduce average emissions per ton of resin applied by changing materials used, application equipment, and/or work practices	5,916.7	$18,317,266	$3,096	13,973.9	$175,381,844	**$12,551**	8,057.2	$157,064,578	**$19,494**
SMC Production	Close resin delivery system, use nylon-containing carrier film	0.0	$12,916	NA	282.5	$5,312,112	**$18,804**	282.5	$5,299,196	**$18,758**
Pultrusion	Reduce emissions by 60% average by enclosures, resin injection, or airflow management (large parts)	127.8	$312,746	$2,447	258.0	$18,170,677	**$70,416**	130.3	$17,857,931	**$137,096**
Mixing of Pastes and BMC	Install MACT-compliant covers, restrict active venting	164.2	$489,295	$2,980	408.2	$13,618,276	**$33,360**	244.1	$13,128,981	**$53,796**
Closed Molding (Injection /Compression)	Leave no more than one mold charge uncovered at any time	0.0	$55,852	NA	401.5	$13,618,276	**$33,921**	401.5	$13,562,424	**$33,782**

All data above are taken directly from the final MACT Docket [11] except the average and incremental costs derived for closed molding. For existing closed molding sources, EPA did not assess control costs.

Capture of emissions from large heated closed molding presses would require air-conditioned building or room enclosures, and on this basis could be considered technically infeasible. In Table 2, control of presses was assumed to be feasible, and the cost was assumed equal that of paste and BMC mixers, which is very conservative given relative ease in which small unheated mixers can be enclosed. Emissions for the closed molding subcategory are given in the MACT database as 422.6 TPY, from which the control reduction was calculated. Conservatively, no emission reduction was credited for P2.

EPA considered options with average costs below $5,000/ton to be clearly cost-effective, and those with average costs above $10,000/ton to be clearly not. Options with intermediate average costs will usually be deemed not cost effective unless incremental costs are reasonable. But that was not a consideration here: all average costs of control easily exceeded $10,000/ton, so above-floor control was rejected and EPA set MACT at the P2 floors.

VOC Control Technology Rules

Best Available Technology under Ohio Permitting Rules

OAC 3745-31 governs the issuance of permits to install air emission sources in Ohio. Per section 31-05.A.3, one criterion for construction approval is that the source employ Best Available Technology (BAT) as applicable to reduce criteria pollutants or their precursors (such as VOC). In 31-01(T) BAT is defined as *"… any combination of work practices, raw material specifications, throughput limitations, source design characteristics, an evaluation of the annualized cost per ton of air pollutant removed, and air pollution control devices that have been previously demonstrated to the director of environmental protection to operate satisfactorily in this state or other states with similar air quality on substantially similar air pollution sources."*

OEPA exercises broad discretion in BAT determinations. For sources of HAP that are also VOC, the agency considers BAT to be employed for VOC if the source complies with all applicable requirements affecting VOC, including relevant MACT standards. For others, the agency requires a control cost analysis. Note that 31-05(B) specifically authorizes OEPA to consider adverse social, economic, and environmental impacts when issuing permits.

The control cost analysis procedures used by OEPA are set forth in Engineering Guide 43, Guidance for Estimating Capital and Annual Costs of Air Pollution Control Systems (1983). The procedures are essentially identical to those used by EPA during evaluation of controls during promulgation of the RPC MACT standard, except that EPA used updated cost factoring methods. EPA also conducted a thorough evaluation of affordability and adverse noneconomic impacts of all MACT options considered.

Reasonably Available Control Technology

Reasonably Available Control Technology (RACT) is defined in the General Preamble-Supplement published at 44 FR 53761 (September 17, 1979) as "the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available, considering technological and economic feasibility." Sections 182(b)(2) and (f) of the Clean Air Act require states to implement RACT for all major VOC (and NOx) sources in nonattainment areas (moderate or worse) and ozone transport regions. For many source categories (but not RPC), EPA developed VOC control guidance generally taken as presumptive RACT.

