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Air Permits Section

William Willets
P.E., Chief, Permitting Section
North Carolina Department of Environmental Quality
Division of Air Quality
Permitting Program
217 West Jones Street
Suite 4000
Raleigh, NC 27603
*Via Electronic and First Class Mail*

RE: Responses to comments from the Environmental Integrity Project on Enviva Northampton Draft Title V Permit

Dear Mr. Willets;

Please find attached Enviva's responses to comments submitted by the Environmental Integrity Project (EIP) regarding the draft Title V Permit (Draft Permit No. 10203T06) for Enviva Pellets Northampton, LLC Garysburg, Northampton County, North Carolina prepared by the North Carolina Department of Environmental Quality (DEQ). Our responses are included in Attachment 1. Attachment 2 consists of a letter from the National Council for Air and Stream Improvement (NCASI) responding to questions VI and VII presented by EIP.

We appreciate the opportunity to respond to these comments and look forward to working with you to continue the permitting process at Northampton. If you have any questions please reach out to me by e-mail or phone at Kai.Simonsen@Envivabiomass.com, or 919-428-0289.

Sincerely,

Kai Simonsen
Air Permitting Engineer

Attachments

Cc: Yuki Puram, Environmental Engineer NC DEQ
Chris Seifert, EHS Director Operations, Enviva
Alan McConnell, Kilpatrick Townsend

# Attachment 1

# Enviva Response to Environmental Integrity Project Comments
# Northampton Draft Title V Permit

*I. The Draft Permit Fails to Assure the Facility's Compliance with Prevention of Significant Deterioration (PSD) Requirements.*

*A. North Carolina DEQ's 2015 Removal of Limits Designed to Restrict the Facility's Emissions Below the PSD Applicability Threshold Triggered PSD Review as Though Construction Had Never Commenced.*

*B. Because the 2015 Removal of Northampton's Enforceable VOC Potential-to Emit Limits Make the Plant a Major Source from the Time of Initial Construction, the Other Changes Made to the Facility in 2015 Triggered PSD Review as a Modification to a Major Source.*

Contrary to EIP's statements, the Facility has never triggered PSD review based on either initial construction or the 2015 permit modifications.

<u>The Original Permit Issued to the Facility</u>

The original 2013 permit limited Facility VOC emissions to 250 tpy on a rolling 12-month basis in order to avoid PSD requirements. The Facility complied with this limit based on a combination of physical constraints and by a restriction on the processing of softwood to no more than 10% on an annual basis. Prior to the 2015 modifications discussed below, the Facility complied with the 10% softwood limit. However, the pre-2015 design capacity of the dryer was also limited due to physical constraints and inefficiency in the dryer configuration. The goal of the 2015 permit modification was to debottleneck current operations and increase throughput. In order to achieve this goal, physical modifications were required.

<u>The 2015 Permit Modification</u>

Operation of the Facility from 2013 to 2015 led Enviva to conclude that physical modifications were required in order for the facility to achieve its design capacity. The 2015 permit modifications included the installation of a new control program for the dryer with additional instrumentation to automatically control the process material feed rate to match the amount of heat available to the amount of water to be evaporated. This new program was designed to achieve maximum evaporation rate at a more consistent dryer exit moisture content. Furthermore, an oxygen sensor was installed to monitor for excess oxygen in order to control recirculation and optimize combustion and a moisture meter was also installed on the dryer in feed.

Other equipment modifications were necessary at the Facility as a result of installation of the new control program. These included the fuel pusher, underfire air grates, underfire dampers, overfire dampers, green bin level controller, recycle damper, dry exit temperature controller, and dryer exhaust pressure controller.

Another modification made to the Facility in 2015 was the installation of a new dry line conveyor system to allow pre-dried material to be introduced directly into the dry hammermills without going through the dryer. Emissions from the new dry line conveyor system are controlled by a previously permitted bagfilter. The new dry line system allows for an increase in dry hammermill production by approximately 10 tons per hour. This additional pre-dried pellet feedstock, that does not need to go through the dryer, also allows the facility to increase the amount of softwood being introduced into the dryer while still complying with PSD avoidance limits

Two new finished product bagging systems were also proposed by Enviva and permitted in the 2015 permit amendment, however these systems have never been installed at the Facility and were removed from the Title V Permit.

