NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF AIR QUALITY
AIR PERMITS SECTION

PREVENTION OF SIGNIFICANT DETERIORATION
PRE-CONSTRUCTION REVIEW AND PRELIMINARY DETERMINATION

FOR

NOMACO, INC.
EDGECOMBE COUNTY
TARBORO, NORTH CAROLINA

THIS REVIEW WAS PERFORMED BY THE
AIR PERMITS SECTION
IN ACCORDANCE WITH NCDAQ REGULATION FOR PREVENTION
OF SIGNIFICANT DETERIORATION OF AIR QUALITY
15A NCAC 2D .0530 AND 2Q .0100

DRAFT

Mailing List

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OFFICIALS	County Manager Mr. Lorenzo Carmen 201 St. Andrew Street Tarboro, NC 27886 (252) 641-7833	Public Notice w/ Cover Letter
LIBRARY	Kim Webb Edgecombe County Memorial Library 909 Main St. Tarboro, NC 27886 (252) 823-1141	Preliminary Determination & Application
SOURCE	Mr. Gary Cunningham V.P. of Operations Nomaco, Inc. 501 NMC Drive Zebulon, North Carolina 27597	Preliminary Determination
EPA	Ms. Heather Abrams Air Permits Section U.S. EPA Region IV Sam Nunn Atlanta Federal Building Atlanta, Ga 30303-3104 (404) 562-9185	Preliminary Determination & Application
EPA	Mr. Bob Blaszczak BACT/LAER Clearinghouse OAQPS, MD-13 RTP, N.C. 27711	BACT Input Summary Sheet
RALEIGH REGIONAL OFFICE	Patrick Butler NCDAQ Air Quality Supervisor 3800 Barrett Dr Raleigh, NC 27609	Preliminary Determination & Application

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- Trinity Consultants, on behalf of Nomaco, Inc., submitted a Prevention of Significant Deterioration (PSD) application to the North Carolina Division of Environmental Management (NCDAQ), Air Quality Section (AQS) on September 13, 2007.

- The application was deemed complete for review purposes pursuant to 15A NCAC 2D .0530(r) on September 26, 2007.

- The applicant proposes to construct two new foam extrusion lines (**ID Nos. ES-26 and 29**). A PSD application was submitted in January 2004 for the construction of one new polyethylene foam extrusion line (**ID No. ES-26**). Nomaco has not constructed or operated the additional extrusion line as allowed in the approved January 2004 application. In addition to the newly proposed extrusion lines, this application also includes a re-evaluation of extrusion line (**ID No. ES-26**). As a result of the 2004 PSD application, Nomaco was given a long-term BACT limit for six extruders (**ID Nos. ES-21, 22, 23, 24, 26, and 27/28**) of 1,393 tons per year. The applicant has requested to subtract potential emissions for line **ES-26** from 1,393 tons per year and establish a new limit for **ES-26 and ES-29** combined. Therefore, the adjusted BACT limit on the five (5) existing extruders is 1152 tpy.

- The applicant is also requesting to modify ID Nos. for seven (7) extruders as follows:

  ES-21 is now ES-1365
  ES-22 is now ES-1377
  ES-23 is now ES-1390
  ES-24 is now ES-1402
  ES-26 is now ES-3960
  ES-27/28 is now ES-1411
  ES-29 is now ES-3961

- The facility is a major source under the definition contained in 40 CFR 51.166. The new lines will result in VOC emissions greater than the PSD significance levels.

- The facility is proposing to limit short-term and long-term VOC (isobutane) usage at the facility.

- The following "Best Available Control Technology" (BACT) emission limits and control techniques are proposed for the emission sources located at the facility:

Emission Source	Pollutant	Proposed BACT Limit	Proposed Control
Extruders (**ID Nos. ES-3960 and ES-3961**)	VOC	482 tpy of VOC (isobutane) usage and 0.6 pound per cubic foot of foam produced as measured each day	No add-on controls

1.0 INTRODUCTION

Nomaco, Inc., through Trinity Consultants, has submitted to the North Carolina Division of Air Quality (NCDAQ) a Prevention of Significant Deterioration (PSD) permit application for a modification of foam manufacturing facility in Tarboro, North Carolina.

This facility produces approximately 5.4 million pounds per year of low-density, closed cell thermoplastic (polyethylene) foam using an extrusion process that employs isobutane as a blowing agent. The following operations are currently located in the foam manufacturing area of the facility: five resin storage silos, two isobutane tanks, and five foam extrusion lines (**ID Nos. ES-1365, 1377, 1390, 1402, and 1411**). Production support equipment includes a reclaim operation consisting of one granulator and two densifiers.

In addition, there are several paint spray booths located on the property (**ID Nos. ES-S01 through ES-S02**). Another entity, Focal Point, and Nomaco jointly own these. The operations of Nomaco are completely separate from those of Focal Point with no products crossing from one entity's operation to the other's. However, due to the joint ownership, these booths must remain on the permit. As a historical note, in order to avoid PSD these booths are limited to the two-year average VOC emissions plus 40 tons per year, a total of 115 tons per year.

Nomaco is proposing to construct two new foam extrusion lines. The proposed project will increase volatile organic compound (VOC) emissions by more than the prevention of significant deterioration (PSD) threshold. Thus, the proposed project is subject to review and processing under the North Carolina Administrative Code, Title 15A, Sub-Chapter 2D, Section .0530 "Prevention of Significant Deterioration". The plant must also comply with other specific NCDAQ air pollution regulations where applicable.

Pursuant to the Federal Register notice on February 23, 1982, North Carolina has full authority by the Environmental Protection Agency (EPA) to implement the PSD regulations in the State effective May 25, 1982. Accordingly, the NCDAQ will conduct a full PSD review and process the PSD permit for the proposed modification.

In accordance with PSD requirements, Nomaco has conducted a best available control technology (BACT) analysis, additional impacts (soils, vegetation, visibility) analysis, and Class I area analysis.

The additional impacts and Class I area evaluations concluded that the proposed project will not cause adverse air quality impacts in the surrounding community or nearest Class I area.