OEPA RACT standards for various industries are set forth in OAC 3745-21-09. These reflect RACT for source categories where sufficient information was available to establish requirements. Because at the time this rule was issued there was no basis for presumptive RACT in the RPC industry, such requirements are not included in the current rule.

For all other sources required originally to install RACT, OAC 3745-21-11 first required a comprehensive study of alternative control measures to determine feasible RACT, which was then imposed as a site-specific requirement under OAC 3745-21-09. The RACT determination employed the same top-down analysis of cost-effectiveness as does the BAT rule, though the feasibility threshold may be different. However, RACT determinations consider all sources at the plant, whereas BAT determinations consider only the sources seeking construction approval at the time.

Under the new ambient air quality standard for ozone, northeast Ohio has been redesignated a moderate nonattainment area. Accordingly, OEPA is now revising both RACT rules to expand RACT coverage. For affected RPC plants, RACT could be imposed either explicitly for the source category under revised 21-09, or through RACT determinations required under revised rule 21-11, with selected RACT for each plant being incorporated under 21-09.

In the Preamble for rules implementing the new ozone standard (70 FR 71216), EPA provided this guidance on the use of MACT evaluations to support RACT rulemakings:

For VOC sources subject to MACT standards, States may streamline their RACT analysis by including a discussion of the MACT controls and relevant factors such as whether VOCs are *well controlled under the relevant MACT air toxics standard, which units at the facility have MACT controls, and whether any major new developments in technologies or costs have occurred subsequent to the MACT standards. …We believe that, in many cases, it will be unlikely that States will identify emission controls more stringent than the MACT standards that are not prohibitively expensive and are thus unreasonable. We believe this will allow States, in many cases, to rely on the MACT standards for purposes of showing that a source has met VOC RACT [70 FR 71255].*

Is the RPC industry one such case where MACT standards may be relied upon to set a categorical RACT standard under 21-09? Clearly control costs have not markedly changed since the RPC MACT was developed. Therefore, the critical issue is whether the technology evaluation under MACT was equivalent to that required to set RACT.

Equivalence of Technology Determinations

As noted, we will consider the subject technology determinations to be equivalent if the essential elements of each are similar, the selection criteria are consistent, and the results are the same.

Both VOC rules require an initial evaluation of candidate emission reduction options. Based on process knowledge and review of measures already employed at other facilities, these rules require that technically infeasible options be eliminated from further consideration. This is exactly the process EPA used to develop the RPC MACT floors and above-floor control option.

Both VOC rules require a detailed analysis of the cost-effectiveness of technically feasible controls, with the most efficient reduction measure that is cost-effective being selected for further evaluation. This top-down methodology is exactly what EPA used to set RPC MACT standards, and the cost threshold adopted by EPA is consistent with that adopted by OEPA in evaluating VOC controls.

Both VOC rules allow affordability and noneconomic impacts to be considered. EPA expressly evaluated such factors for each selected option to ensure that the benefits of control were not excessively offset by other adverse impacts. This evaluation was summarized in the preamble to the MACT rule.

The only point of divergence between the subject determinations is that the MACT cost estimates were generated in part based on model plants developed by EPA, whereas under the VOC rules site-specific estimates are required. How well do EPA's model plants represent actual industry practice? To answer that question, we consider available data from open molding plants.

Open molding was the subcategory with the lowest average and incremental costs per ton. Since these sources represent the strongest case EPA could muster for add-on control above the P2 floor, it is instructive to examine cost and noneconomic impact data developed for individual open molding plants.

