
October 28, 2019

VIA EMAIL

Mr. David Navecky
Surface Transportation Board
Office of Environmental Analysis
395 E Street, SW
Washington, DC 20423-0001

Re: Finance Docket No. 36168 – Oakland Global Rail Enterprise – Authority to Operate a Rail Line in Oakland, California – Responses to Information Requests Nos. 1 and 2

Dear Mr. Navecky,

I am writing in response to your requests for information and clarification regarding Oakland Global Rail Enterprise's proposal to operate a rail line in Oakland, California (the Project). Please find attached, Oakland Global Rail Enterprise's responses to Information Requests Nos. 1 and 2, dated May 25, 2018 and September 26, 2019, respectively.

In addition, I am also providing some background information about the Project including a general overview of the proposed Project, a brief history of the Project site, and descriptions of the Project purpose and need as well as proposed operations. We hope this information will aid OEA in its environmental review of the Project. Please do not hesitate to contact me if you have any questions.

Sincerely,



Kathryn Kusske Floyd

cc: Victoria Rutson
Danielle Gosselin
Skyler Sanders
Jennifer Lee

Surface Transportation Board
October 28, 2019
Page 2

Attachments:

1. Oakland Global Rail Enterprise Response to OEA's May 25, 2018 Information Request No. 1
2. Oakland Global Rail Enterprise Response to OEA's September 26, 2019 Information Request No. 2
3. Information Paper – Proposed Operations of Oakland Global Rail Enterprise

**Oakland Global Rail Enterprise Response to
OEA's May 25, 2018 Information Request No. 1
FD 36168
October 28, 2019**

OEA Request 1: Will Oakland Global Rail Enterprise (OGRE) be seeking operating authority over the 22,202 feet of track proposed for rehabilitation plus that portion of OGRE's track at the OAB that does not require rehabilitation? See Petition, page 3, lines 11 through 14.1.¹ Here, the Petition states that the track requiring rehabilitation and the track not requiring rehabilitation represent "OGRE's entire line."

Response: OGRE will be seeking operating authority over the following track (track lengths are approximated):

- Approximately 22,202 feet of rehabilitated track located in the Rail Right of Way. This track is marked in yellow, pink, green, and tan on Attachment 2.
- Approximately 60,800 feet of existing track owned by the Port of Oakland ("Port"). This track is marked in blue and dark purple (PR3 – Phase I, Zone A and PR4- Phase I, Zone B) on Attachment 2.
- Approximately 6,000 feet of track owned by OGRE and located on land owned by the City and controlled by the Port.
- Approximately 1,500 feet of existing track owned by Union Pacific ("UP"), connecting the Rail Right of Way to the Port rail yard. This track is identified by crosshatching (UPRR Property) on Attachment 2.
- Approximately 1,000 feet of existing track owned by Burlington Northern Santa Fe ("BNSF"), providing connections with the UP mainline and Port's intermodal rail yard. This track is identified in yellow on Attachment 3.
- Approximately 4,525 feet of existing "on docks" track in the West Gateway area. This track is located on the docks in the West Gateway area.

OGRE currently is working to finalize an industrial track agreement with BNSF as well as a rail operating agreement with the Port.

OEA Request 2: In previous conversations between OGRE and the Board's Office of Environmental Analysis, OGRE indicated that it would be seeking operating authority over 2,200 feet of track. What is the relationship between the 2,200 feet, the 22,202 feet of track, the track that does not require rehabilitation, and "OGRE's entire line"?

Response: The 2,200 feet is the linear distance from the western end of the West Gateway to West Burma Crossing. Within the Rail Right of Way, there are four (4) parallel tracks (West Gateway leads Nos. 1-4). The 22,202 feet of track encompasses all segments of track requiring rehabilitation, including parallel segments in the Rail Right of Way. The other existing tracks on which OGRE proposes to operate are listed in response to Question 1 above.

¹ Refers to OGRE's Petition for Exemption/Petition for Declaratory Order (Petition), filed May 23, 2018.

OEA Request 3: Clearly illustrate on a map the location of the 2,200 feet of track, 22,202 feet of track, OGRE track that does not require rehabilitation, and “OGRE’s entire line”.

Response: See maps provided as Attachments 2 and 4. Track over which OGRE intends to operate, which does not require rehabilitation, is indicated in green on Attachment 4. OGRE’s entire line is depicted on Attachment 2. As noted in response to Question 2 above, 2,200 feet is the linear distance from the western end of the West Gateway to the West Burma Crossing, which are both identified on Attachment 2. As noted above, the 22,202 feet of track is identified in yellow, pink, green, and tan on Attachment 2.

OEA Request 4: How long is the OGRE track that does not require rehabilitation?

Response: The OGRE track that does not require rehabilitation is a total of 4,525 feet. This is the existing “on dock track” identified in the response to Question 1 above. This track is located on the docks in the West Gateway area.

OEA Request 5: What will be the total length of track over which OGRE intends to request operating authority?

Response: The total length of track over which OGRE intends to request operating authority is 95,950 feet. See also the response to Question 1 above for a breakdown of this track.

OEA Request 6: Clearly indicate on a map(s) the locations and boundaries of the following:

- Oakland Army Base (OAB);
- Port of Oakland (consisting of 200 acres);
- West Gateway (a ground lease of Oakland Bulk and Oversized Terminal [OBOT, an OGRE affiliate] from the City of Oakland);
- Existing railroad right-of-way in the West Gateway leased by OBOT from the City of Oakland;
- MH-1 Lease Area (as leased by CCIG Oakland Global, LLC [CCIG] from the City of Oakland);
- OBOT’s proposed rail-to-ship bulk commodity marine terminal (Terminal);
- West Burma Crossing;
- Wake Crossing;
- East Burma Crossing;
- Port of Oakland intermodal rail yard;
- Union Pacific main line to OAB

Response: See the maps provided as Attachments 1 and 2.²

OEA Request 7: Clarify why track would not be rehabilitated by OGRE at the Wake and East Burma Crossings (see Petition at page 3, line 8).

² Please note that CCIG only maintains an interest in a small portion of the MH-1 Lease Area. CCIG intends to sublease this area to OGRE to use for its rail operations. CCIG assigned the remainder of its interest in the MH-1 lease area to a separate trade and logistics company after the City’s continued interference with development of the proposed rail line.

Response: The crossings at Wake and East Burma Crossings were completed by the City of Oakland in 2018 as part of the City’s horizontal infrastructure project, before OGRE acquired rights to the ROW.

OEA Request 8: In the Petition on page 3, footnote 5 states that the “area encompassing rehabilitated track is marked by the dark green boxes” in Exhibit 2. Clarify what the relationship is between these dark green boxes and the light green lines on Exhibit 2, which are labeled as “EXCLUSIVE OGRE SPURS.” Are these spurs the portion of “OGRE’s entire line” that does not require rehabilitation?

Response: The tracks identified as “EXCLUSIVE OGRE SPURS” do not currently exist and are not included in the 22,202 feet of track that require rehabilitation. If a rail-serviced tenant locates to the Terminal in the future, the map identifies possible locations where spurs could serve those tenants. However, development of the spur tracks will depend on the rail service demand of future tenants, and the specific length and location of such tracks would be determined when such demand arises.