The 2015 permit amendments did not trigger PSD review because the Facility was not an existing PSD major source, and the 2015 modifications, when viewed in isolation, were also not major. In order to demonstrate that the 2015 permit amendments did not trigger PSD review, the Facility used emission factors developed by Enviva based on stack testing at various softwood/hardwood mixes to calculate annual actual emissions from the Facility for the period from November 2013 to April 2015. This methodology was used to calculate Facility-wide baseline actual emissions using the maximum allowable softwood content of 10%. Based on this analysis, Facility-wide baseline actual VOC emissions using 10% softwood were determined to be 207.4 tpy.

The PSD avoidance condition for VOCs contained in the current permit results from the baseline actual emissions of 207.4 tpy (discussed above) plus an allowable increase of 249 tpy of VOC based on the physical and operational modifications to the facility discussed above. In addition to a new PSD avoidance limit of 456.4 tpy VOC per rolling 12 month period, the Facility is also limited to the utilization of less than 30% softwood in pellet production unless Enviva submits additional emission factors for high softwood mixes that are approved by NC DAQ.

Permit compliance assurance with the synthetic minor permit limits, pre-2015 and post-2015 amendment, consist of requirements to monitor and report the hardwood/softwood mix on a rolling 12-month basis. Based on the hardwood/softwood mix, the Facility must also report annual VOC and CO emissions on a rolling 12-month basis to ensure that the Facility does not exceed PSD avoidance limits.

*C. North Carolina DEQ Has Not Provided Adequate Justification for Failing to Require Emission Testing and Source-Specific Emission Factors to Demonstrate Compliance with the Draft Permit's PSD Avoidance Conditions.*

North Carolina DEQ has acknowledged transcription errors in the draft permit and the emission factors will be corrected in the final permit. As discussed in detail below, there are no differences in design or configuration between the Enviva Ahoskie and Northampton facilities that would invalidate the use of Ahoskie stack testing data for the Northampton facility. Additionally, the facilities process wood from the same region and thus it is reasonable to assume the VOC and HAP emissions profiles from the two facilities are consistent. The draft permit does require testing if Enviva wishes to process a higher percentage of softwood at Northampton.

*1. Significant Differences Exist Between Enviva Northampton and Enviva Ahoskie.*

There are far more similarities between Enviva Northampton and Enviva Ahoskie than there are differences. Both facilities are greenfield manufacturing sites built by Enviva to produce wood pellets. The sites are;

- 39 miles apart
- source wood from the same geographic area
- have the same process configuration from the dryer through product loadout
- The manufacturers of the dry hammer mills and pellet presses and coolers are the same and differ only in physical size or the number of connected units.
- The furnaces/dryers are of similar configuration; stoker style furnace with moving grate floor.

The differences in emissions from differing wood species addressed in EIP's supporting documents are based on differences of geographic vs local scale (thousands of miles vs tens of miles).

Dry shavings are derived from a finished product that has already been dried to a low moisture content. This results in lower potential VOC/HAP emissions as the product arrives on our site pre-dried with VOC/HAP emissions released elsewhere. Therefore, the contribution of emissions from dry shavings is expected to be inconsequential and has been addressed by the conservatism built into the emission factors used to estimate emissions.

*2. The Emission Factors Underrepresent VOC Emissions at the Facility.*

As described above, due to the similarities between the Enviva Ahoskie and Northampton facilities, emission factors from the Ahoskie facility are appropriate for quantifying emissions from the Northampton facility. These emission factors are based on actual stack testing data from a comparable Enviva facility processing wood from the same region. It is not appropriate to compare these stack testing data to that from other facilities with different configurations processing different species of wood.