Exhibits 1-6 at the end of this report summarize data presented to EPA by ACMA (then CFA) from References 2-5. These citations are reports commissioned by ACMA to develop and compare site-specific information on the true cost and impact of control versus pollution prevention at representative plants. Control cost data [2] and noneconomic impact data [4] were developed for 18 facilities. For a representative subset of six of those, the benefit, and cost of pollution prevention was projected [3](study of all 18 sites could not be completed within time and budget available). This enabled an evaluation of the incremental (net) benefit and impact of control over P2 at these six sites [5]. Net adverse impacts were then divided by the net benefit to determine the additional impact per ton of additional emission reduction provided by control over P2. If capture and control reduces emissions by B_c TPY at impact I_c, and P2 reduces emissions by B_p TPY at impact I_p, then:

- Net impact $I_n = I_c - I_p$
- Net benefit $B_n = B_c - B_p$, net tons reduced
- Net impact per net ton reduced (incremental impact) $I_i = I_n/B_n$

Exhibit 3 presents this analysis for two control levels. Level 2 includes all RPC sources at each facility at maximum feasible capture efficiency. Level 1 represents a more economical partial control scenario at the five facilities where partial control was deemed feasible. Five incremental impact measures were evaluated:

- Cost (I_i here is equivalent to incremental cost-effectiveness)
- Electricity Usage
- Natural Gas Usage
- Greenhouse Gas (GHG) Emissions (total of direct from oxidizers and indirect from fuel and electricity production to run oxidizers).
- Criteria Pollutant (CP) Emissions (total of direct and indirect emissions of nitrogen oxides, sulfur dioxide, carbon monoxide, and particulate matter)

Let us first compare control costs. EPA concluded that the average cost of open molding control was $12,551/ton vs $3,096/ton for P2, very close to the corresponding Level 2 values of $12,359/ton and $3,359/ton for the six plants above. The EPA incremental cost of $19,494/ton was lower than the corresponding six-plant average of $41,008 because EPA assumed that 100% capture was technically feasible in the model plant, which was not true at the actual plants.

EPA did not build models corresponding to Level 1. For the five plants where Level 1 was feasible, the average cost of control was $16,757/ton, the average cost of P2 was $3,472/ton, and the incremental cost of control over P2 was $64,112.

EPA did not evaluate affordability of controls or noneconomic impact data specific to existing open molding plants, since controls were eliminated on economic grounds. A separate study of these plants [6] determined that such costs would not be affordable anyway; they could not be absorbed and would force the closure of affected facilities.

The incremental noneconomic impact of control over P2 at the case study plants is summarized in the following table. Incremental Impact (I_i) values are the averages across all plants.

Impact Measure	Level 1 I_i	Level 2 I_i
Electricity, KWHr	125,600	106,682
Natural Gas cf	1,814,756	369,966
GHG Emissions, tons	1,209	332
CP Emissions, tons	2.1	1.3

Values of I_i for each of the impact measures reflect the true unit "price" of additional control reductions. So on average for Level 2 (maximum control), each ton of further reduction gained by installing controls instead of P2 will consume 106,682 KWHr of electricity and 369,966 cf of fuel gas, and will cause the emission of 332 tons of greenhouse gases and 1.3 tons of criteria pollutants. It is clear that the adverse noneconomic impacts of control more than negate the benefit at these six plants.

In summary, EPA concluded based on cost-effectiveness at a model plant that above-floor controls of open molding could not be justified. That conclusion is certainly supported by the above analysis of these six plants. If any of them were located in Ohio, it is clear that controls could not be justified as either BAT or RACT.

These results suggest that the most efficient way to impose BAT and RACT on RPC sources in Ohio is through rules specifying the equivalence of BAT and RACT to MACT. Given that revised RACT rules must soon be issued, OEPA should first add a new section to revised 21-09 stating that all RPC operations complying with the RPC MACT are providing RACT for VOC.

Summary of Conclusions

The following conclusions apply to facilities in Ohio where the “project” of concern consists of VOC emission units affected by the Reinforced Plastic Composites MACT rules.

1. The technology evaluation procedure EPA used to set MACT for the reinforced plastic composites industry addressed the essential factors on which well-founded VOC control technology decisions in Ohio will depend.

2. That evaluation enabled EPA to identify two distinct MACT classes within the industry: those sources for which a 95% emission reduction via add-on control is achievable in practice, and those for which it is not. EPA selected 95% control as MACT for the former class, and pollution prevention (P2) for the latter. P2 measures adopted include modification of raw materials, equipment, and work practices.