1.1 Preliminary Determination

Nomaco's PSD application has been reviewed by the NCDAQ, Air Permits Section staff to determine compliance with the requirements of all NCDAQ air pollution regulations. New Source Review of the application was performed for the following categories:

- o Prevention of Significant Deterioration (PSD) including determination of Best Available Control Technology (BACT) with consideration of non-PSD regulated toxic pollutants, an air quality impact analysis, and an additional impact analysis on soils, vegetation, and visibility;

- o Compliance with the North Carolina Environmental Management Commission regulations Title 15A, North Carolina Administrative Code.

The NCDAQ, Air Permits Section staff has conducted its preconstruction review of the application and made a preliminary determination that the proposed project will comply will all applicable North Carolina Environmental Management Commission air pollution regulations including the PSD requirements. Therefore, the NCDAQ proposes to issue an air permit for the modification and operation of the Nomaco, Inc.'s foam manufacturing plant with specific permit conditions and emission limits. Preliminary preconstruction approval under the PSD requirements was contingent upon the following findings:

- A demonstration that National Ambient Air Quality Standards (NAAQS) will not be violated as a result of emissions from the proposed project.

- A demonstration that air emissions resulting from the proposed facility will not adversely impact any PSD Class I area.

- A demonstration the Best Available Control Technology is applied to each emission unit that will emit any amount of a significant pollutant, and

- A demonstration that emissions from the proposed project will neither cause adverse impacts to soils and vegetation nor cause degradation of visibility, and that economic growth associated with the project will not cause a significant increase in regional air pollutant levels.

The remainder of this report contains a review by NCDAQ of the requested demonstration and analyses presented by Nomaco, Inc. Sections 2 and 3 of this report present a general description of the proposed project and a description of the site location. Section 4 presents a regulatory analysis of the North Carolina and Federal air pollution regulations that apply to the project construction and operation. Section 5 contains the BACT analysis and Section 6 presents the results of the air quality analysis. The NCDAQ draft air permit is contained in Appendix A.

In addition to the regulatory analysis, the application must undergo adequate public participation. The NCDAQ solicits and encourages participation by the general public, industry, and other affected persons impacted by the proposed project. Specific public notice requirements and a thirty (30) day public comment period are required before the NCDAQ takes final action on this application. Appendix B contains a copy of the public notice.

2.0 GENERAL DESCRIPTION

2.1 Process Description

Existing Operations

Polyethylene pellets are transported to the plant via truck. A blower is used to transfer the pellets to on-site storage silos. The pellets are then transferred to individual blending stations via a closed-loop vacuum system. Polyethylene resin and other additives are mixed at the blending stations and fed to screw-type foam extruders. The resin is heated in the extruder to produce a homogeneous melt. The blowing agent, isobutane, is injected into the polymer via a high pressure metering system. A large revolving screw directs the melted resin toward a die to produce the desired shape of the final product. The product is then cooled using either water or air cooling methods, cut to size, printed with product specifications, and further cooled before being packaged and stored in a warehouse.

For solid waste minimization, Nomaco operates a reclaim operation area that consists of a granulator with a cyclone and two densifiers.

Proposed Modifications

The proposed modification will not alter the way in which raw materials are delivered to the plant and handled in the process, or how the foam is made. However, Nomaco is proposing to increase production at the Tarboro plant by adding two new foam extrusion lines.

For the reclaim operation, Nomaco expects no increase in particulate emissions. Most of the off-spec product at Tarboro is generated during start-up. After the proposed modification, Nomaco expects to see no change in the number of product changeovers

2.2 Emissions

Emissions from the Tarboro facility include volatile organic compounds (VOCs) generated due to dispersion of the blowing agent from the extruded foam as well as small amounts of particulate from the reclaim operation. The foam product typically retains a considerable amount of VOC (isobutane) used in the process, even after it leaves the facility. However, for regulatory applicability purposes, it has been conservatively assumed that one hundred percent (100%) of the isobutane used is actually emitted at some point within the facility boundary.

Isobutane is the only VOC constituent emitted from the Tarboro plant. No other hazardous or toxic air pollutant is used or emitted in the process. Most of the VOC is emitted from the extruded foam throughout the process line and curing area (see discussion below). Post modification emissions from the facility are estimated to be 1,634 tpy.

VOC Emission Characteristics and Distribution

The extrusion operations at the Tarboro facility are similar to those at Nomaco's Zebulon facility. Emissions of VOC from the Tarboro facility occur via several modes; releases from the process line and from the foam curing area (warehouse).

Releases along the process line constitute the largest share of VOC emissions at the facility. Based on internal measurements made by process engineering staff, Nomaco estimates that 30% of the isobutane injected (during production of the final foam product) is emitted along the process line. The remaining 70% is gradually lost either within the foam curing area or during transport of the product to the customer. If installed, extruder die exhaust vents release emissions for only for a small percentage of total equipment operating time, occurring when the process is in a startup mode after changing from one foam product to another. Because of this intermittent air release, the levels of VOC emissions from the extruder exhaust vents are very low. The following paragraphs explain the reason for Nomaco's intermittent air release pattern from the extruder die exhaust vents.

The foam extrusion lines are temporarily shutdown to allow for product changeover multiple times per week. These periods of shutdown are followed by a startup cycle that typically lasts thirty to forty-five minutes. However, if difficulties arise the startup period could last as long as one hour before high-quality, low-density foam is produced. Due to the delicate nature of low-density, closed cell polyethylene foam, several parameters (temperature, pressure, amount of gas, and air flow from vents) must be adjusted gradually throughout the startup cycle.

During approximately the first 15 minutes of the startup cycle, high temperature and pressure are used to lower the viscosity of the plastic in the extruder lines. A low amount of blowing agent (isobutane) is injected into the melted polymer resulting in the formation of inferior cellular structures. These inferior structures are incapable of capturing and retaining any significant amount of isobutane. As a result, the gas is allowed to escape as the off-spec product exits the extruder. This is the only point where the isobutane could be captured by an extruder die exhaust vent.

