Guidance Document for the Storage and Handling of Petroleum Coke

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Contents

Introduction

Petroleum coke (petcoke) is a solid product of the refining process. Many products are derived from a barrel of crude oil (e.g. gasoline and diesel) and petcoke is one of those products. After gasoline, jet fuel, diesel fuels and lubricating oils are manufactured from crude oil, some refineries put the remaining material through additional processing called coking. Coking uses heat to crack or break down large hydrocarbon molecules to produce “fuel grade” petcoke, a highly stable, solid fuel as well as other grades of petcoke. Petcoke is produced from all types of crude oil including light, sweet crude oil and heavy sour crude. Petcoke is a valued commodity around the world and there has been a global market for petcoke for decades.

Fuel grade petcoke is an essential fuel that is used in industrial applications and manufacturing processes including the production of steel, aluminum, and other specialty products. The United States Environmental Protection Agency (EPA) classifies fuel grade petcoke as a “traditional fuel” that has been historically managed as a “valuable fuel product.” Since first produced in the U.S. in the 1930s, petcoke has been safely transported by ocean freight, barges, rail and truck. In most locations, petcoke is staged outside in preparation for shipping domestically and internationally as permitted and is governed by federal and state environmental and safety regulations. The use of petcoke has enabled many North American businesses to remain competitive in the global marketplace while employing thousands of people in manufacturing jobs with good wages and benefits. Material Safety Data sheets for petcoke indicate it is non-toxic and non-carcinogenic and the EPA does not consider petroleum coke a hazardous product.

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1 Scope

The purpose of this document is to provide guidance on operating and maintenance practices for the storage and handling of petroleum coke (petcoke). In particular, guidance is provided on the management of airborne particulate matter emissions and water runoff from petcoke storage facilities. A variety of techniques is presented and should be applied based on knowledge of specific facility and product conditions. These techniques are known to be effective depending on specific conditions at the site include average wind speeds and climate, moisture content of the material, etc.

2 References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EPA-450/2-92-004, *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures*, September 1992

Process Guidance Note NIPG 3/5 (Version 2), *Coal, Coke, Coal Product and Petroleum Coke Processes*, U.K. Department of the Environment

3 Terms and Definitions

For the purposes of this document, the following definitions apply:

3.1
fugitive dust
Any particulate matter comprised of petcoke emitted into the atmosphere other than through a stack (i.e. due to wind or human activities).

3.2
petroleum coke
The solid carbonaceous material produced from a coker after cracking and distillation from petroleum refining operations. This coke is also termed “green” coke or “fuel grade” coke.

3.3
roadway
Any road used for repeated travel by car, truck, or off-road mobile heavy equipment but does not mean any part of a pad on which petcoke is staged or stored.

3.4
transfer point
Any location at a facility where petcoke is being moved, carried, conveyed, or transported and is dropped or deposited.

3.5
transport vehicle
Any truck or other vehicle that travels by road to transport petcoke to or from a facility.

3.6
water spray system
A dust suppression technique that uses water or water-based solutions delivered through pipes, tubes, or hoses that are fitted with one or more nozzles.

4 Existing Federal and State Regulations Governing Petcoke Operations

Petcoke operations are regulated by a multitude of existing Federal and state programs as listed below.

— Clean Air Act (broadly prohibiting air pollution).

— Fugitive dust/fugitive emissions (Fugitive Dust Control Plans).

— Limits on duration or opacity of “visible emissions.”

— Title V air operating permits.

— Clean Water Act—National Pollution Discharge Elimination System (NPDES) including storm water runoff.

— Fire prevention codes (typically are based on either the International Fire Code (IFC) or National Fire Prevention Association (NFPA) standards).

With respect to the particular circumstances of a site storing and/or handling petcoke, local, state, and federal laws should be reviewed.

5 Fugitive Dust Management Plan

Sites that store and/or handle petcoke should consider developing a fugitive dust management plan. The management plan should consider including:

— a map showing the location of the facility, location of storage areas, normal traffic patterns to access storage locations, and location of loading/unloading and transfer points;

— a description of the dust suppression system(s) (i.e. control measures, devices, and technologies) the site uses to minimize/control fugitive dust;

— storage, handling, and transportation operations;

— the maintenance and reliability programs for the petcoke handling equipment;

— the maintenance and reliability programs for the emissions control measures/equipment;

— the housekeeping measures employed to prevent fugitive dust;

— water runoff management options.

The management plan should be updated when the site/petcoke equipment is modified or when there is a process change. In addition, a periodic review of the management plan should be conducted to steward fugitive dust management system performance including identification of opportunities for improvements (i.e. continuous improvements cycle) and associated action plans to address the opportunities.