3. For MACT-affected RPC operations, virtually all VOC emissions are the unreacted HAP monomers styrene and MMA. Hence HAP reductions under the RPC MACT are equivalent to VOC reductions.

4. EPA rejected control as infeasible based primarily on adverse cost-effectiveness, especially when compared to P2. For RPC operations (subcategories) where P2 was selected as MACT, EPA determined the average HAP control cost per ton ranged from $12,551 to $70,416, and the incremental cost of controls over P2 ranged from $13,093 to $137,096. These are equivalent to VOC control costs, and are too high for controls to qualify as BAT or RACT in Ohio by any reasonable standard.

5. Case studies of six open molding plants corroborate EPA conclusions for maximum control scenarios, and indicate that cost- effectiveness will be worse (higher) under partial control scenarios. These studies also determined that controls would not be affordable at any plant, and that noneconomic impacts of controls would be excessive.

6. Since the RPC MACT requires the highest feasible level of HAP reduction for affected operations, and virtually all VOCs from such sources are HAPs, Ohio EPA should acknowledge in OAC 3745-21-09 that sources complying with the RPC MACT have met VOC RACT requirements. This would avoid needless site-specific determinations that might otherwise be required under newly revised OAC 3745-21-11. It would also properly recognize MACT as providing Best Available Technology (BAT) for affected Ohio sources.

References

1. National Emissions Standard for Hazardous Air Pollutants: Reinforced Plastics Composites Production, 40 CFR 63 Subpart WWWW, Federal Register Vol 68 No. 76, April 21, 2003
2. Haberlein, R.A. "Feasibility and Cost of the Capture and Control of Hazardous Air Pollutant Emissions from the Open Molding of Reinforced Plastic Composites." EECS, April 2000 (in MACT docket).
3. Lacovara, R. et al. "Composite Industry Facility Examples: Effect of Pollution Prevention Implementation." Composite Fabricators Association, April 2000 (in MACT docket).
4. Lipiro, D.J. "Non-Economic Impacts on the Reinforced Plastic Composites Industry of Emission Control by Oxidation Systems." ECRM Inc, April 2000 (in MACT docket)
5. Lipiro, D.J. "Emission Control vs Pollution Prevention for Open Molding of Composites: Incremental Benefits and Impacts." ECRM Inc. May 2000 (in MACT Docket)
6. MACT for Reinforced Plastics Composites: Affordability at Facilities with 100-250 TPY of HAP Emissions That Are Owned by Large Businesses." Environomics, Inc., 2000
7. Carbon Dioxide Emissions from the Generation of Electric Power in the US. At www.eia.doe.gov/cneaf/electricity/page/other/co2report.html.
8. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual
9. Greenhouse Gases in the United States, Table 24. Report EPA/DOE - 0573, 1999. At www.eia.doe.gov/oiaf/1605/ggcompositest/tbl24.html.
10. Electric Power Annual 1998 Report Executive Summary, Vol II. At www.eia.doe.gov/cneaf/electricity/epa2/epa2_sum.html.
11. Docket A-94-52, Item IV-E-10, January 3, 2003

