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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.
WAKE COUNTY
ZEBULON, 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, 15A NCAC 2H .0600 AND 2Q .0100

JUNE 2003

**Mailing List**

| | | |
|---|---|---|
| NEWSPAPER | The News & Observer<br>Ms. Pam Oleniezak<br>Legal Classified Department<br>P.O. Box 191<br>Raleigh, North Carolina 27602<br>(919) 829-4500<br>FAX: (919) 829-4824 | Public Notice w/ Cover Letter |
| OFFICIALS | County Manager<br>Mr. David Cooke<br>P.O. Box 550<br>Raleigh, NC 27602<br>(919) 856-6160 | Public Notice w/ Cover Letter |
| LIBRARY | Jean Ells<br>Wake County Public Library<br>Zebulon Branch<br>109 E. Horton St.<br>Zebulon, NC 27597<br>(919) 404-3610 | Preliminary Determination & Application |
| SOURCE | Mr. Julian Young<br>Vice President of Operations<br>Nomaco, Inc.<br>501 NMC Dr.<br>Zebulon, North Carolina 27597 | Preliminary Determination |
| EPA | Ms. Kay Prince<br>Air Planning Branch<br>Air Pesticides and Toxics<br>U.S. EPA Region IV<br>345 Courtland Street, N.E.<br>Atlanta, Ga 30365<br>(404) 347-5014 | Preliminary Determination & Application |

**Mailing List (con't)**

| | | |
|---|---|---|
| EPA | Mr. Bob Blaszczak<br>BACT/LAER Clearinghouse<br>OAQPS, MD-13<br>RTP, N.C. 27711 | BACT Input Summary Sheet |
| RALEIGH REGIONAL OFFICE | Ernie Fuller<br>NCDAQ<br>Air Quality Supervisor<br>3800 Barrett Dr<br>Raleigh, NC 27609 | Preliminary Determination |

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# Facts Sheet

**Applicant:**

Nomaco, Inc
501 NMC Drive
Zebulon, NC
Wake County

**Consultant**:

Clayton Engineering, P.C.
1200 Trinity Road
Raleigh, North Carolina 27607
Contact: Rich Pandullo
(919) 851-2160

- Clayton Engineering, P.C., 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 May 28, 2003.

- The application was deemed complete for review purposes pursuant to 40 CFR 51.166 (q) and 15A NCAC 2D .0530 (o) on June 10, 2003.

- The applicant proposes to construct two new foam extrusion lines and relax emissions limitations currently imposed on the existing two sets of extruders ( extruders 1-5 and 6-10, respectively.

- The facility is a major source under the definition contained in 40 CFR 51.166 with two 249 ton per year limits on VOC's. The two new lines will result in VOC emissions greater than the PSD significance levels. In addition, the relaxation of the current limits will require a PSD review of the existing lines.

- The facility is proposing to limit both long-term and short-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 | VOC | 0.6 lb VOC/$ft^3$ of foam produced<br><br>1250 tpy of VOC (isobutane) usage | No add-on controls |

# 1.0 INTRODUCTION

Nomaco, Inc., through Clayton Engineering, P.C., 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 Zebulon, North Carolina.

This facility produces approximately 7 to 8 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 ten foam extrusion lines (organized into two sets of five extruders). Production support equipment includes a reclaim operation consisting of three scrap foam grinders, two agglomerators, four storage silos, and one reclaim extruder.

Nomaco is proposing to construct two new foam extrusion lines and relax emissions limitations currently imposed on the existing two sets of extruders (Extruders #1-5 and Extruders #6-10 as they are identified in the current permit).

The proposed project will increase volatile organic compound (VOC) emissions by more than the prevention of significant deterioration (PSD) threshold and will also result in a relaxation of emission limits taken previously to avoid PSD review. 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 facility.

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 BACT analysis concluded that add-on controls are not cost-effective for Nomaco's operations. Instead, BACT limits for Nomaco involve restricting the amount of VOC (isobutane) used per area of foam produced.

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:

- 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;

- 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:

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

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

- o A demonstration the Best Available Control Technology is applied to each emission unit that will emit any amount of a significant pollutant, including a demonstration that emission of air toxics will not exceed the acceptable ambient levels (AAL's) as regulated by the NCDAQ, and

- o 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 five 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 ten 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 water, cut to size, printed with product specifications, and further cooled before being packaged and stored in a warehouse.