EIP attempts to draw conclusions based on a comparison of emission factors from the Georgia Biomass facility located in Waycross, GA approximately 450 miles away from the Northampton facility. Georgia Biomass processes 100 % yellow pine and as such, based on EIP's own conclusions, VOC and HAP emissions would be substantially higher than those expected at Northampton. In addition, their dryer operates at a higher inlet temperature (950-1000 F) and targets lower chip moisture content (10 %) resulting in significantly higher VOC and HAP emissions than from the dryers at Northampton and Ahoskie. This combination results in VOC emission factors that are substantially higher than those recorded by testing at Enviva Ahoskie. Enviva notes that EIP disagrees with the VOC scaling methodology used by Enviva to adjust for softwood percentage yet then proceeds to use this same methodology to scale emission factors from the Georgia Biomass facility that are based on processing 100% softwood.

EIP also makes comparisons to emission factors based on stack testing at the Enviva Wiggins facility; however, stack testing data from the Wiggins facility is not representative of Ahoskie or Northampton because the Wiggins facility is located in an entirely different region (Mississippi vs. North Carolina) and therefore it processes different species of wood. Differences in wood species result in differences in the quantity of VOC and HAP emissions.

It is well established that VOC emissions increase as the percentage of softwood increases. EIP alleges that the stack testing data from Enviva Ahoskie and Northampton show essentially the same level of VOCs at 30% softwood as at 6% softwood; however, EIP's comparison is erroneous. The emission factor referenced by EIP for Northampton is VOC "as propane" while the referenced Ahoskie emission factor is VOC "as alpha pinene". The emission factors must be converted to the same basis before they can be compared. Table 1 below demonstrates that the stack testing data from Northampton and Ahoskie do show an increase in VOC emissions with increasing softwood percentage.

**Table 1. Emission Factor Comparison**

| *Emissions Basis* | *Northampton (6% Softwood)* | *Ahoskie (30% Softwood)* |
|---|---|---|
| *Lb VOC/ODT (as propane)* | *0.724* | *0.844* |
| *Lb VOC /ODT (as alpha pinene)* | *0.671* | *0.784* |

Finally, EIP expresses concern that VOC emissions from the pellet presses have not been accounted for permitting purposes. At both the Enviva Ahoskie and Northampton facilities emissions from the pellet presses are routed through the pellet coolers; thus, these emissions are captured in the pellet cooler emission factors.

*D. North Carolina DEQ Improperly Failed to Account for Startup, Shutdown and Malfunction Emissions in Establishing the Permit Conditions Designed to Assure Compliance with the Permit's PSD Avoidance Conditions.*

EIP's statement regarding the inclusion of startup, shutdown and malfunction emissions in establishing permit conditions has no merit. Enviva is unaware of any form of air quality permit issued by NC DEQ, or required by US EPA, that does this. Attempting to include startup, shutdown or malfunction emissions in a permit limitation would require the estimation of emissions during an extremely wide range of upset conditions including, for example, emissions from the facility during a power outage or a fire. While states and EPA may take various approaches when responding to permit limit exceedances resulting from startup, shutdown and malfunction; including emissions from these events when establishing permit limits for a facility is not practical, appropriate, or required.

We note that at Enviva facilities, startup and shutdown events typically result in lower emissions than during normal operations. While emissions during malfunction events are highly variable, as discussed above, Enviva's typical response to an upset or malfunction event is to reduce throughput, up to and including complete cessation of operations, and therefore immediately reducing emissions below those of normal operations.

*II. The Draft Permit Fails to Assure the Facility's Compliance with Maximum Achievable Control Technology Requirements (MACT) for Hazardous Air Pollutants (HAPs).*

*A. The Enviva Northampton Plant was a Major Source of Hazardous Air Pollutants as Originally Permitted and Constructed, and Should Have Gone Through a Case-by-Case MACT Review.*

In the original application for the facility, using a combination of AP-42 emission factors and emission factors derived from Enviva stack tests approved by NC DAQ, potential total HAP emissions were estimated to be less than 10 tpy and the estimate for the highest single HAP emissions was less than 4 tpy. Therefore, contrary to the statement by EIP, as constructed, the facility was a minor source for HAPs and no case-by-case MACT review was required.