Exhibits

Exhibit 1

OPERATING CHARACTERISTICS OF COMPOSITES CASE STUDY PLANTS

Plant ID/ Market Sector/ Control Level		Exhaust Flow Rate CFM	Annual Operation Hrs/yr	Process Emissions TPY	Reduction Efficiency			Emission Reduction, TPY		
					Capture & Control	Pollution Prevention	Net [CC-P2]	Capture & Control	Pollution Prevention	Net [CC-P2]
Facility A	1	60,000	6,000	210	23%	15%	8%	48	32	16
Bathware	2	180,000	6,000	210	88%	59%	29%	185	124	61
Facility E	1	35,000	4,000	55	60%	25%	35%	33	14	19
Corrosion Resistant	2	107,000	4,000	55	85%	35%	50%	47	19	28
Facility G	1	62,000	4,000	100	22%	15%	7%	22	15	7
Custom Molding	2	240,000	4,000	100	74%	51%	23%	74	51	23
Facility J	1	78,000	2,500	80	27%	22%	5%	22	18	4
Transportation	2	175,000	2,500	80	73%	60%	13%	58	48	10
Facility L	1	19,000	7,800	116	10%	8%	2%	12	9	2
Transportation	2	200,000	7,800	116	74%	60%	14%	86	70	16
Facility O	1	…	…	…	…	…	…	…	…	…
Bathware	2	150,000	2,000	130	74%	59%	15%	96	77	20
	1	**50,800**	**4,860**	**112**	**28%**	**17%**	**11%**	**27**	**18**	**10**
AVERAGE	2	**175,333**	**4,383**	**115**	**79%**	**56%**	**24%**	**91**	**65**	**26**

References

Pollution prevention data from Lacovara, R et.al.; "Composite Industry Facility Examples: Effect of Pollution Prevention Implementation," CFA, April 2000

See Exhibit 4 for control system costs and energy usage
See Exhibit 5 for greenhouse gas estimates
See Exhibit 6 for criteria pollutant estimates

Exhibit 2

INCREMENTAL IMPACTS: CAPTURE & CONTROL VS POLLUTION PREVENTION

NOTE: 3.38 tons CO2 reduced per ton of styrene emissions prevented

Plant ID/ Market Sector/ Control Level		Annualized Cost			Electricity Usage, kwhr/yr			Natural Gas Usage, mmcf/yr			Greenhouse Gas Emissions, tpy			Criteria Pollutant Emissions, tpy		
		Capture & Control	Pollution Prevention	Net [CC-P2]	Capture & Control	Pollution Prevention	Net [CC-P2]	Capture & Control	Pollution Prevention	Net [CC-P2]	Capture & Control	Pollution Prevention	Net [CC-P2]	Capture & Control	Pollution Prevention	Net [CC-P2]
Facility A	1	$421,800	$90,510	$331,290	1,235,000	0	1,235,000	2.77	0	2.77	2,548	-109	2,658	12	0	12
Bathware	2	$1,062,600	$346,301	$716,300	3,706,667	0	3,706,667	5.25	0	5.25	5,786	-419	6,204	34	0	34
Facility E	1	$276,300	$56,785	$219,515	480,000.00	0	480,000	1.00	0	1.00	948	-46	994	4	0	4
Corrosion Resistant	2	$632,300	$80,446	$551,854	1,468,333	0	1,468,333	4.03	0	4.03	3,483	-65	3,548	14	0	14
Facility G	1	$381,400	$72,612	$308,788	425,000.00	0	425,000	1.70	0	1.70	1,337	-51	1,388	5	0	5
Custom Molding	2	$1,134,400	$244,239	$890,161	1,646,667	0	1,646,667	3.78	0	3.78	3,458	-172	3,630	18	0	18
Facility J	1	$483,200	$49,692	$433,508	670,000.00	0	670,000	3.40	0	3.40	2,546	-60	2,606	6	0	6
Transportation	2	$919,900	$134,352	$785,548	1,501,667	0	1,501,667	6.63	0	6.63	5,103	-162	5,265	14	0	14
Facility L	1	$312,900	$26,326	$286,574	635,000.00	0	635,000	16.93	0	16.93	10,819	-32	10,851	15	0	15
Transportation	2	$1,357,000	$194,810	$1,162,190	6,423,333	0	6,423,333	17.85	0	17.85	15,331	-235	15,566	58	0	58
Facility O	1															
Bathware	2	$768,500	$214,377	$554,124	2,060,000	0	2,060,000	1.67	0	1.67	2,447	-259	2,706	17	0	17
	1	**$375,120**	**$59,185**	**$315,935**	**689,000**	**0**	**689,000**	**5.16**	**0**	**5.16**	**3,640**	**-60**	**3,699**	**9**	**0**	**9**
AVERAGE	2	**$979,117**	**$202,421**	**$776,696**	**2,801,111**	**0**	**2,801,111**	**6.54**	**0**	**6.54**	**5,935**	**-219**	**6,153**	**26**	**0**	**26**