For solid waste minimization, Nomaco periodically operates an enclosed reclaim operation area that consists of three scrap foam grinders with three bin vent cartridge filters, two agglomerators with two cyclones, and four storage silos with four bin vent cartridge filters. Off-spec product is sent to the scrap grinders where it is processed into small pieces and fed to one of the four storage silos. The scrap material is then fed to an extruder and transformed into small pellets. The pellets are redistributed to the manufacturing area and blended with virgin pellets. Off-spec material that is not suitable for reclaim is fed to a scrap grinder and sold as packaging material.

The production facility is heated by propane heaters and two (2) 0.975 MMBtu/hr oil-fired boilers (#2 fuel oil). Process heat for the extrusion process is provided electrically.

*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 Zebulon plant by adding two new foam extrusion lines and by relaxing the existing PSD-avoidance limitations. The new foam lines will be located about 120 feet from the existing lines at the opposite side of the plant.

The oil-fired boilers at the facility are there to provide space heating only (not process heat). Thus, the proposed modification will not increase the emissions of combustion-related pollutants.

For the reclaim operation, Nomaco expects no increase in particulate emissions. Most of the off-spec product at Zebulon occurs during product changeover. After the proposed modification, Nomaco expects to see a decrease in the number of product changeovers because of moving to a seven day per week operation. While the increased production levels will cause some amount of increase in off-spec product, this will be more than offset by the decrease in off-spec product from changeovers.

## 2.2 Emissions

Emissions from the Zebulon 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 Zebulon plant. No other hazardous or toxic air pollutant is used or emitted in the process. Most of the VOC is emitted as a fugitive release from the extruded foam throughout the process line and curing area (see discussion below). Emissions from the facility are estimated to be 1250 tpy.

**VOC Emission Characteristics and Distribution**

Emissions of VOC from the Zebulon facility occur via several modes: (1) fugitive releases from the process line, (2) fugitive releases from the foam curing area (warehouse), and (3) direct atmospheric releases from the extruder die exhaust vents.

Fugitive releases 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 fugitively 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. The 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. Section 4.3 provides more detail on how this situation affects the ability of the facility to capture and control VOC emissions.

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 lasts approximately 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. A vent is positioned near the point where the product exits the extruder to collect the escaping gas.

Over the next 45 minutes, the temperature and pressure are gradually lowered and the amount of isobutane is increased. As a result, the cellular structures become more stable and are able to retain approximately 70% of the isobutane.

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 are turned off or physically moved away from the extruder die head to prevent airflow that could deform the foam as it exits the extruder. Although isobutane is not released directly to the atmosphere once the desired foam product is being manufactured, fugitive 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 Zebulon in eastern Wake County, approximately 20 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 |

Only the $SO_2$ baseline has been triggered for Wake 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 proposed plant site. Only one Class I area, Swanquarter National Wildlife Refuge, is within 200 km of the facility (185 km).

# 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. The BACT analysis presented here is consistent with the EPA based "top-down" approach. Additionally, the BACT analysis must consider the impacts of noncriteria 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 Sub-Chapter 2D, 2H 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. The newly proposed Nomaco, Inc. extrusion lines nor the existing lines to be modified exempted sources, and thus, 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 Wake County, an attainment area for all NAAQS, the planned modification and its emissions are required to be assessed in light of PSD requirements. The Nomaco, Inc. facility currently operates under two 249.9 tpy VOC permit limitations that were taken to avoid PSD review. As part of the current permit application, Nomaco, Inc. is requesting a relaxation of these restrictions as well as the addition of two new extrusion linesd. The Source Obligation provisions of the PSD regulations [(40 CFR 52.21 (r)] require Nomaco, Inc. to evaluate PSD requirements "as though construction had not yet commenced on the source or modification."

### 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, are to 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.

To assist in bringing consistency to the BACT process, the EPA is requiring all PSD applicants to use the "top-down" approach to BACT. The top-down approach consists of 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 the most effective option not rejected as 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 Zebulon facility by adding two new foam extrusion lines and relaxing emission limits on the 10 existing lines. The BACT analysis that is the subject of this report addresses all foam extrusion processes (existing and new) at the Zebulon facility. For this equipment, the analysis considered the feasibility of capturing VOC from each line 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 ten existing and two new extrusion lines, the BACT analysis considered the amount of VOC that can feasibly be routed to a control device. Because the extruder exhaust vents only release isobutane emissions during start-up mode (which lasts about one hour), 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 Zebulon's extrusion process affects the amount of VOC that can be ultimately controlled.