Over the next 30 minutes, the temperature and pressure are gradually lowered and the amount of isobutane is increased. After operating set points are reached, more of the isobutane is retained at the face of the die where the hood is located. Approximately 30% is released at the die when the set points are reached.

Once the desired product characteristics are achieved, it is imperative that airflow (from the corresponding exhaust vents) not be introduced anywhere near the newly forming foam. Significant airflow could potentially interfere with the production of low-density polyethylene foam according to desired specifications. Therefore, the vent hoods may be physically moved away from the extruder die head to prevent airflow that could deform the foam as it exits the extruder. The hoods are not providing much capture due to the low capture velocity. To introduce more capture velocity to achieve higher efficiencies would have negative impact on temperature stability, which is critical. Although isobutane is not released directly to the atmosphere once the desired foam product is being manufactured, isobutane emissions continue to occur from the downstream process line and curing area.

3.0 REGIONAL DESCRIPTION

3.1 Area Classification

The Nomaco facility is located in Tarboro in Edgecombe County, approximately 70 miles east of Raleigh. Air Quality in that area is classified with respect to the National Ambient Air Quality Standards (NAAQS) as listed below:

Pollutant	**Attainment Status**
Particulate	Attainment
Sulfur Dioxide	Attainment
Nitrogen Dioxide	Attainment
Carbon Monoxide	Attainment
Ozone	Attainment

The baselines for PM-10, NO_x, and SO_2 have been triggered for Edgecombe County. This area is considered a Class II area with allowable PSD increments for PM, SO_2, and NO_x emissions. There are no Class I areas within 50 kilometers of the plant site. The nearest Class I area, Swanquarter National Wildlife Refuge, is approximately 215 km from the facility.

4.0 REGULATORY ANALYSIS

The following discussion pertains to the regulatory requirements that must be met for the modification of the Nomaco, Inc. facility. These requirements include both federal Prevention of Significant Deterioration (PSD) regulations and State air quality regulations.

4.1 PSD Applicability and Required Analysis

The basic goal of the PSD regulations is to ensure that the air quality in clean (i.e. attainment) areas does not significantly deteriorate while maintaining a margin for future industrial growth. The PSD regulations focus on industrial facilities, both new and modified, that create large increases in the emission of certain pollutants. The EPA promulgated final regulations governing the Prevention of Significant Deterioration (PSD) in the Federal Register published August 7, 1980. Effective March 25, 1982, the North Carolina Division of Air Quality (NCDAQ) received full authority from the EPA to implement PSD regulations in the State.

Under PSD requirements all major new or modified stationary sources of air pollutants regulated and listed in this section of the Clean Air Act must be reviewed and approved prior to construction by the permitting authority. A "major stationary source" is defined as any one of 28 named source categories which has the potential to emit 100 tons per year of any regulated pollutant, or any other stationary source which has the potential to emit 250 tons per year of any PSD regulated pollutant. Nomaco, Inc. is a "major stationary source" for PSD purposes, therefore the emission increases as a result of this modification must be compared to the "significance levels" as listed in 40 CFR 51.166 (23)(i) to determine which pollutants must undergo a PSD review.

Because the proposed facility is considered a major stationary source, each pollutant with a "potential to emit" greater than the significance levels is subject to PSD review and must meet certain review requirements. Nomaco, Inc. performed the following reviews and analysis related to PSD for VOC:

1) A Best Available Control Technology (BACT) determination,

2) An Additional Impacts Analysis including effects on soils, vegetation, and visibility.

Under PSD regulations, the determination of the necessary emission control equipment is developed through a Best Available Control Technology review. BACT is defined, in pertinent part, by the Federal Register [40 CFR 51.166 (b)(12)] as:

An emissions limitation... based on the maximum degree of reduction for each pollutant... which would be emitted from any proposed major stationary source or major modification which the reviewing authority, on a case-by-case basis, taking into account energy, environment, and economic impacts and other costs, determines is achievable... for control of such a pollutant.

The BACT requirements are intended to ensure that the control systems incorporated in the design of the proposed facility reflect the latest control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the facility. Additionally, the BACT analysis may consider the impacts of non-criteria pollutants and unregulated toxic air pollutants, if any are emitted, when making the BACT decision for regulated pollutants. The pollutant subject to PSD review for Nomaco Inc.'s foam manufacturing facility are VOC's. A discussion of the BACT determination can be found in Section 5 of this document.

4.2 NCDAQ Air Pollution Regulations

In addition to the PSD requirements, the NCDAQ has promulgated air pollution control requirements under Title 15A NCAC Subchapter 2D and 2Q. Under the BACT requirements of the PSD regulations, all BACT emission limits must, at a minimum, comply with any applicable standard of performance under 40 CFR Parts 60 (New Source Performance Standards) and Parts 61 (National Emission Standards for Hazardous Air Pollutants), and the North Carolina State

Implementation (SIP) plan.

The NCDAQ emission control regulations that affect the proposed facility are summarized below:

Regulation	Affected Pollutant(s) or Emission Parameter	Regulatory Requirements
2Q .0101	All emissions sources	A permit is required for all sources of air emissions not specifically exempted
2D .0530	All PSD affected sources and PSD Pollutants	PSD review as a major modification is required
2D .0535	All emission sources	Emissions in excess of established permit limits that last for more than 4 hours require notification of the Director within 24 hours.
2D .0958	VOC emission sources	Work practice standards
2D .1806	Odorous emission sources	Requires control of objectionable odors

4.2.1 15A NCAC 2Q .0101 - Required Air Quality Permits

This regulation requires the owner or operator of all sources for which there is an ambient air quality or emission control standard, that is not exempted from permit requirements, to apply for an air quality permit. The owner or operator of a source required to have a permit shall not begin construction or operation of the source without first obtaining a permit. Neither the newly proposed Nomaco, Inc. extrusion lines nor the existing lines to be modified are exempted sources, and thus, Nomaco, Inc. is required to file an air permit application and obtain a permit prior to any construction of the source. Nomaco, Inc. has submitted the required application and information sufficient to obtain an air quality permit, including all information required pursuant to 15A NCAC 2D .0530 "Prevention of Significant Deterioration".