Exhibit 3

INCREMENTAL IMPACT PER TON REDUCED

Plant ID/ Market Sector		Annualized Cost Per Ton			Electricity Usage, kwhr/tr			Natural Gas Usage, cf/tr			Greenhouse Gas Emissions, ton/tr			Criteria Pollutant Emissions, ton/tr		
		Capture & Control	Pollution Prevention	Net	Capture & Control	Pollution Prevention	Net	Capture & Control	Pollution Prevention	Net	Capture & Control	Pollution Prevention	Net	Capture & Control	Pollution Prevention	Net
Facility A	1	$8,733	$2,795	$20,814	25,569	0	77,590	57,281	0	173,818	53	-3	167	0.2	0	0.7
Bathware	2	$5,750	$2,795	$11,762	20,058	0	60,865	28,409	0	86,207	31	-3	102	0.2	0	0.6
Facility E	1	$8,373	$4,179	$11,308	14,545	0	24,727	30,303	0	51,515	29	-3	51	0.1	0	0.2
Corrosion Resistant	2	$13,525	$4,179	$20,067	31,408	0	53,394	86,275	0	146,667	75	-3	129	0.3	0	0.5
Facility G	1	$17,336	$4,789	$45,159	19,318	0	62,154	77,273	0	248,617	61	-3	203	0.2	0	0.7
Custom Molding	2	$15,330	$4,789	$38,703	22,252	0	71,594	51,126	0	164,493	47	-3	158	0.2	0	0.8
Facility J	1	$22,370	$2,799	$112,700	31,019	0	174,181	157,407	0	883,903	118	-3	677	0.3	0	1.7
Transportation	2	$15,752	$2,799	$75,533	25,713	0	144,391	113,584	0	637,821	87	-3	506	0.2	0	1.4
Facility L	1	$26,974	$2,799	$130,582	54,741	0	289,347	1,459,770	0	7,715,928	933	-3	4,944	1.3	0	7.0
Transportation	2	$15,808	$2,799	$71,563	74,829	0	395,525	207,945	0	1,099,138	179	-3	958	0.7	0	3.6
Facility O	1															
Bathware	2	$7,989	$2,795	$28,417	21,414	0	105,641	17,325	0	85,470	25	-3	139	0.2	0	0.9
	1	**$16,757**	**$3,472**	**$64,112**	**29,039**	**0**	**125,600**	**356,407**	**0**	**1,814,756**	**239**	**-3**	**1,209**	**0.4**	**0**	**2.1**
AVERAGE	2	**$12,359**	**$3,359**	**$41,008**	**30,782**	**0**	**106,682**	**84,111**	**0**	**369,966**	**74**	**-3**	**332**	**0.3**	**0**	**1.3**

Exhibit 4

CONTROL SYSTEMS FOR COMPOSITES CASE STUDIES

Plant ID/ Market Sector/ Control Level		Total Annual Cost	Exhaust Flow Rate CFM	Annual Operation Hrs/yr	Average Concentration ppmv	Total Emissions TPY	Capt & Cntl Efficiency %	Reduced Emissions TPY	Electricity Usage Kwh/yr	Natural Gas Usage MMCF
Facility A	1	$421,800	60,000	6,000	19	210	23%	48	1,235,000	2.77
Bathware	2	$1,062,600	180,000	6,000	32	210	88%	184	3,706,667	5.25
Facility E	1	$276,300	35,000	4,000	32	55	60%	33	480,000	1.00
Corrosion Resistant	2	$632,300	107,000	4,000	15	55	85%	47	1,468,333	4.03
Facility G	1	$381,400	62,000	4,000	23	100	22%	22	425,000	1.70
Custom Molding	2	$1,134,400	240,000	4,000	21	100	74%	74	1,646,667	3.78
Facility J	1	$483,200	78,000	2,500	15	80	27%	21	670,000	3.40
Transportation	2	$919,900	175,000	2,500	18	80	73%	58	1,501,667	6.63
Facility L	1	$312,900	19,000	7,800	11	116	10%	12	635,000	16.93
Transportation	2	$1,357,000	200,000	7,800	8	116	74%	86	6,423,333	17.85
Facility O	1		…	…	…	…	…	…	…	…
Bathware	2	$768,500	150,000	2,000	44	130	74%	96	2,060,000	1.67