6 Primary Practices to Control Petcoke Emissions—Storage

6.1 General

Petcoke storage may occur at a variety of locations including the point of production, an intermediate logistics terminal, and the end user facility. At each of these locations, maintaining the optimum moisture content of petcoke is a key practice required to control petcoke fugitive emissions. There are three primary techniques that should be considered to maintain optimal moisture content and control potential petcoke emissions (i.e. fugitive dust) during storage:

1) pile maintenance,

2) wetting with water, and

3) treating with an anti-dust chemical agent.

6.2 Pile Maintenance

Pile maintenance is important as a method to control potential fugitive dust. Proper maintenance of petcoke piles will help reduce the potential for fugitive dust emissions, particularly when combined with wetting or anti-dust chemical agent practices, as discussed in 6.3 and 6.4. More specifically, the following should be considered with regard to properly maintaining a petcoke pile:

— pile height consistent with facility's water application capabilities,

— shaping of the piles to remove peaks and sharp edges,

— pile compaction,

— reclaiming practices designed to reduce potential dust emissions,

— pile stacking practices designed to reduce potential dust emissions (e.g. minimizing drop height from stacking conveyors).

6.3 Wetting with Water

An emission control technique that is commonly used at petcoke storage locations is the application of water to storage piles. The systematic application of water to petcoke helps to control fugitive dust emissions and maintain product moisture content, and can be accomplished through both portable and fixed infrastructure. Water increases the particle weight and acts as a binding agent between particles. Water spray systems may require periodic reapplication of water to overcome the hydrophobic nature of petroleum coke. Wetting systems for petcoke piles can include the following:

— water cannons;

— water trucks;

— misters and aerial sprays.

The following issues should be considered when using water spray systems on petcoke piles:

— location of components (e.g. cannons, misters, sprays, etc.) relative to the location of the piles;

— frequency of water spray system operation;

— application rate;

— adjustment of frequency or application rate depending on weather forecasts/conditions;

— adequacy to cover targeted area;

— freezing temperatures may require additional practices to mitigate fugitive dust (see Section 10).

An engineering analysis may be required to determine the correct wetting systems for the piles. Ultimately, the most effective water application technology for an operation will be dictated by site specific conditions, but the primary considerations when selecting wetting equipment are:

— ensure the operation meets existing permit requirements;

— integrity of the product is preserved;

— optimal moisture content is achieved on a repeatable basis.

6.4 Anti-Dust Chemical Agent/Treatment

In some situations, water spray systems can be combined with anti-dust chemical agents such as surfactants and humectants. Application of anti-dust chemical agents is normally achieved by combining the chemical into the water spray. The surfactant enhances the wetting by lowering the surface tension of the water thereby allowing the water droplets to penetrate deeper into the petcoke. Humectant helps slow moisture evaporation.

The use of anti-dust chemical agents may offer the following benefits:

— have a residual effect of up to 45 days or more for pile integrity, depending on weather conditions and type of chemical used;

— minimize need for reapplication of water;

— allow additional coke pile height, if needed;

— routine cleanup requirements for the coke conveyors may be reduced;

— maintenance needs within the coke handling facilities may be reduced.

7 Other Practices to Control Petcoke Emissions—Storage

7.1 General

In addition to the three primary practices to control petcoke fugitive dust from storage mentioned in Section 6, other practices that a site storing petcoke may consider include enclosures or wind screens. In addition, refineries that produce petcoke may consider walled petcoke pads. These additional practices are discussed further in 7.2, 7.3, and 7.4, and may be considered if management of product moisture content is not effective in meeting permitted fugitive dust emission requirements.

7.2 Enclosures

Storage enclosures typically consist of a completely roofed and walled structure or building surrounding an entire petcoke pile (i.e. petcoke barn or dome). Methods for controlling fugitive dust from enclosures include the following:

— water spray system to control fugitive dust at vents, entrances and exits;

— air pollution control equipment to control fugitive dust at vents, entrances and exits;

— doorways covered with overlapping flaps or sliding doors.

7.3 Wind Screens

Wind screens are used to lower the wind velocity to reduce entrainment of particulates by the wind.

7.4 Walled Coke Pads at Production Facilities (e.g. refineries)

Coke pads may be used to provide sufficient residence time for petcoke dewatering after petcoke is cut from the coke drum. There are two broad categories for coke pads:

1) standalone coke pad,

2) coke pad combined with a pit.

Coke pad design does not necessarily contribute to or reduce petcoke fugitive dust emissions. It is recommended that steps be taken to keep the coke pile on the pad sufficiently wet to prevent petcoke fugitive dust emissions. This can be accomplished by using water sprays on the coke pile. If the water sprays are inadequate, one or more of the following additional controls should be considered:

— additional water sprays,

— anti-dust chemical agent in the water spray system,

— additional or improved enclosures,

— wind screens.