As discussed above, physical and operational changes made to the Facility pursuant to the 2015 permit modification debottlenecked existing operations and allowed for an increase in throughput at the Facility. This increased throughput resulted in an increase in potential total HAP emissions to 37.8 tpy and to 15.1 tpy potential emissions of the highest-emitted single HAP. While the 2015 permit modifications resulted, for the first time, in the Facility becoming a major source of HAPs, it is clearly established that Clean Air Act Section 112 case-by-case MACT requirements do not apply to modifications. Therefore, the facility has never triggered any requirement for case-by-case MACT review.

*1. North Carolina DEQ Underestimated Formaldehyde and Methanol Emissions.*

The AP-42 emission factors used as the basis for the Enviva dryer HAP calculations are specific to particle board dryers which, given the potential for significant differences in wood dryer operation across industries and the significant impact of dryer operating conditions on emissions, are considered by Enviva to be conservative for the Northampton dryer. Particle board dryers reduce the moisture content of the wood product to much lower levels than Enviva dryers. Additionally, most other wood industry dryers operate at considerably higher temperatures which result in higher emissions of HAP. Research has shown that while not all individual HAP emissions are directly correlated with temperature, methanol and formaldehyde emissions do increase significantly with increasing temperature (Milota and Mosher, July 2008). While the scaling method employed by Enviva may not capture the exact relationship between softwood percentage and individual HAP emissions, Enviva believes the scaled methanol and formaldehyde emission factors are conservative for the Northampton dryer. Additional supporting detail is provided in the response to 2 below.

Regarding the Appling County wood pellet facility, without further information regarding the stack testing methodology used or the operating conditions of the dryers it is difficult to evaluate that data in the context of the Enviva Northampton facility. Differences in test methods, facility equipment, and operating conditions can lead to significant differences in measured HAP emission rates.

> *2. Hardwood Drying Likely Emits Higher Amounts of Certain HAPs Than Softwood Drying.*

Enviva disagrees with EIP's speculation concerning methanol and other organic HAP emissions from dryers processing hardwoods and softwoods.

EIP made the following statement.

> "...North Carolina DEQ assumes that methanol and other HAPs decrease when processing hardwood, yet considerable evidence exists that this may be incorrect for certain HAPs, especially methanol. Studies of lumber and engineered wood dryers show that during the wood drying process, hardwoods emit significantly more methanol than softwoods."

In support of their statement, EIP cites an article published by Michael Milota in the June 2000 issue of Forest Products Journal. A review of this article demonstrates that this is very general information concerning air quality in the wood products industries and is not a research paper presenting original data and/or the test results of the author. This is strictly an introductory article that is by no means focused on the possible differences in emission of HAPs from softwoods and hardwoods from wood dryers.

EIP only cites data for oriented strandboard dryers and leaps to the conclusion that these emission factors should be applied to the Enviva Pellets Northampton dryer. EIP fails to cite the different data for plywood dryers listed several lines above the oriented strandboard dryer in the same table provided by Milota. For plywood dryers, the reported methanol emissions from softwood and hardwood dryers are identical.

Milota cited two NCASI technical bulletins as the source of these emissions data. The information concerning oriented strandboard dryers was drawn from NCASI publication 772 dated 1999. The information concerning plywood dryers was drawn from NCASI publication 768 dated 1999. In addition to the EIP's very selective citing of the information in the Milota article, EIP fails to note that all of the information in Milota's table and the NCASI publications cited by Milota pre-date the development and use of NCASI Method 105.1 and EPA Method

320. These are the test methods that are now used to measure HAP emissions from wood products industry sources.

The information described by EIP's falls well short of "...considerable evidence." Rather, it cannot even be characterized as "anecdotal information."

In addition to carefully selecting only the information that supports their speculation, EIP's do not discuss (1) the significant industry-to-industry differences in wood dryer operation and (2) the significant impact of wood dryer operating conditions on emissions. Both oriented strandboard dryers and lumber kiln dryers reduce the moisture content of the wood product down to levels much lower than the dryers used in the wood pellet industry—especially the Enviva dryers. Furthermore, oriented strandboard dryers, lumber kiln dryers, and most other wood industry dryers operate at considerably higher gas exit temperatures, which increases HAP emissions.