Note: Facility L has only an oxidizer for Level 1. All other Level 1 and all Level 2 systems were configured with concentrators feeding oxidizers

Control system data from Haberlein, R.A; Feasibility and Cost of the Capture and Control of Hazardous Air Pollutant Emissions from the Open Molding of Reinforced Plastic Composites, CFA, April 2000

Exhibit 5

GREENHOUSE GAS EMISSIONS
ATTRIBUTABLE TO OXIDIZER SYSTEMS

						CO2 Emissions				N2O Emissions (CO2 Equivalents)				Total GHG
						Primary at		Secondary at	NetTotal	Primary at		Secondary at	Total	
Plant ID	Cntrl Level	Exhaust Flow Rate CFM	Styrene Burned TPY	Electricity Usage Kwh/yr	Natural Gas Usage MMCF	3.38 lb/lb styrene TPY	1.23 lb/CFgas, TPY	1.352 lbs/kwhr, TPY	TPY	71.88 lb/MMCFs TPY	71.88 lb/MMCFg TPY	5.70E-03 lb/kwhr, TPY	TPY	TPY
A	1	60,000	48	1,235,000	2.77	162	1,697	835	2,531	13	0.1	4	17	2,548
	2	180,000	184	3,706,667	5.25	622	3,220	2,506	5,725	50	0.2	11	60	5,786
E	1	35,000	33	480,000	1.00	112	613	324	938	9	0.0	1	10	948
	2	107,000	47	1,468,333	4.03	159	2,473	993	3,466	13	0.1	4	17	3,483
G	1	62,000	22	425,000	1.70	74	1,043	287	1,330	6	0.1	1	7	1,337
	2	240,000	74	1,646,667	3.78	250	2,320	1,113	3,433	20	0.1	5	25	3,458
J	1	78,000	21	670,000	3.40	71	2,085	453	2,538	6	0.1	2	8	2,546
	2	175,000	58	1,501,667	6.63	196	4,068	1,015	5,083	16	0.2	4	20	5,103
L	1	19,000	12	635,000	16.93	41	10,384	429	10,813	3	0.6	2	6	10,819
	2	200,000	86	6,423,333	17.85	291	10,946	4,342	15,289	23	0.6	18	42	15,331
O	1	…	…	…	…	…	…	…	…	…	…	…	…	…
	2	150,000	96.2	2,060,000	1.67	325	1,022	1,393	2,415	26	0.1	6	32	2,447

CO2 primary emission factor calculated assuming all carbon is converted to CO2. Secondary emission factor from Ref . 19.
N20 primary emission factor (CO2 equivalent) : 0.1 kg/TJ (Ref. 20) x 2.2 lbs/kg x 1054 TJ/MMCFx 310 CO2/NOx equivalence (Ref 21)
N20 secondary emission factor : ((27,000 mtons/yr Ref. 21 x 2208)/(3240E9 kwhr/yr Ref. 22)) x 310 CO2/N2 5.70E-03

Above data presented in Lipiro, D.J.; " Non-Economic Impacts on the Reinforced
Plastic Composites Industry of Emission Control by Oxidizer Systems," CFA April 2000
The following references from that report are cited above:

Ref 19	Carbon Dioxide Emissions from the Generation of Electric Power in the US DOE
Ref 21	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual
Ref 22	Greenhouse Gases in the United States, Table 24. Report EPA/DOE - 0573, 1999.