OEA Request 9: Based on the Petition on page 6, and the length of time required for rehabilitation of rail lines, does OGRE propose to begin operating over its rail lines in the April to July 2019 timeframe?

Response: While operations did not begin in the April to July 2019 timeframe, it is OGRE’s intent to begin operating as soon as the rail rehabilitation project is completed and OGRE receives authority to operate.

Attachment 1:

Oakland Army Base Boundaries



FIGURE 2-2

LSA



0 1000 2000
FEET

-  2012 Oakland Army Base Project Boundary
-  2002 Oakland Army Base Area Redevelopment Plan EIR Boundary
-  Oakland Army Base Boundary - City Owned Land; balance of project site is Port owned
-  Oakland Army Base Boundary

SOURCES: CITY OF OAKLAND, CEDA, 2012.

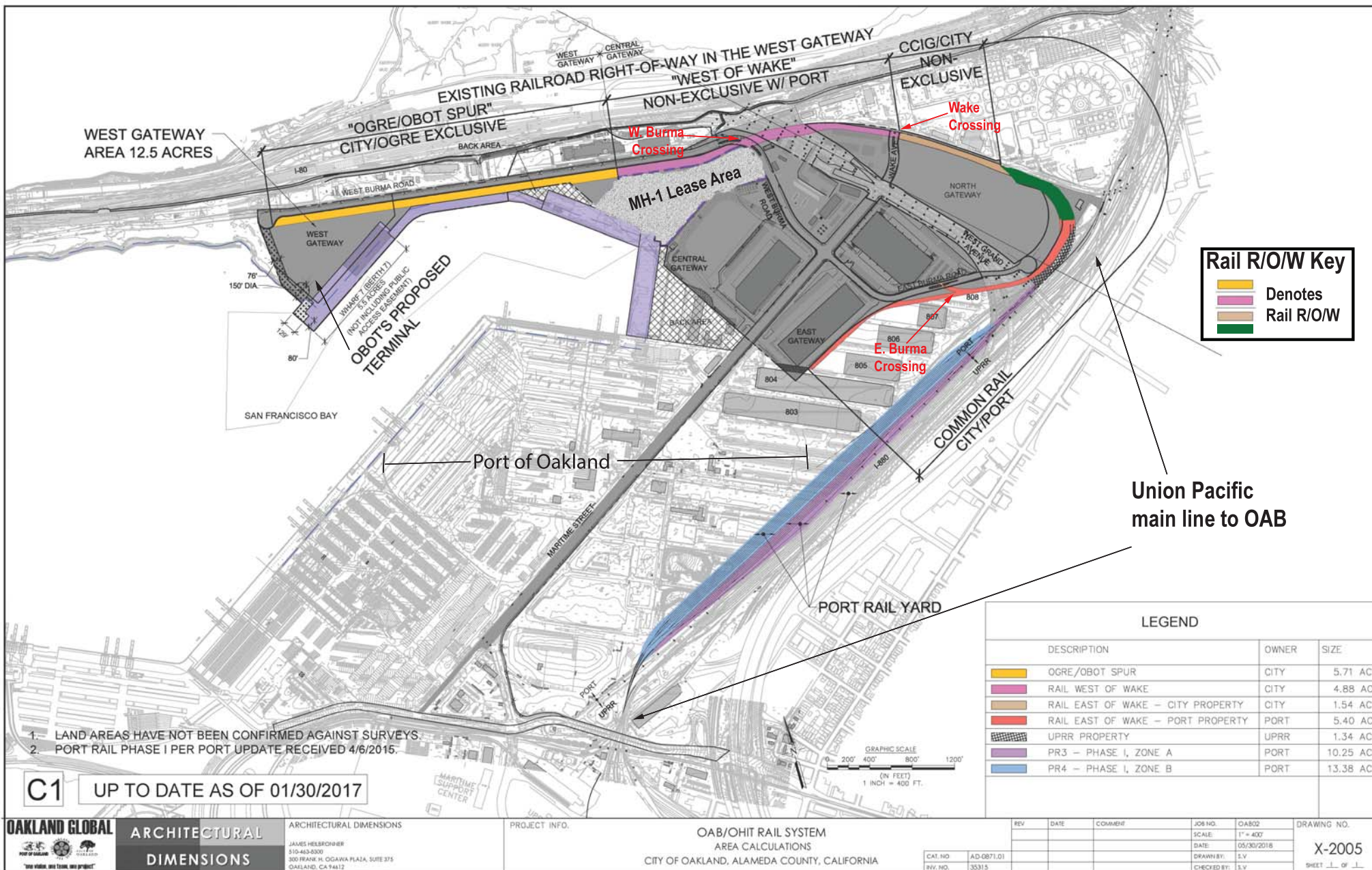
I:\COO1001 Oakland Gateway\figures\Fig_2-2.ai (3/20/12)

2012 Oakland Army Base Project
Army Base Boundaries

Attachment 2:

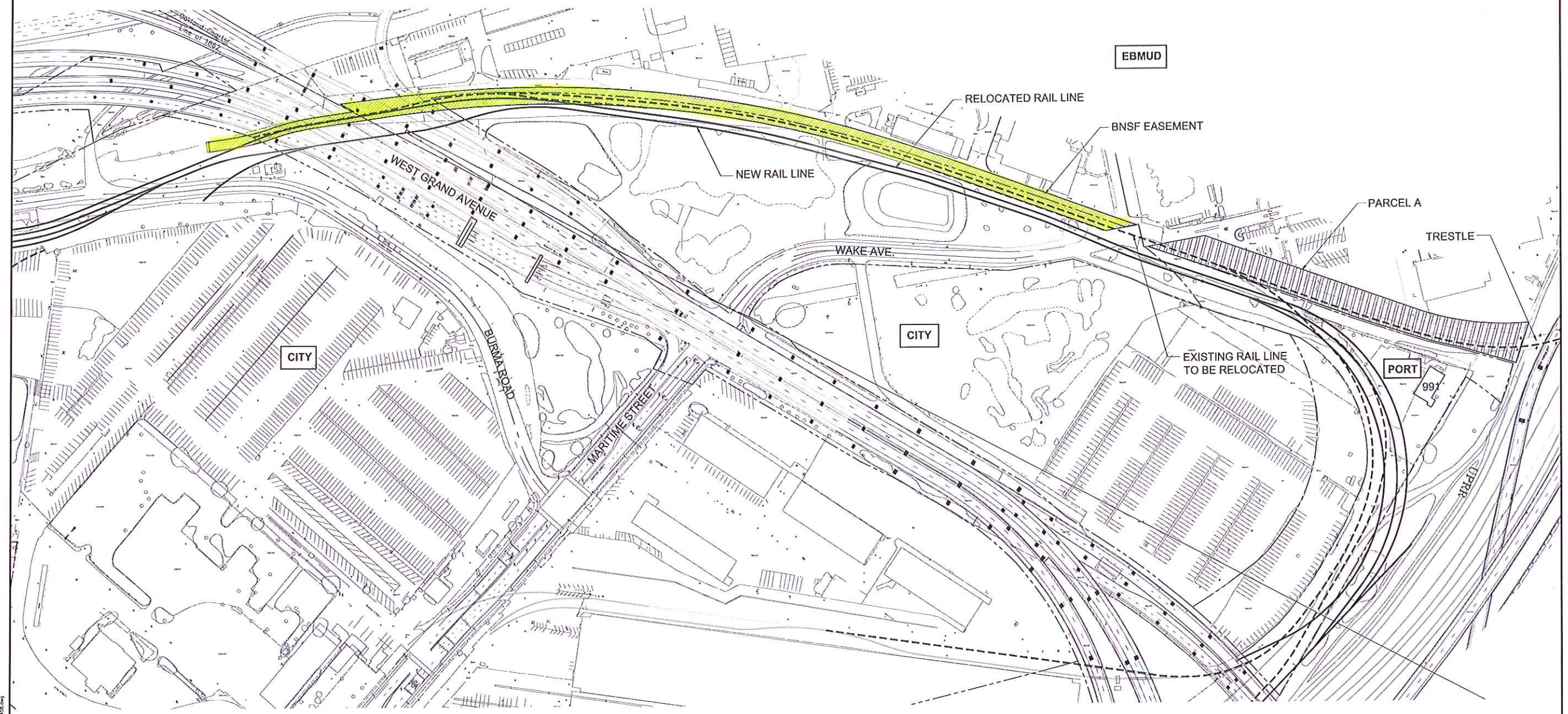
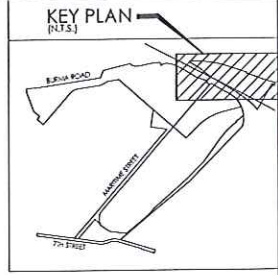
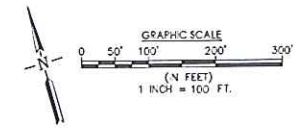
OAB/OHIT Rail System Architectural Drawing