Operating conditions at Nomaco Zebulon 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 45 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. Because the final product is extremely sensitive to air flow, the vent hoods (located directly above the die head where the isobutane is injected) are shut down or relocated 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.

*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 existing extrusion line utilizes approximately 8 kg/hr of isobutane for the final product. Therefore, during the initial stages, the flowrate of the isobutane is reduced to about 4 kg/hr per line. The remainder of the hour is spent incrementally ramping up the isobutane flow rate to the final required value (i.e., 8 kg/hr).

The maximum amount of isobutane directed to the control device depends on the maximum number of lines that can be started-up simultaneously. Realistically, only two to three extrusion lines can be started up simultaneously since only two to three extrusion line operators are present at one time. The operators have to be present since they manually control the parameter fluctuations during start-up according to an operating procedure. Therefore, the emissions vented to the control device consist of emissions from a maximum of 3 lines, since only 3 lines can be vented to the device at one time. However, to be conservative, the BACT analysis assumes that all twelve 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 11 decisions involving facilities with polyethylene, polypropylene, or polystyrene foam manufacturing operations. Approximately half (6) of BACT/LAER decisions identified thermal oxidation as the required control technique. Only three of these decisions were based on BACT; the other three were based on LAER. Five 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 five facilities, which were required to limit blowing agent usage based on its weight percent in plastic or in pounds of emissions per year. In two decisions, thermal oxidation was determined to be cost ineffective (i.e., $6,500/ton at the Woodbridge Corp. Whitmore Lake, MI Plant and $5,000-$8,000/ton at the Tuscarora Chesaning, MI 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 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 Zebulon, 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 Zebulon 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.[3] 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 Zebulon facility, only emissions from the extruder die head exhaust vents can feasibly be controlled.

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, since the proposed two lines will be physically separated from the existing 10 lines by approximately 120 feet. Two enclosures would have to be installed, one for proposed lines and one for existing, thus inflating installation costs. In addition, not all fugitive emissions 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 as fugitive emissions 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 10.5 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

As noted above, the BACT analysis presented here is based on the top down approach suggested by the EPA, where all "available" control options are ranked from the most effective to the least effective in terms of emissions reduction potential.

A top down BACT analysis was performed on add-on control technologies. Raw material substitution techniques are not currently considered technically feasible for the Nomaco Zebulon facility as discussed earlier. Thus, these technologies were not included in the BACT analysis.

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. 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 proposed extrusion lines 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. Note that the cost analysis did not incorporate two additional cost estimates that need to be considered for installing a control device. First, Nomaco Zebulon does not currently use natural gas onsite, which would be needed to fuel the control device. Therefore, the capital installation cost would be higher than estimated in order to include extending the nearest natural gas line into the plant. Secondly, the proposed extrusion lines would be located approximately 120 feet from the existing lines, and the cost estimates did not address the cost of additional ductwork necessary to vent all extrusion lines to a common control device.

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.

**Top Down 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 (2001 $) | Total Annual Cost ($/yr) | Cost-Effectiveness ($/Ton) |
|---|---|---|---|---|---|---|---|
| All Extrusion Lines | 6032 | Regenerative Thermal Oxidation | 19.8 | 98% | 843,883 | 178,582 | 9,019 |
| | 6032 | Recuperative Thermal Oxidation – 0% Heat Recovery | 19.8 | 98% | 187,472 | 661,954 | 33,432 |
| | 6032 | Recuperative Thermal Oxidation – 35% Heat Recovery | 19.8 | 98% | 493,058 | 488,663 | 24,680 |
| | 6032 | Recuperative Thermal Oxidation – 70% Heat Recovery | 19.8 | 98% | 733,355 | 542,999 | 27,424 |
| | 6032 | Catalytic Incinerator | 19.8 | 95% | 390,343 | 212,138 | 11,052 |

The economic, environmental, and energy impacts of the three add-on control devices were investigated. No add-on control is proposed as BACT for the Nomaco Zebulon modification.