EIP's cited a second publication to support their claim that wood dryers processing hardwoods have higher methanol emissions. EIP cited the July 2008 paper by Milota and Mosher. This publication goes beyond the generalities of Milota (2000) to provide some original data generated by the authors. Accordingly, the paper of Milota and Mosher deserves more weight. This paper does indicate that the one hardwood species, Red Alder, had laboratory-based methanol emission rates of 0.418 lbs./MBF versus five softwood species with laboratory-based methanol emission rates averaging 0.154 lbs./MBF. Red Alder is a hardwood species with a range limited to the western United States from Alaska to southern California. EIP's conclude that,

> "Granted, there are significant differences between lumber kilns and wood pellet dryers, however, these results show that in certain instances drying hardwoods can release greater levels of methanol than softwoods."

The key phrase in this comment is "certain instances." EIP's provide no evidence supporting their conclusion that this hardwood/softwood relationship applies to the type of wood dryers operated by Enviva.

In fact, other data and conclusions presented in Milota and Mosher and the NCASI publications cited by Milota and Mosher support the conclusion that the wood dryer operating temperature is much more important than the wood species with respect to methanol emissions. For example, the methanol emissions for Red Alder drop from the 0.416 lbs./MBF at a dryer temperature of 235°F to 0.124 lbs./MBF at 180°F. This is a decrease by a factor of 3.3 over a temperature range of only 55°F. Similar strong temperature dependences are indicated by Milota and Mosher for the five species of softwoods tested. On pages 53, 54, and 55 Milota and Mosher make the following statements regarding the importance of dryer temperature.

> ". . . in this data set, the methanol emissions greatly increase with temperature. . . "
> Page 53, Milota and Mosher, July 2008

"At high temperature (bottom graph), the rate of methanol and formaldehyde emissions increased dramatically as the wood dries. This occurred with every species tested." Page 54 Milota and Mosher, July 2008

"HAP emissions vary greatly among species. The hardwood species tested had the highest HAP emissions, probably due to the great number of methoxy groups in hardwood lignin and the higher hemicellulose content and number of acetyl groups. Overall, HAP emissions increase with temperature; however, not all the HAPs are affected by temperature in the same way. Methanol and formaldehyde emissions increase dramatically with temperature...."
Page 55, Milota and Mosher, July 2008

These strong conclusions presented by Milota and Mosher are directly relevant to methanol emissions from the Enviva dryers. Wood chip dryers at pellet plants in general, and especially at Enviva pellet plants, operate at temperatures well below the temperatures of oriented strandboard plants, particleboard plants, MDF plants, and lumber kilns. Accordingly, the data of Milota and Mosher would indicate that methanol emissions are much lower on a pounds methanol per unit of wood basis from Enviva's dryers when compared to other types of wood product industry dryers. Data from these other industries should not be casually transferred to the Enviva dryers without considering this very important operating condition that minimizes emissions from the Enviva dryers.

With respect to the AP-42 Section 10 emission factors which don't indicate higher methanol emissions in hardwood drying, EIP concludes that these AP-42 data are not "conclusive" as indicated in the following excerpt.

"Finally, although the AP-42 emission factors do not show a rise in methanol emissions with hardwood, AP-42's methanol emission factor for hardwood is based on tests of just three dryers all operating at 55% hardwood.[52.] Notably, these emission factors received a 'D' reliability rating, meaning it is one of the least trustworthy emission factors in AP-42.[53]. Given the extremely low number of data points and the poor reliability ration, these emission factors cannot be considered conclusive."

While AP-42 emission factors certainly have some limitations, EIP's criticism of these methanol emission factors is excessive and inappropriate. It is useful to note that the three emission tests summarized in AP-42 apply to full scale, commercial facilities while the data primarily relied upon by EIP are from the very limited lumber kiln simulator laboratory studies conducted by Milota and Mosher.