May 31, 2018 - 11:25am, Printed By: [redacted]
D:\Oakland\Rail\Oakland\Architectural\DIMENSIONS\X-2005.dwg



Attachment 3:

BNSF Easement Architectural Drawing



OAKLAND GLOBAL

ARCHITECTURAL
DIMENSIONS

ARCHITECTURAL DIMENSIONS

JAMES HEILBRONNER
510-463-8300
300 FRANK H. OGAWA PLAZA, SUITE 375
OAKLAND, CA 94612

PROJECT INFO.

BNSF RAIL EASEMENT
NORTH GATEWAY
CITY OF OAKLAND, ALAMEDA COUNTY, CALIFORNIA

REV	DATE	COMMENT

CAT. NO.	AD-024203
REV. NO.	20833

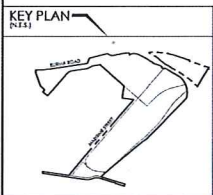
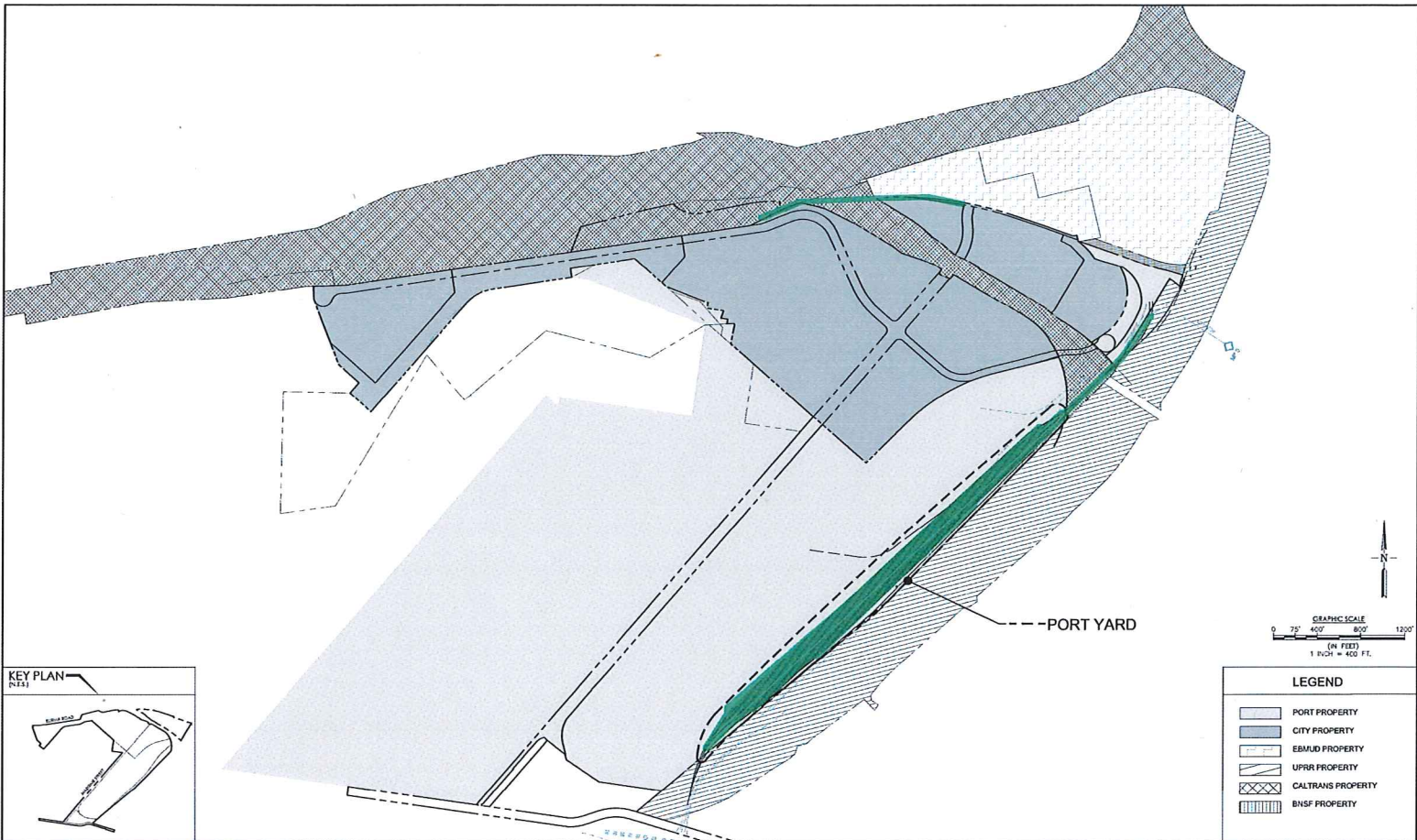
JOB NO.	0A802
SCALE:	1" = 100'
DATE:	3/21/2013
DRAWN BY:	J. ARMADA
CHECKED BY:	K. ROSSO

DRAWING NO.	X-458
SHEET	1 OF 1

May 22, 2013 - 2:00pm - Revised for presentation
C:\Users\james.heilbrunner\Documents\BNSF Rail Easement\X-458.dwg

Attachment 4:

Port Rail Yard Architectural Drawing



LEGEND	
	PORT PROPERTY
	CITY PROPERTY
	EBMUD PROPERTY
	UPRR PROPERTY
	CALTRANS PROPERTY
	BNSF PROPERTY



ARCHITECTURAL DIMENSIONS

ARCHITECTURAL DIMENSIONS
JAMES HOLBROOK
310-443-8300
300 FRANKLIN COWLEY PLAZA SUITE 305
OAKLAND, CA 94612

PROJECT INFO.