Exhibit 6

CRITERIA POLLUTANT EMISSIONS ATTRIBUTABLE TO OXIDIZER SYSTEMS

						NOx			CO			SO2				PM10			TOTAL
Plant / Control Level	Annual Operation Hrs/Yr	Exhaust Flow Rate CFM	RTO Flow Rate CFM	Electricity Usage Kwh/yr	Fuel Gas Usage MMCF	Primary at 5 stack ppm TPY	Sec'y at 0.00446 lb/Kwhr TPY	Total TPY	Primary at 20 stack ppm, TPY	Sec'y at 0.00231 lb/kwhr TPY	Total TPY	Primary at 0.6 lbs/MMCF, TPY	Secondary at 181.98 lbs/MMCF, TPY	0.00765 lbs/kwhr, TPY	Total TPY	Primary at 2.5 lb/MMCF TPY	Sec'y at 2.28E-04 lb/kwhr TPY	Total TPY	TPY
A1	6,000	60,000	6,000	1,235,000	2.77	0.65	2.75	3.40	1.57	1.43	3.00	0.00083	0.25	4.73	4.98	0.0035	0.14	0.14	11.52
2	6,000	180,000	18,000	3,706,667	5.25	1.94	8.26	10.19	4.71	4.28	8.99	0.00158	0.48	14.19	14.67	0.0066	0.42	0.43	34.28
E1	4,000	35,000	3,500	480,000	1.00	0.25	1.07	1.32	0.61	0.55	1.16	0.00030	0.09	1.84	1.93	0.0013	0.05	0.06	4.47
2	4,000	107,000	10,700	1,468,333	4.03	0.77	3.27	4.04	1.87	1.69	3.56	0.00121	0.37	5.62	5.99	0.0050	0.17	0.17	13.76
G1	4,000	62,000	6,200	425,000	1.70	0.44	0.95	1.39	1.08	0.49	1.57	0.00051	0.15	1.63	1.78	0.0021	0.05	0.05	4.80
2	4,000	240,000	24,000	1,646,667	3.78	1.72	3.67	5.39	4.19	1.90	6.09	0.00114	0.34	6.30	6.65	0.0047	0.19	0.19	18.32
J1	2,500	78,000	7,800	670,000	3.40	0.35	1.49	1.84	0.85	0.77	1.62	0.00102	0.31	2.56	2.87	0.0043	0.08	0.08	6.42
2	2,500	175,000	17,500	1,501,667	6.63	0.78	3.35	4.13	1.91	1.73	3.64	0.00199	0.60	5.75	6.35	0.0083	0.17	0.18	14.30
L1	7,800	19,000	19,000	635,000	16.93	2.66	1.42	4.07	6.47	0.73	7.20	0.00508	1.54	2.43	3.98	0.0212	0.07	0.09	15.34
2	7,800	200,000	20,000	6,423,333	17.85	2.80	14.31	17.11	6.81	7.41	14.22	0.00536	1.62	24.58	26.21	0.0223	0.73	0.75	58.29
O1	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	….	…	
2	2,000	150,000	15,000	2,060,000	1.67	0.54	4.59	5.13	1.31	2.38	3.69	0.00050	0.15	7.88	8.04	0.0021	0.23	0.24	17.09

Emissions of NOx and CO are based upon assumed RTO exhaust concentrations reflecting typical modern RTO's properly operated. Primary SO2 and PM10 emissions are based upon AP-42 emission factors for small gas-fired industrial boilers. Secondary fuel gas SO2 emission factors are from AP-42 values for gas desulfurization, asssuming 90% of SO2 produced is recycled. Secondary PM10 emission factors are derived from AP-42 factors for fully controlled coal-fired utility boilers, assuming 30% thermal efficiency. Secondary electricity generation emissions of NOx, CO, and SO2 are derived from 1998 annual emissions data divided by 3240E9 total kWhrs power purchased annually (ref: Greenhouse Gases in the United States, Table 24. Report EPA/DOE - 0573, 1999.).

Above data presented in Lipiro, D.J.; " Non-Economic Impacts on the Reinforced Plastic Composites Industry of Emission Control by Oxidizer Systems," CFA April 2000