To term the methanol factors as "...one of the least trustworthy emission factors in AP-42..." is certainly overly critical. There are many D and E factors in many industrial categories in AP-42, due primarily to the limited number of test reports available. Notably, the laboratory-oriented data presented by Milota and Mosher, and relied upon by EIP, would not even be accepted as E-rated data in AP-42 because these data were not obtained at full scale, commercial facilities.

EIP's attempt to dismiss the AP-42 factors, that do not support their speculation regarding hardwood/softwood-related emission relationships, is simply inadequate.

References


[50] Milota, Michael. "Emissions from Wood Drying: the Science and the Issues." Forest Products Journal. 2000. Issue 50(6) (Attachment E).

[51] Milota, Mike and Mosher, Paul. "Emissions of Hazardous Air Pollutants from Lumber Drying." Forest Products Journal. July 2008 Issue 7/8. at 50-55 (Attachment F).


*III. The Draft Permit's Monitoring Requirement Fails to Assure Compliance with Limits on Visible Emissions.*

*IV. The Draft Permit's Particulate Matter Monitoring is Insufficient to Assure Compliance with the Applicable PM and Opacity Limits.*

The permit language regarding compliance monitoring for limits on visible emissions is boilerplate language used by NC DAQ in hundreds of air permits issued in North Carolina since the 1990's and has survived decades of public and EPA comment and review. This is the same language used in all other Enviva permits. EIP's criticism of this approach to compliance monitoring has no merit.

Enviva strongly disagrees with EIP's assertion that "COMS are relatively common at wood pellet facilities on the scale of Enviva Northampton" and refer to permits for Georgia Biomass and Hazelhurst Wood Pellets. The named permits only require the installation of COMS for steam generating units applicable to 40 CFR 60 subparts Db and Dc respectively and not for any other emissions unit. Enviva Northampton does not operate a steam generating unit so installation of COMS is not required. Additionally, the flue gas from the furnace/dryer are treated via a Wet Electrostatic Precipitator resulting in a wet plume for which a COMS is not suited.

Similarly, the permit conditions addressing compliance and monitoring of PM emissions contained in Enviva's permit are typical of hundreds of permits issued by DEQ since the 1990's. Inspection and maintenance requirements, along with associated recordkeeping and reporting requirements, are typical and appropriate for the emission sources in Enviva's permit. Furthermore, reference method testing performed in 2013 demonstrated that PM emissions were less than 10 % of the emission standards applicable to PM sources at the Facility.

*V. North Carolina DEQ Failed to Provide Timely Access to the Title V Permit Application and Other Materials, Violating Title V's Requirement That These Materials Be Made Available to the Public.*

NC DAQ to respond

*VI. North Carolina DEQ Should Require Enviva Northampton to Prepare and Implement a Fugitive Dust Control Plan.*

The letter from the National Council for Air and Stream Improvement, attachment 2, addresses response to questions VI. And VII.

*VII. The Draft Permit Does Not Assure Compliance with the Requirement to Design and Maintain a Safe Facility Under the Clean Air Act Section 112(r)(1) General Duty Clause.*

> The letter from the National Council for Air and Stream Improvement, attachment 2, addresses response to questions VI. And VII.

Combustible dust is regulated by OSHA.

# Attachment 2

ncasi

**NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT, INC.**
SOUTHERN REGIONAL CENTER
*Mailing and Street Address:*
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November 22, 2017

Kai Simonsen
Air Permitting Engineer
Enviva Raleigh Office
4242 Six Forks Road, Suite 1050
Raleigh, NC 27609

Dear Kai,

We have reviewed sections VI and VII of the Environmental Integrity Project (EIP) comments on draft Title V Air Operation Permit No. 10203T06 for Enviva's Northampton County Wood Pellet Plant. The material in those sections is not consistent with the best available science and knowledge about the nature and health impacts of potential fugitive dust emissions from the facility. Attached, you will find our comments addressing some of the specific concerns we had about the EIP comments.

I hope you will find this useful. Please do not hesitate to contact me if you have any questions or would like additional information.