EXHIBIT 1.1.1.1.a- PORT RAIL YARD
RAIL ACCESS AGREEMENT
CITY OF OAKLAND, ALAMEDA COUNTY, CALIFORNIA

REV	DATE	COMMENT
1	12/21/2014	ADD UPRR INTERFACE SOUTH SIDE

JOB NO.	QAB02
SCALE	1" = 400'
DATE	12/21/2015
DRAWN BY	V. BRISCA
CHECKED BY	V. BRISCA

DRAWING NO.	X-1
SHEET	1 OF 14

**Oakland Global Rail Enterprise Response to
OEA's September 26, 2019 Information Request No. 2
FD 36168
October 28, 2019**

Please provide OGRE's proposed rail operations for each of the following factors:

OEA Request 1: Numbers of trains per day

Response: Due to the phased nature of the Oakland Army Base ("OAB") redevelopment project, the traffic forecast for OGRE's operations once the OAB is at full capacity is not known at this time. The 2012 Oakland Army Base Project Initial Study/Addendum ("2012 EIR")¹ anticipated that, at full operational capacity, the Terminal² could handle up to three unit trains per day, with each unit train being 6,400 feet long and broken into six 3,200 feet long trains. However, this study contemplated the Terminal operating at full capacity. Based on delays to date, it is possible that the Terminal may operate at less than full capacity. Accordingly, actual traffic levels may ultimately be lower than three unit train per day estimate contained in the 2012 EIR.

Union Pacific ("UP") and OGRE have jointly analyzed the OHIT/OAB interchange capacity and agreed that, at present, it could handle up to two unit trains per day inbound and two unit trains outbound, limited to 7,200 feet per train (approximately 120 cars) in the Support Yard, in addition to the current and ongoing daily manifest train interchange traffic in the Manifest Yard. The total capacity of the Manifest Yard tracks is 190 cars, which should easily give capacity to move well over 20,000 manifest carloads a year if the demand calls for it. Since these studies were performed, however, portions of the OAB area have been leased to tenants that will not be rail served.³

While there have been a number of potential customers that have expressed interest in utilizing rail services for future operations at the OAB, due to the ongoing dispute between OGRE and the City, which has interfered with OGRE's rail rehabilitation work—including the reconnection of the OAB rail to the interstate rail network—no customer has been willing to definitively commit to rail service.⁴ Potential customers expressed that they may be willing to commit to rail service once operations become more reasonably foreseeable.

For multiple reasons, levels of traffic for service to the Terminal area cannot be predicted with certainty at this time. First, as noted above, there are currently no secured tenants or end users for this area. Second, even when tenants are secured, the tenants' operations at the Terminal will likely be phased in over an extended period of time. OGRE is continuing to refine its traffic

¹ Available at <http://www2.oaklandnet.com/oakca1/groups/ceda/documents/report/oak035061.pdf>.

² Unless otherwise indicated herein, capitalized terms used but not defined in this response have the meanings ascribed in OGRE's Information Paper regarding Proposed Operations of Oakland Global Rail Enterprise, dated October 28, 2019.

³ A more recent estimate predicts that the Terminal will receive 1.56 trains per day. See Dkt. 185, Oakland Bulk & Oversized Terminal v. City of Oakland, No. 3:16-cv-07014-VC (N.D. Cal. Dec. 18, 2017).

⁴ The City and OBOT have been involved in ongoing litigation regarding a ground lease for portions of the OAB area. This litigation includes, among other things, claims of breach of contract and intentional interference with contract. Until this ongoing litigation is resolved, uncertainty regarding the current effect of the lease may continue to affect OGRE's ability to secure tenants or end users for the Terminal.

estimate and anticipates submitting more detailed traffic information when appropriate.

OEA Request 2: Length of trains as defined by the number of railcars per train

Response: Commodity unit trains have been approved by UP Engineering for up to a length of 7,200 feet, which would be approximately 120 railcars. These trains are expected to have various locomotives but will most likely have head-end power or distributed power configurations. Manifest train sizes are expected to be less than 5,000 feet long, or up to 100 railcars. Manifest trains are expected to have head-end locomotives but could easily be accommodated with distributed power as necessary. Manifest service trains could be brought in directly from the UP mainline or from UP's West Oakland Yard or Desert Yard.

OEA Request 3: Commodities to be moved by OGRE

Response: While the specific commodities to be handled at the Terminal are not currently known with certainty, the 2012 EIR predicted that export cargo would generally consist of non-containerized bulk goods and inbound cargo would consist primarily of oversized or overweight cargo unable to be handled by trucks. These commodities could include, to the extent permitted by law, proteins, resins, iron ore, copper concentrate, coal, soda ash, and agricultural products.

Information Paper

Proposed Operations of Oakland Global Rail Enterprise

I. Background

The area comprising the Oakland Army Base (“OAB”) is located in western Oakland, partially along the eastern shoreline of the San Francisco Bay,¹ and has been operating as a sea port since the 1800s. In 1941, the War Department began construction and commissioned the OAB as a trans-shipment facility, sending tens of thousands of soldiers and 25 million tons of supplies to the Pacific during World War II, much of which was handled by rail. The Army continued to use the OAB as a major cargo port and warehousing center, employing approximately 2,040 individuals, until 1995 when it was announced the OAB would be closed as part of the Base Realignment and Closure program. The federal government officially decommissioned the OAB in 1999.

In August 2006, approximately 170 acres of the former OAB were conveyed to the City of Oakland (the “City”), and another 200 acres were transferred to the Port of Oakland (the “Port”). The land sat underutilized until approximately 2008 when the City and the Port began redeveloping the OAB. As part of this redevelopment, Oakland Bulk and Oversized Terminal (“OBOT”) entered into a ground lease with the City for the portions of the OAB known as the West Gateway and the existing railroad right of way located on the West Gateway, along the northern border of the OAB (the “Rail Right of Way”). OBOT plans to build a rail-to-ship bulk commodity marine terminal (“Terminal”) at the West Gateway.²

Oakland Global Rail Enterprise (“OGRE”), an affiliate of OBOT, has subleased the Rail Right of Way. After the former rail line has been rehabilitated, OGRE intends to operate over approximately 95,950 feet of track at the OAB.

II. Project Overview

The OAB is adjacent to several regional transportation links, including the UP Desert Line. To facilitate future transportation and logistics operations at the Terminal, OGRE is proposing to operate over a rehabilitated section of railroad tracks in the Rail Right of Way, as well as over track owned by the Port, Union Pacific (“UP”), and Burlington Northern Santa Fe (“BNSF”).³ OGRE’s rail operations will reconnect the OAB rail network to the UP main line. The operations will also be integrated with the Port’s newly developed Outer Harbor Intermodal Terminal (“OHIT”) rail yard.