4.2.2 15A NCAC 2D .1806 - Control and Prohibition of Odorous Emissions

Under this regulation, no facility shall operate without employing suitable measures for the control of odorous emissions.

4.2.3 15A NCAC 2D .0530 - Prevention of Significant Deterioration

Because the plant is located in Edgecombe County, an attainment area for all NAAQS, the planned modification and its emissions are required to be assessed in light of PSD requirements. As part of the current permit application, Nomaco, Inc. is requesting the addition of two new extrusion lines (**ID Nos. ES-3960 and ES-3961**).

4.2.4 15A NCAC 2D .0535 - Excess Emissions Reporting and Malfunctions

This regulation applies to all permitted facilities and outlines the procedures of reporting excess emissions as a result of malfunctions or operational upsets. The facility owner/operator must notify the appropriate regional office of any excess emissions that last for greater than four hours. This report must be made within 24 hours of becoming aware of the occurrence.

4.2.5 15A NCAC 2D .0958 – Work Practices for Sources of Volatile Organic Compounds

This regulation establishes work practice standards for sources that emit VOC.

5.0 BEST AVAILABLE CONTROL TECHNOLOGY

Each pollutant subject to a Prevention of Significant Deterioration (PSD) review must meet the criteria of "Best Available Control Technology" (BACT) which refers to the maximum amount of emission reduction currently possible with respect to technical application and economic, energy, and environmental considerations. Since equipment within categories of sources vary widely, it is difficult to establish a uniform BACT determination for a particular pollutant or source. Economics, energy, and environment in combination with the unique functions of the source and engineering design, require BACT to be determined on a case-by-case basis. In most instances BACT may be defined through an emission limitation. In cases where this is impossible BACT can be defined by the use of a particular type of control device and its achievable emission reduction efficiency. In no event can a technology be recommended which would not comply with any applicable standard of performance under 40 CFR Part 60 and 61.

As a result of the EPA remand involving the North County Resource Recovery project in Region IX, the effects of non-regulated PSD pollutants, such as toxic air pollutants, may be accounted for in determining if the BACT otherwise being prescribed for a regulated pollutants still represents an appropriate level and type of control. There is no specific formula for making PSD decisions for unregulated pollutants; this is a case-by-case process involving the judgment of the reviewing authority. If the reviewing authority judges the potential environmental effects of such unregulated pollutants to be of possible concern to the public, then the final BACT decision for a regulated pollutant should address these efforts and reflect, as appropriate, the control technology beyond what might be otherwise chosen as BACT. In the case of Nomaco, Inc. there are no toxic pollutants to be concerned with.

The BACT analysis performed for Nomaco Tarboro included five basic steps. These are:

1) Identify all control technologies,
2) Eliminate technically infeasible options,
3) Rank remaining control technologies by control efficiencies,

4) Evaluate the most effective controls and document results, and

5) Select BACT

The first step in this approach is a comprehensive listing of control technologies for each applicable pollutant. Step two is a demonstration of technical feasibility to ensure the technology evaluated was appropriate for the characteristic gas stream to be treated. Step three ranks the remaining control technologies by control effectiveness, including the control efficiencies (percent of pollutant removed), expected emission rate (tons per year and pounds per hour), expected emission reduction (tons per year), economic impacts (cost effectiveness), environmental impacts (including emission of toxic or hazardous air contaminants), and energy impacts (benefits or disadvantages). Step four is a case-by-case evaluation of energy, environmental, and economic impacts. Step five requires the selection of BACT for the emission source.

The scope of this BACT analysis includes applicable control techniques for plastic foam production facilities in general, with particular consideration given to those precedents already established in the polyethylene and polypropylene manufacturing industry.

5.1 Equipment Examined and Operating Factors Considered in the BACT Analysis

Nomaco is proposing to modify its Tarboro facility by adding two new foam extrusion lines. The BACT analysis that is the subject of this report addresses all foam extrusion processes (existing and new) at the Tarboro facility. For this equipment, the analysis considered the feasibility of capturing VOC from each line and the reclaim area, and the typical VOC usage pattern for extrusion lines operated simultaneously.

Feasibility of Capturing VOC from Extrusion Lines

In evaluating the cost-effectiveness of controlling the five existing and two new extrusion lines, the BACT analysis considered the amount of VOC that can feasibly be routed to a control device. Tarboro’s extrusion process is similar to those of Nomaco’s other facility in Zebulon. In order to capture emissions at Tarboro, these hoods would first have to be installed.

If installed, the extruder exhaust vents only capture isobutane emissions during start-up mode (which lasts about one hour), meaning only a small amount of VOC from the extrusion process can be feasibly controlled. The following paragraphs explain why the intermittent release pattern characteristic of Tarboro's extrusion process affects the amount of VOC that can be ultimately controlled.

Operating conditions at Nomaco Tarboro are highly controlled to protect the quality of the final product. Before a final product can be extruded, the raw material polymer mixture must first undergo fluctuations in parameters such as temperature and pressure before the polymer has a stabilized cellular structure ready to capture the blowing agent. In the start-up mode, the process begins by heating the polymer to a high temperature (for about 15 minutes) to melt the pellets. There is very low solubility of isobutane in the polymer at this point since the viscosity of the polymer is so high. Since only a small fraction of isobutane is retained in the polymer at this stage, the extruder vent hoods capture the majority of the isobutane injected and flashed off.

During the next stage of the start-up mode (lasting about 30 minutes), the temperature is slowly decreased as the polymer becomes more stable and able to hold the gas in its structure. Once the foam reaches its ideal conditions, the polymer has a stable cell structure and retains approximately 70% of the isobutane. Because the final product is extremely sensitive to air flow, the vent hoods can be moved away from the die to prevent a strong draft at the die head. Any significant airflow during normal production deforms the foam product.

Thus, isobutane can only be vented during the one-hour start-up period when the process conditions for the raw materials are being adjusted so that the desired product can be made. Once the desired product is being made, the isobutane cannot be feasibly controlled because: (1) process exhaust vents no longer capture isobutane from the extruder die head, and (2) most of the isobutane is retained in the foam product at this stage.