Sincerely,

Vickie Tatum

Vickie Tatum, Ph.D.
Program Manager

**NCASI comments on sections VI and VII of the Environmental Integrity Project (EIP) comments on draft Title V Air Operation Permit No. 10203T06 for Enviva's Northampton County Wood Pellet Plant**

EIP's primary health concerns about fugitive dust emissions from Enviva Northampton appear to be that:

> *Health problems associated with exposure to particulate matter pollution primarily involve damage to the lungs and respiratory system due to inhalation. Specifically, the inhalation of dust particles can irritate the eyes, nose and throat; cause respiratory distress, including coughing, difficulty in breathing and chest tightness; increase the severity of bronchitis, asthma and emphysema; cause heart attacks and aggravate heart disease; and lead to premature death in individuals with serious lung or heart disease. When exposed repeatedly over a longer time period, fugitive dust exposure can lead to severe illness such as cancer.*

However, these claims are not particularly relevant to Enviva Northampton's operations. "Particulate matter" and "dust particles" are non-specific labels that provide no information on the exact nature of the particles of interest. Any potential adverse health effects that might be associated with "particulate matter" or "dust particles" are a function of the size, shape, and chemical makeup of the specific particles. Thus, it may be true that *some* types of particles are associated with specific health impacts, but that does not mean that *all* types of particles are associated with those same health impacts. In addition, the potential for adverse health effects is also a function of exposure concentration and duration, and for most substances in the environment, there is a threshold of exposure concentration and duration below which no adverse health effects will be observed.

In this case, according to the EIP comments, the particles of concern appear to be primarily wood dust or unpaved road dust, since they state that "[m]ajor sources of fugitive dust at wood pellet plants include wood handling, wood storage piles, conveyor transfer points, yard dust, haul road dust and engine exhaust." Key points to consider include 1.) size of these particles, which affects how deeply they can penetrate the respiratory tract and how far they can travel in the atmosphere; 2.) potential exposure concentrations; and 3.) any associated adverse health effects and the threshold concentrations for those effects.

Unpaved road dust is composed primarily of larger particles. For example, Organiscak & Reed (2004) reported that the majority of dust generated by trucks on unpaved haul roads was >10 μm in diameter and thus too large to penetrate deeply into the respiratory tract. Similarly, Zhao et al. (2017) reported that 80% of the total mass of particles collected adjacent to unpaved roads came from particles greater than 10 μm in diameter. Dyck & Stukel (1976) noted that "[p]articles with larger diameters [>30 μm diameter] generally settle out of the air within 25 ft. of the road," and that "[a]lthough these particles may constitute a nuisance in areas immediately adjacent to unpaved roads, they do not contribute to the ambient dust levels at locations far removed from the road." Organiscak & Reed (2004) sampled dust levels on the berms of unpaved roads and 50 and 100 ft. away from the road. They reported that airborne dust concentrations notably decreased when moving away from the road, with average dust concentrations 100 ft. from the roadside of less than 20% of the levels measured on the road berm. Thus, not only are the particles generated by traffic on unpaved roads generally too large to penetrate the respiratory tract, they do not move any great distance away from the point of generation.

Furthermore, there is little indication that exposure to large ("coarse") particles of crustal material such as those that primarily make up unpaved road dust are associated with any serious health impacts. For example, epidemiology studies conducted by Pope et al. (1999) and Schwartz et al. (1996, 1999) found no associations between coarse particulate matter (e.g. from windblown dust) and mortality and Claiborn et al. (2002) reported no association between increased crustal particulate matter levels and emergency department visits for asthma.