As noted above, OGRE will operate over 95,950 feet of track. This includes approximately 22,202 feet of track to be rehabilitated within the Rail Right of Way, 4,525 feet of existing “on dock” track

¹ A map of the OAB is included as Exhibit 2 to Oakland Global Rail Enterprise Response to OEA’s May 25, 2018 Information Request No. 1, FD 36168 (Oct. 28, 2019) (“Response No. 1”).

² A map depicting the proposed Terminal and existing infrastructure is included as Attachment 2 to Response No. 1.

³ OGRE currently is working to finalize an industrial track agreement with BNSF as well as a rail operating agreement with the Port.



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located at the West Gateway, 1,500 feet of existing UP track, 1,000 feet of existing BNSF track, 6,000 feet of track owned by OGRE and located on land owned by the City and controlled by the Port, and 60,800 feet of existing track owned by the Port.⁴ Additional details on the specific location of these tracks and related maps are provided in OGRE's Response to OEA's May 25, 2018 Information Request No. 1.

OGRE's proposed rail connection will provide tenants at the OAB area (including the Terminal) with the means to move import and export goods and commodities by rail instead of by truck. Rail service, as a more efficient and cost-effective transportation option, is expected to increase economic competitiveness, while at the same time increasing quality of life and sustainability in the region.

III. Project Purpose and Need

Rail is a critical part of the plan to redevelop the OAB, increase international trade, and promote economic growth in Oakland, California. To facilitate rail service at the OAB, the Port has already developed a new OHIT rail yard for unit train and manifest business including various bulk and neo-bulk and other transload commodities. The OHIT includes support yard tracks ("Support Yard"), manifest yard tracks ("Manifest Yard"), and connections to various industry tracks which are intended to provide support for industry and terminal operations in the vicinity.

The purpose of OGRE's proposed rail operations is to provide rail service to the OAB area on both lands controlled by the City and Port, including, without limitation, the West Gateway area, improve rail access to existing intermodal facilities to support desired train volumes, and allow for increases in the Port's intermodal rail throughput capacity as demand increases. As an alternate mode of freight transportation for OAB tenants, OGRE's operations will also reduce the distribution and transportation burden on the surrounding communities and existing infrastructure, particularly by reducing track traffic on the already-congested I-880, I-580 and I-80 freeways.

By facilitating and supporting the development of the OAB, OGRE's rail operations will help open the door to greater economic development efforts to support Oakland, California. The OAB redevelopment is expected to create good paying and sustainable jobs in an area that has historically suffered from over sixteen percent (16%) unemployment and increase U.S. economic competitiveness by providing more service options for U.S. shippers seeking avenues to foreign trade, increasing market access for new businesses, and enhancing the gateway to world markets for American commodities.

An operational rail line reconnecting the OAB to the interstate rail network is needed as soon as possible to allow the Oakland area to reach its full economic potential. While potential tenants for the OAB area are hesitant to commit to rail service in light of the ongoing dispute with the City, they have indicated interest in rail service and a desire to resume negotiations for such service as soon as the dispute is resolved and operations become more reasonably foreseeable. Regardless of specific tenant needs, an operational rail line reconnecting the OAB rail network to the OHIT and UP main

⁴ Track lengths are approximated.



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line is necessary to further attract tenants and support redevelopment of the OAB, including the Terminal. OGRE also anticipates that the rail line will be used to transport construction materials needed for continued development of the OAB.

IV. Description of Operations

As explained above and in Response No. 1, OGRE will operate over the following tracks located at the OAB:

- An approximately 22,202 foot segment of rehabilitated track located in the Rail Right of Way. The Rail Right of Way has been leased to OBOT by the City, and subleased by OBOT to OGRE. The track runs from the northwest portion of the OAB adjacent to West Burma Road to connections with tracks owned by the Port and/or UP in an area referred to as the Martinez Subdivision.
- Approximately 4,525 feet of existing “on dock” track. This track is located in the West Gateway area, which has been leased by the City to OBOT.
- Approximately 6,000 feet of track owned by OGRE and located on land owned by the City and controlled by the Port.
- Approximately 60,800 feet of existing track owned by the Port. These tracks are part of the OHIT rail yard and run through the central Port area.
- Approximately 1,500 feet of existing track owned by UP. This short section of track connects the OGRE track to the OHIT rail yard.
- Approximately 1,000 feet of existing track owned by BNSF at the Wood Street Yard, which is adjacent to Wood Street. This track would provide connections with the UP mainline and the Port’s intermodal rail yard.

Four major rail lines extend north and south from the OAB rail network. The Martinez Subdivision starts in Oakland (starting on the main line adjacent to the OAB property) and runs north and east to Roseville, CA. It passes through Emeryville, Berkeley, Pinole, and Martinez, where it crosses the Carquinez Strait to Benicia.

The Niles Subdivision runs south from West Oakland and Newark. It passes through Jack London Square and the UP East Oakland Yard, and provides access to Oakland for the UP Coast Subdivision at Elmhurst (46th Avenue in East Oakland) and the Oakland Subdivision at Niles Junction near Fremont. The Coast Subdivision runs to Los Angeles via Santa Barbara, and the Oakland Subdivision runs to Stockton, Southern California, and Sacramento.

To facilitate access to the OAB project and OHIT yard, UP has constructed a connection known as the South Lead to the OAB from their mainline turn-outs just north of Martin Luther King Drive on



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UP West Oakland Yard Lead track near the Adeline Street overpass. The OAB South Lead track shares the same corridor as UP Railport Oakland (“Railport”) and then follows the western perimeter of the Railport. This OAB South Lead completely bypasses UP’s West Oakland and Railport intermodal yards and crosses the 7th Street underpass to tie into the existing arrival and departure track for the Port’s Joint Intermodal Terminal (“JIT”), where the OHIT/OAB access has its own power switch and dedicated turnout.

Westbound unit and manifest trains will exit the Niles Subdivision just south of Adeline Street along the UP West Oakland Yard lead tracks. Shortly after leaving the mainline, the trains will cross the Railport truck gate (at-grade) and enter the OAB South Lead along the westerly perimeter of the Railport facility. The trains will then proceed directly into either the Manifest Yard or the Support Yard. OGRE will manage the classification of railcars and transfer of trains between OHIT and the OAB tenants.

Once a unit or manifest train is delivered to the Support Yard, OGRE can classify the train into the Manifest Yard and then deliver segments to the City, West Gateway, or Port unloading facilities. The West Gateway has two leads to allow a cut of cars to be pulled to City terminals on one track and allow the locomotive to leave on the other. The West Gateway may also need to meet or pass inbound and outbound cuts of cars.

Cuts of railcars bound to Port industry tracks west of the Support Yard will need to be pulled from the OHIT onto a West Gateway Lead and then moved back onto an industry track between OHIT and Maritime Street. Railcars are taken back to the Support Yard or Manifest Yard in the same manner.

Eastbound unit and manifest train cuts are expected to be assembled from multiple Support Yard tracks. Trains depart along the OAB South Lead and onto the Niles Subdivision, and BNSF trains will depart from JIT.