Feasibility of Capturing VOC from the Reclaim Area

For solid waste minimization, Nomaco operates a reclaim operation area that consists of one granulator and two densifiers. The total amount of scrap produced is dependent on the annual production rate. The proposed rate is 7.9 million pounds of which an estimated 20 percent or 1.58 million pounds will be scrap. Of that total, 90 percent or 1.42 million pounds will be "foam" scrap having actually been injected with blowing agent. Approximately 7 percent of the foam scrap is comprised of isobutene and 50 percent of that is estimated to be lost prior to reclaim. Therefore, only 25 tons are available for "capture" at reclaim.

A cost analysis for the reclaim area was performed based on 25 tons per year of VOC removal and a regenerative thermal oxidizer. The cost effectiveness of an RTO was found to be more than $6,000 per ton removed.

Typical VOC Usage for Extrusion Lines Operated Simultaneously

The cost effectiveness of add-on control depends on the total amount of isobutane vented during the startup mode. This, in turn, depends on the total isobutane flowrate during the start-up mode and on the number of lines that can be started up simultaneously. The amount of isobutane injected varies throughout the overall extrusion process. During the first 15 to 30 minutes, a low isobutane flow is injected into the melted polymer. This isobutane flowrate is approximately 50 percent of the amount injected during production of the final product. For example, each single extrusion line utilizes approximately 20 kg/hr of isobutane for the final product and each tandem line uses approximately 36 kg/hr. Therefore, during the initial stages, the flowrate of the isobutane is reduced to about 10-18 kg/hr per line. The remainder of the hour is spent incrementally ramping up the isobutane flow rate to the final required value.

The maximum amount of isobutane directed to the control device depends on the maximum number of lines that can be started-up simultaneously. For this analysis, the facility assumes that all five lines are started up daily.

5.2 Previous BACT/LAER Determinations

An investigation was performed to identify current regulatory BACT/LAER determinations for plastic foam manufacturing operations. This review of NSR permit data identified 16 decisions involving facilities with polyethylene, polypropylene, or polystyrene foam manufacturing operations. Nine of BACT/LAER decisions identified thermal oxidation as the required control technique. Only four of these decisions were based on BACT; the other five were based on LAER. Eight of the facilities requiring control produce polystyrene foam, and only one facility produces polypropylene and polyethylene foam. One of the facilities that produce polystyrene foam (Dart Container Corporation of PA, Leola, PA) reported a cost effectiveness of $1,002/ton. The other facilities that installed a control device did not report a cost effectiveness number.

The next level of control included eight facilities, which were required to limit blowing agent usage based on its weight percent in plastic or in pounds of emissions per year. In three decisions, thermal oxidation was determined to be cost ineffective (i.e., $6,500/ton at the Woodbridge Corp. Whitmore Lake, MI Plant, $5,000-$8,000/ton at the Tuscarora Chesaning, MI Plant, and $9019/ton at the Nomaco Zebulon Plant).

When considering the BACT decisions summarized in this section, it is important to note that Nomaco’s polyethylene process differs from the polyethylene, polystyrene, and polypropylene foam blowing processes listed. For most of the BACT decisions listed it appears that the processes examined use of expandable beads, which contain dissolved liquid pentane. The expandable beads enter a compression mold, where the beads are melted and the pentane vaporizes to expand the polymer into the foam. In this situation, the gas is concentrated and localized at one point and thus can be pulled off through a vacuum system and sent to a thermal oxidizer. Since the foam is contained in a mold, pulling the gas off the foam will not distort the foam. Therefore, it is technically feasible and often cost effective to control emissions from an expandable bead foam process.

Conversely, for a polyethylene extrusion process like the one at Nomaco Tarboro, the foam is not contained within a mold to protect the integrity of the final product's form. The blowing agent remains a gas throughout the extrusion process. Thus, the gas never reaches a point where it is sufficiently concentrated in a localized area, where it can then be sent to a control device without jeopardizing the integrity of the final product. Therefore, it is marginally feasible and not cost effective to capture emissions at the die head and route to a control device from the extrusion process at the Nomaco Tarboro Plant.

5.3 Control Technologies Applicable to Plastics Foam Production

Two types of control technologies are available to the plastics foam manufacturing industry:

- Process changes, and
- Add-on controls

This section describes each control technology and discusses the feasibility for plastic foam production facilities.

5.3.1 Process Changes

To reduce VOC emissions from foam production operations, the facility may consider changes to their process as means of controlling pollutants. Process changes include such items as raw material substitution (i.e., alternative blowing agents) and blowing agent usage limitations.

5.3.1.1 Raw Material Substitution

Previously chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), including CFC-11, CFC-12, HCFC-141b, and HCDC-142b, were used as high performance polymer foam blowing agents. Reasons for their use included their desirable physical properties, such as their stability, relatively high molecular weight, and low toxicity. However, these traditional blowing agents are gradually being phased out of production after the signing of the Montreal Protocol, since they deplete stratospheric ozone. This phase-out of both CFCs and HCFCs has prompted industries to search for a suitable substitute. There is a strong need for a substitute that is non-ozone-depleting, nonflammable, thermally stable, compatible with various polymers low in toxicity, and available at an acceptable cost.

The next standard blowing agent is expected to be hydrofluorocarbons (HFC) blowing agents such as

HFC-245fa. However, HFCs have some negative effects due to their medium global warming potential (GWPs) and considerably higher vapor thermal conductivities than some CFCs and HCFCs. HFCs will not be readily available until they undergo extensive testing and the certification process, and their high cost will limit their immediate use as an alternative blowing agent.

A new group of high-performance foam blowing agents, iodofluorocarbons (IFCs), has high molecular weights and low atmospheric impact. They exhibit short atmospheric lifetimes, which promotes a minimal global warming potential (GWP) and provides them with a negligible ozone-depletion potential (ODP). However, the availability of IFCs is limited and sold commercially in relatively small amounts as a fire suppression agent. IFCs have been tested more as a fire retardant or insulating foam using polyurethane and polystyrene as the polymer. Some tests have shown insufficient solubility of the blowing agents in polyurethane foam, thus making the foams denser than desired. Although prices have dropped substantially over recent years, the prices remain much higher than if IFCs were produced in bulk.