8 Practices to Control Petcoke Emissions—Handling and Transportation

8.1 General

Fugitive dust emissions can also occur during the handling and transportation of petcoke. The following sections describe the control practices that should be considered for each of these activities. Details of these practices implemented at a site should be described in the fugitive dust management plan (see Section 5).

8.2 Handling

Wetting can be an effective control technique for petcoke loading, unloading and transfer points, and roadways. At points where petcoke is transferred via front end loaders, bull dozers, cranes, etc., the use of a wetting dust suppression system should be considered prior to loading and transport.

While wetting product during handling is important, petcoke end uses are varied and their needs with regard to moisture must be taken into consideration when determining the optimum moisture content and/or volume of water to

be applied to petcoke. Also, excessive application of water during petcoke handling can result in challenges that may increase the potential for fugitive dust generation. As with any control device, the application of water at various stages of the petcoke handling must be well reasoned and documented, taking into consideration multiple variables (initial moisture content, weather conditions, product temperature, etc.) within a facility fugitive dust management plan.

The application method for water during petcoke handling will be determined by the logistics of the transfer operation, product specific variables, and operating permit conditions. For example, transfer points where petcoke is being transferred from one conveyor to another may utilize a water spray bar or misting system.

To help mitigate fugitive dust emissions, particular areas of the petcoke handling system should employ a wetting dust suppression system. Dust suppression points that should be considered include:

— **Conveyors** [Configurations (uncovered, covered, enclosed, half-moon, tube) and Transfer Points (use of bag houses, water sprays)]

  Configurations for conveyor systems used to transfer petcoke include uncovered, covered, enclosed, half-moon, or tube styles. At each transfer point within the conveyer system, a wetting fugitive dust suppression measure—or in the case of an enclosed transfer point, a bag house—should be considered.

  Transfer of “moist” material can be considered as a fugitive dust control measure. Because petcoke is hydrophobic, additional moisture can typically be applied without impacting product quality while improving the operator’s ability to transfer and handle the material without creating fugitive dust emissions. The moisture content level required for fugitive dust control is dependent on the properties of the material and should be understood by the operator for specific products and operations.

  Accordingly, the use of water sprays or water cannons should be considered prior to loading petcoke onto conveyors if the moisture content of the petcoke is low. Wetting also should be considered along the conveyor route. Moist petcoke tends to promote more evenly distributed loading across the conveyor belt, which further reduces chances of spillage and dust creation. In addition, water application at the transfer points can help address the issue of petcoke “drying up” as it gets transported from belt to transfer point and onto the next belt, several times on a long conveyor run. For example, one facility has a belt train that is over 2 miles long and two of the eleven transfer stations are equipped with water spray systems that help keep the coke moist before it gets transported further downstream. Another configuration is where the conveyor belts are housed in “galleries” which can significantly reduce the amount of fugitive dust emissions to the atmosphere since most of it is contained within the gallery structure.

  Frequent conveyor monitoring and maintenance is recommended to ensure a reliable system with minimal spillage/carryback and reduced fugitive dust emissions. Minor adjustments and maintenance (such as re-aligning a belt, replacing idler pulleys, adjusting transfer station belt scrapers, etc.) may frequently be needed and contribute towards minimizing downtime and repairs.

— **Loading and Unloading Practices**

  Truck loading and unloading should be conducted so as to minimize the potential generation of fugitive dust. Steps may include:

  — applying water to product being loaded or unloaded,

  — minimizing drop distances.

8.3 Transportation

In addition to the storage and handling guidance provided above, sites should take steps to minimize fugitive dust emissions generated during on-site activities related to transportation. Trucks leaving the premises should be cleaned and steps should be taken to ensure the petcoke loads are appropriately covered or wetted, with consideration given to treating with anti-dust chemical agent to prevent emissions. Specific steps to consider include, but are not limited the following.

- **Site speed limits**—restrict to an appropriate limit for site such that fugitive dust is not created.
  - Use of speed bumps to manage speed of transport vehicles.
  - Enforce on-site speed limits to minimize stirring up petcoke fugitive dust.
- **Truck trailers**
  - After loading, if the petcoke is leaving the site, the transportation company should take the appropriate steps to manage potential fugitive dust emissions.
  - Truck trailer tops may be covered with a tarp after being loaded.
  - As an alternative to full covers and as local circumstances allow, truck trailers may be able to use a narrow top opening cover.
  - Covering may not be necessary as long as the petcoke is kept wet and the guidelines for storage and loading/unloading are followed.