Because OGRE intends to split unit trains and manifest trains into smaller segments of railcars once they arrive at OAB, it is anticipated that a single locomotive can be utilized to haul each segment, with another locomotive available on site to support the primary locomotive in the event of a malfunction.⁵

To facilitate its proposed operations, OGRE has purchased one Tier IV locomotive. OGRE intends to acquire an additional back-up Tier IV locomotive in the future, but at this point has decided to postpone such capital acquisition until operations are initiated.

⁵ For your reference, we are enclosing as Exhibit 1 an expert report addressing air quality in the Bay Area Air Quality Management District; for a specific discussion of rail exhaust impacts, see pages 91-93.

Exhibit 1:

Expert Report of Mr. Lyle Chinkin

United States District Court
Northern District Of California

OAKLAND BULK & OVERSIZED
TERMINAL, LLC,

Plaintiff,

V.

CITY OF OAKLAND,

Defendant.

Civil Action No. 16-07014 (VC)

EXPERT REPORT OF MR. LYLE CHINKIN

**Report Prepared
October 6, 2017**

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I, Lyle Chinkin, submit the following report on behalf of Plaintiff Oakland Bulk & Oversized Terminal, LLC ("OBOT").

1. Summary

1.1 Background

On behalf of Oakland Bulk & Oversized Terminal, LLC (OBOT), I have been asked to conduct an independent scientific assessment of certain purported "findings" by the Oakland City Council in connection with its passage of Ordinance Number 13385, titled "AN ORDINANCE (1) AMENDING THE OAKLAND MUNICIPAL CODE TO PROHIBIT THE STORAGE AND HANDLING OF COAL AND COKE AT BULK MATERIAL FACILITIES OR TERMINALS THROUGHOUT THE CITY OF OAKLAND AND (2) ADOPTING CALIFORNIA ENVIRONMENTAL QUALITY ACT EXEMPTION FINDINGS" (the "Ordinance"), as well as certain submissions in the public record that purportedly support these findings, particularly as they relate to air quality issues associated with OBOT's proposed operations of a marine terminal facility at the former Oakland Army Base. I have also been asked to perform an independent assessment of potential air quality issues at that proposed facility. My review focused in particular on emissions quantification and potential air quality impacts of fugitive coal dust particulate matter (PM) emissions associated with handling coal at the proposed OBOT facility.

The OBOT facility is proposed to be a state-of-the-art covered bulk terminal which would minimize all fugitive PM emissions to the fullest extent practicable. The facility would receive commodities by rail and would handle, store, and load the commodities onto cargo ships for export. The facility is proposed to be almost entirely enclosed and would consist of a railcar unloading system, conveyor systems, warehouse and dome storage facilities, and ship loading equipment utilizing the best available emissions control technologies.

The OBOT facility is designed to handle a number of different commodities and would be located at the northwestern area of the *Oakland Army Base Redevelopment Project* (City of Oakland, 2017) just west of the community of West Oakland, California ([Figure 1](#)).

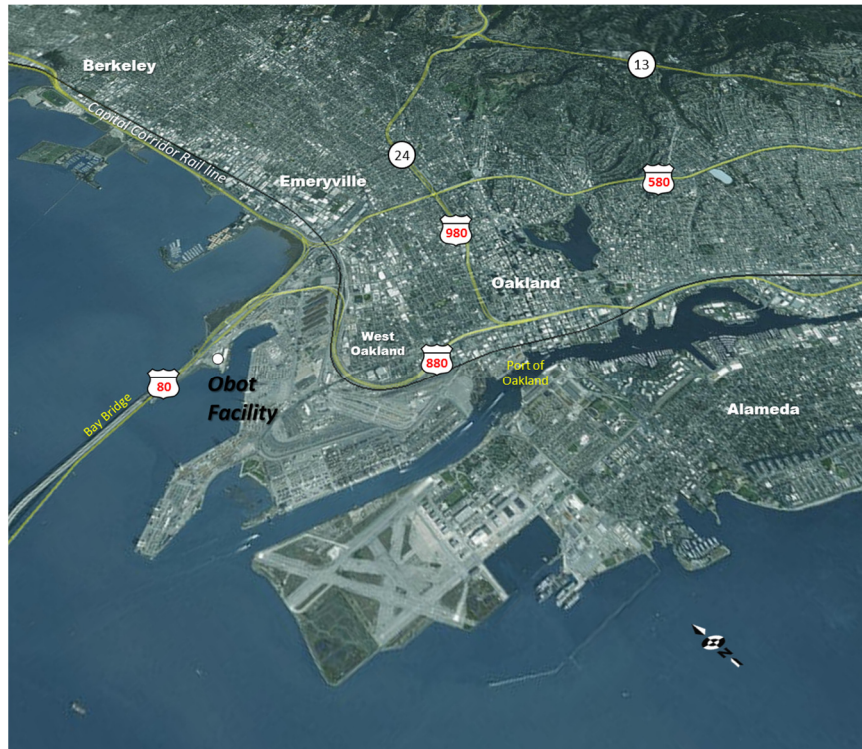


Figure 1. Map of the proposed OBOT facility, West Oakland, and the surrounding area.

In 2000, the City of Oakland (the City) adopted and approved the *Redevelopment Plan for the Oakland Base Redevelopment Project*, which established an 1,800-acre redevelopment project area within the former Oakland Army Base (OARB). The OARB was first commissioned in 1941 as a port and trans-shipment facility and the base was officially closed for military operations in September 1999.

Prior to the official closure of the base, the Oakland Base Reuse Authority (OBRA) was established to direct the planning process for the future reuse of the OARB. As part of the planning process, OBRA consulted with representatives of the West Oakland community, the community that would be most affected by the closure, and other key stakeholders. The OBRA's efforts resulted in a Final Reuse Plan for the OARB which was adopted in July 2002. The development area is referred to as the 2012 Oakland Army Base Project (LSA Associates, 2012). The proposed OBOT facility would be located within the 2012 Oakland Army Base Project area. The 2012 Oakland Army Base Project area and the proposed location for the OBOT facility are shown in [Figure 2](#).

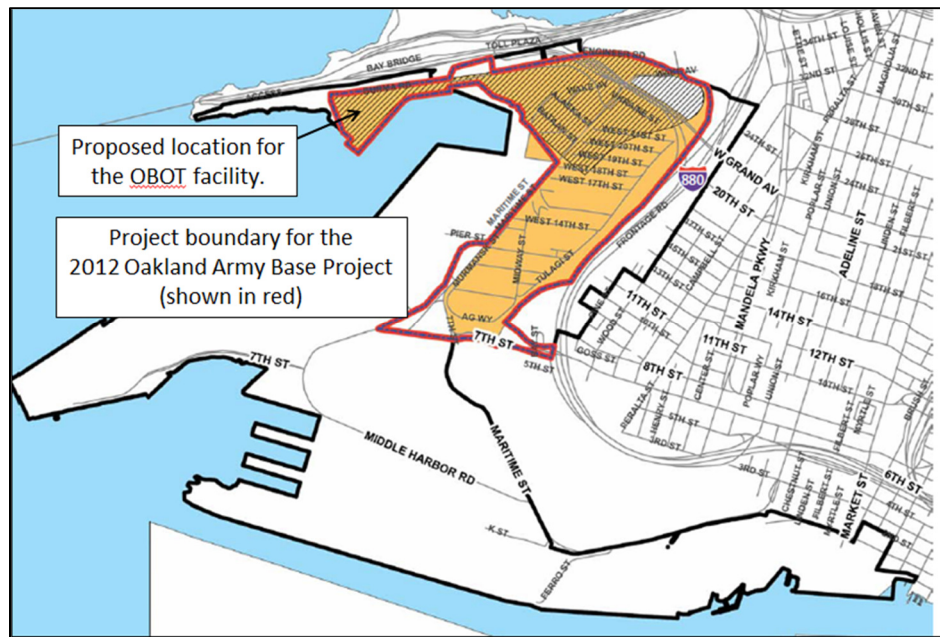


Figure 2. Map of the location of the proposed OBOT facility and the project boundary for the 2012 Oakland Army Base Project area (shown in red).