At this time, there are no commercially available alternative blowing agents that have been proven in the polyethylene and polypropylene foam industry. In time, the cost of these alternative blowing agents may decrease to allow for use in commercial production; however, the use of these alternate raw materials is technically and economically infeasible.

5.3.1.2 Blowing Agent Usage Limitation

A facility may restrict blowing agent usage, thus limiting potential VOC emissions. The bases for these restrictions may vary. A limitation can be based on a weight percent of blowing agent in the polymer (i.e., 7% pentane in product). In the same fashion, the blowing agent limitation may be expressed as a weight of blowing agent per weight or beads (i.e., 7 lb isobutane per 100 lb of polymer beads) or weight of blowing agent per volume of foam produced (i.e., lb/ft^3). In other options, the blowing agent and resultant VOC emissions can be restricted on a time period basis (i.e., hourly, monthly, annually). Since a facility may produce several types of products with various polymers and desired densities, the limitation has to factor in these variations if it is expressed as a weight percent or weight per weight product limitation.

5.3.2 Add-on Controls

This section provides a discussion of six types of add-on controls available to the plastic foam manufacturing industry:

- Thermal incineration (with or without recuperative heat recovery),
- Thermal incineration with regenerative heat recovery,
- Catalytic incineration, and
- Condensers, flares, and carbon adsorption.

The BACT analysis examined only those VOC emissions that can feasibly be captured and routed to an add-on control device. As discussed earlier, for the Tarboro facility, only emissions from the extruder die head exhaust vents (if installed) could feasibly be controlled. As for the reclaim area, even if they could be controlled, the cost is too high as was discussed in Section 5.1.

The BACT analysis examined two other control scenarios that were judged to be technically infeasible. These included: (1) installing an enclosure around the extrusion lines and venting the emissions within the enclosure to a regenerative thermal oxidizer (RTO), or (2) ventilating the entire building's exhaust airflow to an appropriately designed RTO. For the first option, the analysis concluded that a permanent enclosure would be difficult to install around all the extrusion lines. In addition, not all VOCs are lost along the extrusion line. The lines are approximately 100 feet long, and based on an internal testing program, samples taken at the end of the extrusion line (after the water cooling bath and cooling rack), shows that less than half of the retained isobutane is lost along the line. Therefore, controlling these emissions would only be controlling a fraction of the total isobutane emissions. Additionally, the existing extrusion area is located in tight physical quarters and would require the relocation of several exit doorways to accommodate an enclosure of the extrusion equipment. Therefore, an enclosure system would not provide a means to capture the majority of isobutane emissions in a cost effective manner.

The second alternative control option involves venting the entire building's airflow to a centralized RTO. Since the building has many open side rooms (i.e., warehouse areas and offices), controlling the airflow and directing it to the RTO would be difficult. Additionally, the large increase in flow rate would drive down the concentration of the VOCs in the waste stream, thus making this control option cost ineffective.

5.3.2.1 Thermal Incineration

Thermal incineration is a process in which waste gas is brought to adequate temperature and held at that temperature for a sufficient residence time for the organic compounds in the waste gas to oxidize. The constituents of the waste streams generated by surface coating operations will be converted to carbon dioxide (CO_2) and water in the presence of heat and sufficient oxygen. In the recuperative incinerator design, a heat exchanger upstream of the incinerator uses the heat content of the incinerator flue gas to preheat the incoming VOC-laden stream to the incinerator, thereby reducing fuel costs.

Thermal incinerators can be used to control waste streams containing various organic compounds and mixtures of organic compounds, and thus are technically feasible for controlling emissions from plastic foam manufacturing operations. The compounds typically contained in these exhaust streams (pentane, isobutane) are readily converted to innocuous compounds using thermal incineration technology. Due to Nomaco's operating conditions, it is not possible to route a continuous VOC stream to a control device, therefore, only a small percentage of the total VOC emissions can be controlled in a batch-type process.

5.3.2.2 Thermal Incineration with Regenerative Heat Recovery

In regenerative incineration, the inlet gas stream is drawn through a hot ceramic or stoneware bed that preheats the gas stream prior to its entering the combustion chamber. The hot flue gas exits the incinerator and passes into a second ceramic bed, which captures and stores thermal energy. When this bed has been heated sufficiently, the flow is switched so that the inlet gas is now redirected through the hot bed and the exhaust gas is passed through the now cool primary bed. By switching flows in this manner, high heat exchanger temperatures are maintained. Aside from the ceramic media heat exchanger, regenerative systems operate in the same manner as conventional thermal incineration.

Regenerative incinerators provide a high degree of thermal heat recovery (typically up to 95 percent) and are useful for situations where the air flowrate is high and VOC concentration is low. In these cases, a significant amount of heat recovery is required to minimize overall system operating costs. As with recuperative thermal incinerators, costs can be high because of the capital investments, and supplemental fuel along with other operating costs.

5.3.2.3 Catalytic Incineration

In a catalytic incinerator, a catalyst is used to lower the activation energy needed for oxidation. When a preheated gas stream is passed through a catalytic incinerator, the catalyst bed initiates and promotes the oxidation of VOC without being permanently altered. In catalytic incineration, combustion occurs at significantly lower temperatures than with thermal incineration. However, care must be taken to ensure complete combustion.

A major disadvantage of catalytic incineration is the high cost of fuel and catalyst replacement. Although catalytic incineration requires less fuel than thermal incineration at the same heat recovery rate, the catalyst replacement costs can be significant. In some cases, disposal of spent catalyst can also prove a difficult hurdle because of deposits of potentially hazardous substances.

5.3.2.4 Condensers, Flares, and Carbon Adsorption

Condensers operate by separating volatile compounds in a vapor mixture from the remaining vapors by means of saturation followed by a phase change. Condensers are typically refrigerated to decrease the temperature to aid in saturation and therefore increase the removal efficiencies of the units. There are two common types of condensers used for VOC removal – surface and contact condensers. The coolant does not contact the gas stream in surface condensation; the vapor condenses as a film on the cooled surface and then discharges to a collection tank. Conversely, the vapor stream is sprayed with a liquid coolant in a contact condenser. The VOCs contained within the waste coolant often create a disposal problem since they cannot be recycled or separated from the stream without additional processing.