    NOTE Local or state regulations may require the use of covers in some circumstances.
  - Trailers may be equipped with single, wide tires as opposed to dual tires to avoid carrying out any coke between the tires.
- **Truck washing**—wheel washing and use of rumble strips.
  - During non-freezing conditions, trucks should be washed after being loaded with petcoke.
    - Trucks can drive through an automatic truck wash prior to leaving the loading area, or
    - manual wash can also be utilized.
  - After unloading, trucks/trailers should be sprayed/washed before exiting the plant.
  - Rumble strips should be used to help vibrate loose petcoke from the truck prior to washing.
  - Truck operators should brush off any spillage onto ledges of trucks after loading process is complete.
- **Management of water collected from washing activities**
  - Sites should have a system in place to collect and manage the runoff water from washing the trucks.
  - The use of berms can be an effective system to route runoff water to proper treatment areas.

9 Other Activities and Associated Control Practices

9.1 General

In addition to petcoke storage, handling and transportation activities, petcoke fugitive dust emissions can be created by other sources at a site. These other sources that should be managed at a site may include crushers (see 9.2); screeners (see 9.3); and repair, replacement, and maintenance of petcoke equipment (see 9.4).

9.2 Crushers

Refineries utilize crushers to reduce the size of the petcoke pieces produced during the coke cutting process. Typically, crushers are used in or very near to the “coke pit.” When crushers are used in these types of scenarios, operators can apply water to a limited degree. However, over application of water during crushing can cause the crushing process to bog down or clog. These are situations where foggers or vacuum assist devices (bag houses) may be more effective for fugitive dust control.

9.3 Screeners

Screeners are used to segregate or “size” petcoke and other bulk commodities. Screeners are also used to separate trash or contaminants from the petcoke. The type of screener directly impacts the appropriate type of fugitive dust control needed. Manual type screeners are generally more susceptible to petcoke dust because manual screeners typically have fewer “built in” dust control systems (e.g. spray bars). A water truck that periodically applies water to the pre-screened material can be an effective practice. A fogger system directed at the material drop point can also be effective. When using manual type screeners, operators should consider weather conditions. Days with high humidity and low wind are more favorable to screening operations.

9.4 Repair, Replacement, and Maintenance of Petcoke Equipment

Original equipment manufacturer recommendations should be followed to ensure proper maintenance is completed on petcoke handling equipment. This equipment may include chutes, bins, hoppers, cranes, conveyor belt systems, screeners, and crushers. Failure to properly maintain equipment can result in a greater potential for fugitive dust emissions.

Maintenance on petcoke equipment should consider the following: good housekeeping, routine oil testing on gear boxes, transmission alignment, temperature monitoring on rotating equipment, current monitoring on motors, testing and monitoring rubber belting on conveyors, greasing of bearings, adjustment of belt scrapers and skirting, thickness testing on pulley faces/end disks/drums, wire rope lubrication, idler greasing/replacement, and idler alignment. Breakers/disconnects should also be routinely cleaned with a vacuum to remove any dust along with tightening wires.

10 Practices to Control Petcoke Emissions—Adjustments for Freezing Conditions

Adjustments may be required during below freezing conditions when water cannot be used to maintain moisture levels. The following practices are mitigation strategies for wintertime conditions.

— Proactively maintaining adequate moisture levels prior to the arrival of subfreezing conditions.

— Proactively treating piles with anti-dust chemical agents prior to the arrival of subfreezing conditions.

— Transfer of moist product.

— Pile grooming and compaction.

11 "Housekeeping" Considerations

Housekeeping activities have been shown to be effective in managing petcoke fugitive dust emissions and should be included in a site's fugitive dust management plan. The types of housekeeping activities that should be considered in the fugitive dust management plan include:

— washing down the area around crushers and screeners,

— washing down/sweep/vacuum roadways,

— paving or placing gravel on roadways,

— street sweepers,

— general housekeeping such as sweeping petcoke loading areas and routes daily.

12 Water Runoff Management Options

Some petcoke facilities are "non-discharge." For those petcoke facilities that do discharge stormwater and/or process water, water runoff management options typically require control of water by collecting the water, settling solids, and then discharging in compliance with the regulatory requirements. Treatment to reduce total suspended solids may include collection of runoff into ponds and ditches, and providing circuitous pathways for the solids to settle. Other treatments can utilize flocculating agents to enhance the settling of the solids and may also use various filters, berms, weirs, silt screens, or silt fencing to enhance solids settlement closer to the petcoke piles.

Water runoff management systems should address both the recovery and recycle processes (i.e. using runoff for water spray activities, transport vehicle washing, etc.) as well as any discharge from the facility to nearby lakes, rivers, etc. (see Section 4 on regulatory requirements and permit limits).

For sites in colder climates, water management plans should include the potential for the water to freeze in the winter.

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