The cost impacts of controlling equipment emissions with add-on controls are presented in the table above. 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, four 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 2001 dollars using Chemical Engineering Plant Cost Indices. The rate of $5.42/1000 scf for natural gas, and $0.059/kw-hr was used for electricity rates in these cost evaluations. Labor rates were obtained from the Department of Labor.

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. 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.

In summary, the proposed BACT limit for all of the extrusion lines at Nomaco Zebulon is the restriction of blowing agent (isobutane) usage. Although add-on controls appear to be technically feasible for some plastic foam production operations, an economically feasible add-on control could not be identified for the Nomaco facility. Incineration is not cost-effective because of the difficulty in capturing a significant portion of VOC in the extruder exhaust streams at the Zebulon plant.

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, as shown below, is a combined restriction on short-term and long-term usage:

?? 0.6 lb VOC per cubic foot of foam produced (0.6 lb/$ft^3$)

?? 1,250-tpy total isobutene

**Summary of BACT Evaluation at Nomaco Zebulon Plant**

| **Control Option** | **Technical Feasibility** | **Control Level** | **BACT Conclusion** |
|---|---|---|---|
| Regenerative thermal oxidation | Yes | 98% | Technically feasible but not cost effective. [>$9,000/ton] |
| Recuperative thermal oxidation | Yes | 98% | Technically feasible but not cost effective. [>$33,000/ton ] |
| Catalytic oxidation | Yes | 95% | Technically feasible but not cost effective. [>$11,000/ton] |
| Flares | No | 98% | Not feasible for this application (and likely not cost effective either) |
| Carbon adsorption | No – Isobutane's vapor pressure is too high for adsorption | 95% | Not feasible for this application (and likely not cost effective either). |
| Condensers | No – Isobutane not easily condensable – boiling point too low | 90% | Not feasible for this application (and likely not cost effective either). |

# 6.0 AIR QUALITY IMPACT ANALYSIS

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 the establishment 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. Volatile organic compounds are the only NAAQS pollutant to exceed the PSD significance level, thus requiring a review.

## 6.1 Volatile Organic Compounds (VOC's)

VOC's 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 tons per year. The emissions increase due to the proposed modification will increase VOC emissions in excess of 100 tons per year. Previous and ongoing regional air dispersion modeling efforts to determine ozone attainment within the North Carolina air shed have shown that VOC emissions at this level (1250tpy) will not contribute to significant ozone formation. No additional monitoring or modeling is required.

## 6.2 Non Regulated Pollutant Impact Analysis

There are no non-regulated pollutant emissions to be evaluated for this modification.

# 7.0 ADDITIONAL IMPACT ANALYSES

An additional impacts analysis was performed consistent with the requirements of 40 CFR 52.21(O) to determine air pollution impacts on visibility, growth, soils, and vegetation from the proposed modifications at the Nomaco, Inc. facility. The additional impact analysis focused on the potential effects of VOC's because these are the compounds that will be emitted in excess of PSD significance emissions levels.

A literature search was performed to identify information on the potential adverse impacts of both specific compounds and VOC's in general. Although significant literature exists documenting adverse impacts on vegetation, soils, and visibility from criteria pollutants (e.g., $SO_2$, $NO_x$, PM), very few studies have addressed the effects of specific or combined VOC's. Because VOC's can be photochemically transformed into tropospheric ozone, the potential adverse impacts of ozone were also researched and are presented below. The analyses are presented pursuant to the requirements of PSD regulations.

Based on the findings, no adverse impacts to soils, vegetation, or visibility will result from the proposed facility expansion

## 7.1 Growth Impact Analysis

The growth analysis includes the projection of the associated industrial, commercial, and residential source emissions that will occur in the area as a result of the proposed expansion. This analysis focuses on the increase in local work force and assessing secondary emission sources that will be created in the area to support Nomaco's proposed expansion.

The Zebulon facility has recently experienced a steady increase in the number of employees. Approximately 255 people are currently employed at the facility. Nomaco anticipates an increase in the number of employees at the Zebulon plant. As a result of the expansion, Nomaco intends to hire an entire additional shift of hourly workers and related supervisors to support the new shift.