The approved OAB Reuse Plan included the adoption of the 2002 Army Base Redevelopment Plan Environmental Impact Report (EIR) and the 2012 OAB Initial Study Addendum to the 2002 EIR. These reports address EIR and California Environmental Quality Act (CEQA) findings, mitigation measures, and a Standard Conditions of Approval/Mitigation Monitoring and Reporting Program (SCAMMRP) for the project. The SCAMMRP established air quality monitoring requirements to monitor air pollution during and after the project. Throughout 2012 and 2013, the City issued permits and a right and obligation to the OBOT developers to redevelop land as part of the 2012 Oakland Army Base Project. Air quality monitoring stations were established at three sites in and around the project area in 2014.

In September 2015, the Oakland City Council held a public hearing on a potential ban of coal in Oakland, and accepted public comment and submission on the issue. Terminal Logistics Solutions (TLS), who partnered with OBOT to develop plans to construct the proposed facility, submitted a Basis of Design (BOD) package to the City, dated July 21, 2015. The BOD contains conceptual design specifications for two proposed commodities, commodity A (coal) and commodity B (petcoke).

In 2016, the City hired a contractor, Environmental Science Associates ("ESA"), to summarize public comments and provide a report about the health, safety, and air quality impacts of "any" bulk terminal that would handle coal and petcoke, but used the proposed OBOT as an example terminal. ESA prepared a report titled: "Report on The Health and/or Safety Impacts Associated with The Transport, Storage, and/or Handling of Coal and/or Coke in Oakland, including at the Proposed Oakland Bulk and Oversized Terminal in the West Gateway Area of the Former Oakland Army Base" , the "ESA Report"(Environmental Science Associates, 2016). As discussed below in detail, the ESA

Report commissioned by the City did not include a comprehensive science-based analysis of the potential air quality impacts from the OBOT facility.

In June 2016, the City passed the Ordinance and a related Resolution banning the storage, handling, loading, unloading, and transloading (loading onto ships), of coal and petcoke in Oakland. In connection with the Ordinance, purportedly relying on evidence in the public record, including the ESA Report, the Oakland City Council made certain “findings and determinations” regarding the “public health and/or safety impacts” of the transportation, storage or handling of coal or petcoke in Oakland.

1.2 Summary of Approach

This report focuses on fugitive dust emissions and air quality impacts from transporting coal or petcoke by rail to the proposed OBOT facility in West Oakland, and fugitive dust emissions associated with the proposed OBOT facility operations. In my report, I rely on a comprehensive set of scientific analysis methods and tools to evaluate PM₁₀ and PM_{2.5} fugitive coal dust emissions and air quality impacts from the OBOT facility including:

- A review of the public record on which the City based its findings and conclusions regarding the handling of coal in Oakland;
- Analysis of ambient air quality and meteorological data from monitoring sites throughout the Bay Area and in West Oakland to assess ambient PM₁₀ and PM_{2.5} concentrations and attainment status;
- An independent literature review of more than a dozen sources of information about the current methods for estimating coal dust emissions from rail cars and dust mitigation technologies;
- Development of an emission inventory for fugitive coal dust for the OBOT facility and for the activities associated with transporting coal by rail to the facility using current emissions estimation methods and EPA best practices; and
- Air quality modeling and analysis using the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) Dispersion Model (AERMOD) to predict and evaluate PM₁₀ and PM_{2.5} concentrations resulting from the OBOT facility.

The opinions below are based upon the education, knowledge, and experience that I have acquired over the past nearly four decades in practicing and consulting in the field of atmospheric science, meteorology, and environmental science, and any information or material mentioned in the text of this report and the other exhibits to this report.

1.3 Summary of Conclusions

Finding 1: The City's ban on the transport, storage, or handling of coal or petcoke through the passage of the Ordinance was done without adequately performing a scientifically credible assessment of emissions, air quality, and/or health impacts from the proposed OBOT facility.

Records obtained via subpoenas indicate that the City *discouraged* a scientifically robust analysis because it would have likely indicated that coal and petcoke dust emissions associated with the OBOT facility would not pose a threat to public health, or that emissions of coal and petcoke dust could be mitigated using modern facility engineering and emissions control technologies.

Finding 2: The City's findings and determinations in the Ordinance regarding the potential impacts of the OBOT facility on air quality and health in West Oakland are flawed and in error.

They are heavily biased, inadequate, based on false assumptions, and contain calculation errors and inconsistencies. The City generally makes the argument that PM emissions from fugitive coal dust associated with the OBOT facility would contribute to already unacceptably high ambient pollutant concentrations in West Oakland. However, the City has failed to adequately or accurately quantify both the current ambient air quality in the West Oakland area, which is in fact in attainment of the National Ambient Air Quality Standards, nor have they performed any air quality modeling to scientifically characterize the potential air quality impacts of emissions from the OBOT facility. Air quality modeling is necessary to quantify the impact of emissions from a facility on ambient pollutant concentrations, and ultimately, the public's exposure to those pollutants.

Finding 3: The emissions estimates, assumptions, and conclusions in the ESA Report relied upon by the City lack scientific basis or engineering judgement, and are contrary to instructions in government guidance documents. Specifically, Table 5-7 on page 5-17 of the ESA Report contains a summary of emissions associated with the OBOT facility upon which many of ESA's conclusions are drawn from. Table 5-7 is peppered with mislabeling, typographical errors, and basic mathematical errors. In addition, several of the emissions estimates presented in Table 5-7 are not based on EPA best practices and/or are incorrect.

Finding 4: The ESA Report relied on by the City incorrectly assumed that rail car covers or other suppressants would have no beneficial emissions controls effects. One of the key arguments made in the ESA Report is that because rail car covers have not been specifically tested for controlling dust from rail cars transporting coal they are completely ineffective at reducing coal dust emissions. Fugitive dust emissions from the staging of rail cars at the OBOT facility is one of the largest sources of emissions when it is assumed that no dust controls will be in place (i.e., rail car covers or topping agents to control dust). The OBOT facility operators have agreed to use rail car covers which are not yet widely used to cover coal cars, but are currently being evaluated for that use. Topping agents, or surfactants, are widely used to control coal dust emissions and studies have shown surfactant to have a range of effectiveness (61% to 99%) at controlling coal dust emissions. For my analysis, I developed and modeled four different emission scenarios based on different

assumptions about the amount of coal handled and the presence or absence of rail car covers and surfactants.