Since the condenser's removal efficiency is highly dependent on the characteristics of the waste gas stream, they are only feasible for removing certain compounds. Compounds with high boiling points and low volatility are more easily condensable than compounds with low boiling points and high volatility. Isobutane has a much lower boiling point (e.g., 11 degrees F) than other common compounds (e.g. 176^{o} F for benzene and 232^{o} F for toluene). EPA recommends, as a conservative starting point for considering condensers as a control, that the VOCs have boiling points above 100^{o} F. Therefore, condensers are not a viable control option for removing isobutane.

Flares are used for incinerating waste gases emitted during normal operations or during intermittent or inconsistent flows (i.e., emergency gas releases or process up-sets). Flares utilize a specially designed burner tip to incinerate VOCs in an open flame. Flares also use auxiliary fuel and additional air to ensure mixing for maximum destruction efficiency. If the net heating value of the waste gas is less than 300 Btu/scf, auxiliary fuel may need to be added to achieve a destruction efficiency of 98 percent. Since the maximum heating value for Nomaco's emission stream is less than 0.76 Btu/scf (assuming no dilution air), an exorbitant amount of auxiliary fuel would be required to maintain an appropriate destruction efficiency.

Adsorption is a process where VOCs are removed from low to medium concentration gas streams. The gas molecules pass through a bed of solid particles such as activated carbon, which is the most widely used adsorbent. The molecules are held to the adsorbent by attractive forces, which are weaker than chemical bonds. Carbon adsorbers operate optimally with VOCs with low vapor pressures rather than high vapor pressures. Since vapor pressure is inversely proportional to molecular weight, VOCs with higher molecular weights (i.e., low vapor pressures) are more easily removed from gas streams than lighter compounds. Since isobutane has a much higher vapor pressure and lower molecular weight than other waste compounds (e.g., benzene and toluene), a carbon adsorption system would not be most effective in controlling isobutane emissions.

5.4 BACT Analysis Results and Conclusions

A BACT analysis, consistent with the Clean Air Act, was performed on add-on control technologies. Raw material substitution techniques are not currently considered technically feasible for the Nomaco Tarboro facility as discussed earlier. Thus, these technologies were not considered further.

To perform the BACT analysis, it was necessary to make engineering judgments concerning the control efficiency of various add-on controls. The destruction efficiency of both recuperative and regenerative heat recovery thermal incinerators was estimated to be 98 percent and the destruction efficiency of catalytic incineration was assumed to be 95 percent.

Other assumptions used in performing this analysis are included in the detailed cost calculations presented in Appendix A of the application. All cost estimates were prepared using actual extrusion line flowrates and a calculated VOC emission rate for both existing and proposed equipment. Annual operational hours were assumed to be 8,760 per year.

The cost estimates presented here were developed by first identifying the facility VOC emission points for which control is feasible and by obtaining flow rates, concentrations, and other gas stream characteristics. In developing the cost estimates, consideration was given to grouping vents from both existing and the proposed extrusion line together for potential control, since the flow rates were relatively small for all vents. Details on the cost estimate are described in Appendix A of the application.

This analysis considered the following hierarchy of controls, starting from the most stringent to the least stringent:

- Thermal incineration with 0, 35, and 70-percent recuperative heat recovery;
- Thermal incineration with 95-percent regenerative heat recovery;
- Catalytic incineration 70-percent recuperative heat recovery; and
- Restricted use of blowing agent.

The economic, environmental, and energy impacts of the add-on control devices were investigated.

The cost impacts of controlling equipment emissions with add-on controls are presented in the table below. The estimated cost impacts for thermal incinerators with regenerative heat recovery, thermal incineration, and catalytic incineration were estimated using the Office of Air Quality Planning and Standards Control Cost Manual (OCCM). In the case of thermal incineration, three recuperative heat recovery options were evaluated (0, 35, and 70-percent heat recovery) and the option with lowest annualized cost was selected. By using a regenerative heat recovery system, thermal incinerators can attain 95-percent heat recovery. All costs provided in the OCCM were updated to

2007 dollars using Consumer Price Index Price Inflation calculator[1]. The rate of $7.89/1000 scf for natural gas[2], and $0.050/kw-hr was used for electricity rates in these cost evaluations. Labor rates were obtained from the Department of Labor[3].

1 Consumer Price Index Calculator developed by the US Department of Labor Bureau of Labor Statistics

2 US Department of Energy, Energy Information Administration webpage, average price of NG delivered to Industrial consumers for 2006.

3 2005 National Occupational Employment and Wage Estimates. US Department of Labor, Bureau of Labor Statistics webpage, For Operating Labor – SOC No. 51-4011; Maintenance Labor – SOC No. 49-2092.

BACT Analysis for Add-on Control Technologies

Source Description	Treated Flow (scfm)	Add-On Control Technology	VOC Emissions Reduction (TPY)	VOC Emissions Reduction (%)	Total Capital Cost (2007 $)	Total Annual Cost ($/yr)	Cost-Effectiveness ($/Ton)
Two Extrusion Lines	2,320	Regenerative Thermal Oxidation	21.09	95%	932,399	252,868	11,700
	2,320	Recuperative Thermal Oxidation – 70% Heat Recovery	21.09	95%	423,253	265,944	12,609
	2,320	Catalytic Incinerator	21.09	95%	259,876	179,487	8,510

Although each of the potentially feasible add-on control devices evaluated would provide reductions in VOC emissions, each device would also have associated negative energy and environmental impacts. The energy and secondary environmental impacts are presented in the Table below for each add-on control alternative. In the case of incineration, the combustion of natural gas would result in small quantities of combustion pollutants: nitrogen oxides (NO_x), sulfur oxides (SO_2), particulate matter (PM), carbon monoxide (CO), and VOCs. These emissions would occur with the use of thermal (recuperative and regenerative heat recovery units) and catalytic incineration, in proportion to the amount of natural gas used. Emission factors from EPA's AP-42 document are used to calculate these emissions.