The particle size distribution of wood dust generated by the manufacture of wood products is a function in part of the type of processing. In general, operations like sawing and chipping yield larger particles while operations like finish sanding produce smaller particles. However, since most research on airborne wood dust concentration and morphology has been done in the context of occupational exposures, sampling has typically been done using samplers that do not capture particles larger than 100 μm in diameter, so information on the full range of particles generated during wood processing is uncommon. We were able to identify two reports that addressed particle size of airborne dust generated during the production of wood pellets. Melin (2008) collected dust samples from wood pellet manufacturing and handling facilities, stating that samples were "collected in areas where the dust had settled which means that the particles were representative of the entire spectrum of sizes encountered in a typical working environment for bulk handling of pellets." Size fractions were separated and identified via sieving and by use of a machine vision system and the researchers reported that "the most representative particle size" was somewhere between 63 and 75 μm in diameter. Igathinathane et al. (2009) also used a machine vision system to assess the particle size distribution in "airborne dust from soft pine wood sawdust pellets and ground pine tree bark pellets." They reported that the arithmetic mean length of airborne dust particles from wood and bark pellets were 113.8 and 118.1 μm, respectively. These findings suggest that many of the particles generated during the production and transport of wood pellets are too large to be inhaled and, as with unpaved road dust, too large to be transported in air as fugitive dust to any great distance from the point of generation.

There is no published information identifying any adverse health impacts of wood dust exposures to the general public. Wood dust exposure is generally considered to be strictly an occupational issue, since, aside from woodworking hobbyists, the public is not exposed to wood dust of relevant particle sizes at concentrations above the threshold of effects.

There are many published epidemiology studies in which associations between adverse health effects and occupational exposure to wood dust have been explored. Unfortunately, much of the data in those reports come from studies of furniture manufacturing and workers outside North America and do not reflect the exposure conditions typical of wood pellet manufacturing facilities in the US and Canada. Similarly, there are few data available on worker wood dust exposures and potential related health effects in pellet mills globally and none from the US or Canada. The North Carolina Department of Labor (NCDOL) (2012) identifies a number potential health effects that may be of concern to workers. Note that concerns about cancer, exposure to irritant chemicals, allergies, and sensitization from wood are not relevant to wood pellet manufacturing because they are associated with species of wood that are not used in pellet manufacturing (e.g. western red cedar, exotic hardwoods). With respect to respiratory health effects, the most relevant study available in the scientific literature is that of Glindmeyer et al. (2008). This 5-year longitudinal study was conducted in the US, in facilities operating under currently applicable industrial hygiene practices, and included extensive exposure assessments and objective health measures. The researchers found no statistically significant associations between exposures to "wood solids" and any adverse effects on respiratory health.

Under the Clean Air Act (42 USC Chapter 85, Subchapter 1, Part A, Sec. 7412), hazardous substances are defined in subsection (b)(2) as "pollutants which present, or may present, through inhalation or other routes of exposure, a threat of adverse human health effects (including, but not limited to, substances which are known to be, or may reasonably be anticipated to be, carcinogenic, mutagenic, teratogenic, neurotoxic, which cause reproductive dysfunction, or which are acutely or chronically toxic) or adverse environmental effects whether through **ambient concentrations**, bioaccumulation, deposition, or otherwise…" [emphasis added]. There is no evidence that either wood dust or unpaved road dust "released" from the Enviva Northampton facility in the form of fugitive dust is carcinogenic, mutagenic, teratogenic, neurotoxic, causes reproductive dysfunction, or is acutely or chronically toxic at ambient concentrations. Nor do these dusts bioaccumulate or pose any health hazard via inhalation or other route of exposure once "deposited" in the environment.

The EIP comments also appear to suggest that wood dust should be subject to regulation under the General Duty Clause of the Clean Air Act (section 112(r)(1) due to the risk of combustible dust explosions. The Clean Air Act does not apply to combustible dust because such explosions take place only within the confines of a facility, not in ambient air. OSHA describes the elements of a combustible dust explosion as an "explosion pentagon." The five elements they identify are:

1. Combustible dust (fuel)
2. Ignition source (heat)
3. Oxygen in air (oxidizer)
4. Dispersion of dust particles in sufficient quantity and concentration
5. Confinement of the dust cloud (in a building, room, or vessel)

Note number 5, "confinement of the dust cloud in a building, room, or vessel." Combustible dust in the ambient atmosphere does not explode or burn. Combustible dust is regulated, very appropriately, under the OSHA General Duty Clause and the Clean Air Act is not applicable.

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