The plant will also expand from a 24-hour/5 days a week operating schedule to a 24-hour/7 days a week schedule. This will necessitate the hire of additional support staff for safety, quality, and administrative positions.

Employment data for Wake County was obtained from the NC Employment Security Commission. This data indicates the average labor force in 2002 was 386,071 workers of which on average 20,411 (5.3%) were unemployed. If Nomaco needs to increase employment, workers are expected to come from the existing labor pool. No new support services or parts suppliers are expected to locate in the area as a result of this project. Therefore, the impact of economic growth associated with the proposed project will be negligible.

### 7.2 Effects on Vegetation

The vegetation analysis is limited to an evaluation of "vegetation with any commercial or recreational value" (*NSR Workshop Manual*). The major cash crops grown in the region surrounding Zebulon include tobacco, cotton, soybeans, corn, and small grains.

The health and well being of vegetative ecosystems are dependent on many environmental (e.g., precipitation, insects, disease) and anthropogenic factors (e.g. logging, urban sprawl, pollution). All of these factors combined influence the overall health and productivity of vegetative ecosystems, including croplands and forests. The effects of ozone on individual plants and the factors that modify plant response to ozone are complex and vary with species, environmental conditions, and soil and nutrient conditions. Factors such as genetic susceptibility, light, temperature, relative humidity, soil nutrients, and soil moisture influence the uptake of ozone. Symptoms of air pollution-related damage include reduction in growth rates, reduction in reproductive rates, direct foliar damage, and mortality.

Biogenic sources are also very important contributors to VOC emissions. In the Southeastern US it is estimated that biogenic sources exceed anthropogenic VOC emissions by a factor of five. In NC, the biogenic emissions are estimated to be a factor of two greater than point sources (900 tons/day verses 400 tons/day), which includes industrial facilities such as Nomaco. Operating at its proposed VOC limit of 1250 tpy, Nomaco would be an insignificant fraction of the statewide biogenic and anthropogenic point source emission totals.

Studies have shown that ozone formation in the southeast is "$NO_x$-limited;" that is, ozone formation is more dependent on ambient $NO_x$ than VOC concentrations. Current regulatory strategies for addressing ozone nonattainment in the Eastern US are focused almost exclusively on reducing $NO_x$ emissions. Because Nomaco is a minor source of $NO_x$, it is reasonable to conclude that Nomaco is not a primary contributor to ozone formation and therefore will not adversely affect vegetation in the surrounding area.

### 7.3 Effects on Soil

Zebulon and surrounding areas are located in the Piedmont physiographic province. The general topography consists of gently sloping to rolling hills and contains drainage ways that are bordered by moderately steep slopes. The Neuse River and its tributaries drain Zebulon and its surrounding areas. Appling sandy loam is the main soil type found on and around the Zebulon facility. This soil was formed through weathering of granite, gneiss, schist, and other acidic rocks. Appling sandy loam is strongly acidic and moderately permeable.

Studies of direct pollutant impacts to soils via atmospheric deposition have focused on acidic precipitation and particulate deposition. The proposed project at Nomaco will result in increased emissions of VOCs. VOCs can lead to the formation of tropospheric ozone. Documentation of any direct effects of ozone on soils was not found during literature searches. The proposed project will not alter the pH balance of the soils in the impact area. Therefore, it is concluded that the increased VOC emissions from Nomaco will produce no adverse impact on soils in the surrounding area.

## 7.4 Effects on Visibility

Of the four closest Class I areas, only one (Swanquarter) is within 200 km of the Zebulon facility at a distance of 185 km, with the remaining Class I areas (Linville Gorge, Joyce Kilmer-Slickrock, Shining Rock, Great Smokey Mountains, and James River Face) are all greater than 200 km. Per discussion with Bud Rolofson of the Fish and Wildlife Service (FWS) no Class I analysis is required of this facility.

The Class II visibility impairment analysis is distinct from the Class I impact in that it is concerned with visibility only within the impact area of the proposed new source or modification. This is accomplished by initially determining the visual quality of the area and then use a conservative screening tool to assess the possibility of visibility impairment based on expected emissions. Since VOCs are the only pollutant no Class II visibility analysis is required.

Based on the ambient impact analysis, this facility will not cause or contribute to any violation of

the Class II NAAQS or the PSD increment standards or Class II increment.