Source Description	Control Technology	NO_x Emissions (tpy)	SO_x Emissions (tpy)	PM Emissions (tpy)	CO Emissions (tpy)	VOC Emissions (tpy)	Energy Impacts		
							Natural Gas Requirement (scfm)*	Natural Gas (MMBtu/yr)	Electricity (MW-hr/yr)
All 7 Extrusion Lines	Regenerative Thermal Oxidizer	0	0	0	0	0	4.2	1,934	71
	Recuperative Thermal Oxidizer	7.07E-01	4.24E-03	5.37E-02	5.94E-01	3.89E-02	26.9	12,404	69
	Catalytic Incinerator	3.40E-01	2.04E-03	2.58E-02	2.85E-01	1.87E-02	12.9	5,957	75

NOTE: Only 70% heat recovery numbers are shown for the Recuperative Thermal Oxidizer

Basis: **Natural Gas Factors from AP-42 Section 1.4 , 7/98**

NOx	100 $lb/mmft^3$	Table 1.4-1 Small Boilers (<100 MMBtu/hr) - Uncontrolled
SO_2	0.6 $lb/mmft^3$	Table 1.4-2
PM	7.6 $lb/mmft^3$	Table 1.4-2
CO	84 $lb/mmft^3$	Table 1.4-1 Small Boilers (<100 MMBtu/hr) - Uncontrolled
VOC	5.5 $lb/mmft^3$	Table 1.4-2

Natural Gas MMBtu/yr = scfm * 60 min/hr * 8760 hr/yr *21,502 Btu/lb * 0.0408 lb/ft^3 * 1MMBtu/10^6 Btu

In summary, the proposed BACT limit for all of the extrusion lines at Nomaco Tarboro is the restriction of blowing agent (isobutane) usage. Although add-on controls appear to be technically feasible for some plastic foam production operations, after consideration of the environmental, energy, and economic impacts it was determined that BACT did not include these options.

To meet BACT requirements, Nomaco proposes to limit VOC (isobutane) usage in their plastic foam manufacturing process to the maximum extent feasible while still allowing manufacture of their desired low-density foam products. The proposed BACT limit for the two new extrusion lines, as shown below, is a short term and long-term usage:

- 0.6 pounds per cubic foot of foam produced measured each day and 482 tpy total isobutane (12-month running total)

6.0 AIR QUALITY IMPACT ANALYSIS

NOMACO, INC. (TARBORO FACILITY)

PSD regulations [40 CFR 51.166(k)] require an applicant to perform an ambient impact analysis to demonstrate, 1) that no National Ambient Air Quality Standard (NAAQS) will be exceeded at any location and during any time period where the proposed new source or modification will have significant impact; and 2) that the proposed new source or modification, in combination with other increment-affecting sources, will not cause any allowable PSD increment to be exceeded. PSD regulation 40 CFR 51.166(m) requires analysis of ambient air quality in the impact area of the proposed source or modification for all pollutants (including those for which no NAAQS exist) with emissions increases in significant [40 CFR 51.166(b)] quantities.

6.1 Potential Emissions

VOC emissions are considered precursors to ozone formation. PSD regulations [40 CFR 51.166(i)] states that an ambient impact analysis of ozone, including the gathering of ambient air quality data, is required if the net VOC emission increase is greater than 100 tpy. Previous and ongoing regional air dispersion modeling efforts to determine ozone attainment within the North Carolina air shed have shown that VOC emissions at the level stated above will not contribute, by itself, to significant ozone formation. No additional monitoring or modeling is required for this pollutant.

6.2 Non-Regulated Pollutant Impact Analysis

There are no North Carolina toxic pollutants that will be emitted as part of this modification.

6.3 Additional Impact Analysis

Growth Analysis

The growth analysis includes the projection of the associated industrial, commercial and residential source emissions that will occur in the area due to the source. The evaluation looked at the local work force increase and assessed secondary emission sources that potentially will build in the area to support the Nomaco facility.

It was determined that employment will not increase at the facility with this modification, thus; the impact on additional emissions from growth will be negligible.

6.3.2 Soils and Vegetation

The Tarboro area is located in the North Carolina Coastal Plain. The surrounding terrain is gently sloping with occasional rolling hills and is drained by the Tarboro River and its tributaries. Goldsboro fine sandy loam is the main soil type, which is strongly acidic and moderately permeable. This region of North Carolina is characterized with mixed land use such as farming, open grasslands and forest. The crop types within the local area include tobacco, cotton, soybeans, corn, and small grains such as oats and wheat. Vegatation other then crops include several grasses and trees such as longleaf-slash pine, loblolly-shortleaf pine, mixed oak-pine and oak-hickory, hickory, black gum, elm, ash and other hardwood trees.

Studies have determined that this amount of VOC emissions will not alter the pH balance of the soils in the impact area and thus no adverse impact on either soils or vegetation is expected.

6.3.3 Class II Visibility Impairment Analysis

The Class II visibility impairment analysis is distinct from the Class I impact in that it is concerned with visibility within the surrounding area (impact region) of the proposed new source or modification. Since this modeling analysis is only concerned with VOC's, no visibility impairment analysis is required.

6.4 Class I Increment/Air Quality Related Values (AQRV) Regional Haze Impact Analysis

Of the four closest Class I areas, only Swanquarter is within 250 kilometers (213 kilometers) of the Tarboro facility. A regional haze analysis is used to determine the net change in visibility (deciview) on a Class I area due to the facility emissions. This is accomplished by assessing the emissions of particulates (PM/PM_{10}), nitrate and sulfate emissions (NOx and SO_2). As stated above, since this facility is only emitting VOC's, a regional haze analysis is not required.

6.5 Non-attainment Analysis

There are no designated non-attainment areas impacted by this project.

6.6 Source Impact Analysis Conclusion

Based on the ambient impact analysis, the proposed Nomaco facility will not cause or contribute to any violation of the Class II NAAQS, PSD Increment, Class I Increment, or any Federal Land Manager (FLM) AQRV's.