Finding 5: The Bay Area, including West Oakland, is in attainment of the National Ambient Air Quality Standards (NAAQS) for PM_{2.5}. While PM_{2.5} concentrations are higher in West Oakland than other sites throughout the Bay Area, 24-hour average concentrations are in the range of 20-25 µg/m³ (micrograms per cubic meter), which is below the standard of 35 µg/m³. The 24-hour average design value for PM_{2.5} in the San Francisco Bay Area is 25 µg/m³ which is 10 µg/m³ below the NAAQS. The OBOT facility operators have agreed to use state-of-the-art, modern engineering and emissions controls to minimize PM emissions to the extent possible. Based on the air quality modeling results, increases in PM_{2.5} concentrations from the OBOT facility for all scenarios modeled are predicted to be less than 1 µg/m³ in the residential areas of West Oakland and would not result in exceedances of the PM_{2.5} NAAQS.

Finding 6: The emissions results show that even if rail car surfactants or covers are not used, total fugitive dust emissions from the OBOT facility would remain *below* the BAAQMD's thresholds of significance for PM₁₀ and PM_{2.5}. Assuming the use of rail car covers or surfactants would lower OBOT emissions even further. The emissions estimates I developed provide a range of potential emissions from the OBOT facility assuming both uncontrolled and controlled emissions from the staging of rail cars. Each of those estimates show that total fugitive dust emissions from the OBOT facility would be below the Bay Area Air Quality Management District's thresholds of significance.

Finding 7: The OBOT modeled and ambient observed concentrations combined do not result in exceedances of the federal government regulatory levels of concern. My analyses showed that whether the most likely scenario (BACT emissions controls and rail car covers) or the worst case scenario occurs (BACT emissions controls at the OBOT facility and no fugitive dust controls on rail cars), the air quality impacts shown in my work are below federal government regulatory levels of concern when both modeled OBOT PM concentrations and ambient observed PM concentrations are combined.

2. Experience and Qualifications

2.1 Area of Expertise

I am an atmospheric scientist with over 35 years of experience in meteorological, pollutant emissions, and air quality analysis. The following information summarizes my experience and qualifications related to this study. My full resume is provided in Appendix A, a list of my publications is provided in Appendix B, my previous experience with expert testimony is provided in Appendix C, and a statement of compensation is provided in Appendix D.

2.2 Professional Experience

I joined Sonoma Technology, Inc. (STI) in 1992 and currently serve as Chief Scientist and President Emeritus. I have over 30 years of professional consulting experience in air quality and about five years of experience at the California Air Resources Board (CARB). I am a nationally recognized expert in emission inventory development and assessment and air quality analysis. I have worked on projects for federal, state, and local government agencies; universities; public and private research consortiums; and major corporations. My areas of expertise include (1) developing and improving regional emission inventories; (2) providing independent assessments of emission inventories using bottom-up and top-down evaluation techniques; (3) conducting field studies to obtain real-world data and improve activity estimates and emission factors; (4) conducting scoping studies to develop conceptual models of community-scale air quality; (5) assisting with State Implementation Plan (SIP) development; and (6) providing expert testimony and presentations to public boards. I have been appointed to the National Research Council of the National Academy of Sciences Committee on the Effects of Changes in New Source Review Programs for Stationary Sources of Air Pollutants and to a panel to review "Improving Emission Inventories for Effective Air Quality Management Across North America, a NARSTO Assessment" (2005).

2.3 Education and Training

I received my Bachelor of Science (BS) and a Master of Science (MS) degree in Atmospheric Science from the University of California at Davis.

2.4 Honors, Professional Appointments, and Memberships

I have served as an EPA-invited peer reviewer three times, including for the EPA particulate matter (PM) National Ambient Air Quality Standards Criteria Document, the 2006 draft “EPA Report on the Environment,” and an EPA report on air quality impacts from a railyard operated in an urban environment. I have also served as an expert panel member for the review of the Valdez Air Health Study; and as an expert witness for the U.S. Department of Justice on multiple occasions and the Attorney General’s Office of the State of North Carolina on environmental enforcement actions. I was the project manager and co-author of the EPA national guidance document on the preparation of emission inputs for photochemical air quality simulation models. In addition, my projects have included improving estimates of PM and ammonia emissions, determining air toxic emissions from wood preservation activities, and improving natural source emission estimation tools, including biogenic VOCs and smoke from wild and prescribed fires. I frequently direct studies that combine public- and private-sector participation, including an assessment and ground-truth study of industrial emissions in the Houston Ship Channel under the joint direction of the Texas Natural Resource Conservation Commission (now Texas Commission on Environmental Quality) and local industry. I have also assisted numerous industrial clients with projects such as development of emission-estimation tools for the American Petroleum Institute and top-down evaluations of emissions inventories for the Coordinating Research Council.

I have been a member of the Air & Waste Management Association (current); the International Association of Wildland Fire; and the American Meteorological Society (1979-1984, 2012). I also served as a California Registered Environmental Assessor, REA-00715 (1984-1989).

3. Overview of the Atmosphere, Air Pollution, and Air Quality

This section provides an overview of the atmosphere, air pollution, air pollutant characteristics, and air quality.

3.1 The Atmosphere and Air Pollution

The atmosphere is a complex, dynamic natural system of gases and particles that are essential to support life. Air pollution is the introduction of chemicals such as PM, or biological materials into the atmosphere that cause harm or discomfort to humans or other living organisms, or damage the environment. Four general processes affect the concentrations of pollutants in the atmosphere: (1) emission, (2) chemical transformation, (3) transport and diffusion, and (4) removal. While pollutant concentrations change as a result of these processes, mass is conserved, meaning that emitted pollutants may change form, be transported to other locations, be diluted, and be deposited to the earth's surface, but they do not disappear. The following processes provide an overview of how air pollutants are introduced into the atmosphere and the important chemical and physical processes by which they can transform or be removed from the atmosphere.

- **Emission** – Emission sources emit gases and particles that vary spatially (horizontally and vertically), temporally (i.e., by month, day, and hour), chemically, and physically (i.e., particle size) depending on the type of source.
- **Chemical Transformation** – Emitted pollutants can undergo chemical transformation in the atmosphere through reactions with other gases and particles, and solar radiation.
- **Transport and Diffusion** – The atmosphere is always in motion, and pollutants can be transported from their source to nearby or distant receptors by the wind. The atmosphere is also turbulent, and pollutant concentrations may be diluted when polluted air is mixed with cleaner air—a process referred to as diffusion.
- **Removal** – The principal processes for pollutant removal from the atmosphere are wet and dry deposition of gases and particles to the earth's surface, which include respiration by humans, animals, and vegetation.

The complexity of atmospheric processes affecting pollutant concentrations makes it important to understand how pollutants emitted from sources will affect the concentrations of other pollutants in the atmosphere. To address this issue, computer models of atmospheric physics and chemistry have been developed that, based on current scientific knowledge, (1) integrate the important processes that control the emission, chemical transformation, transport and diffusion, and removal of

atmospheric pollutants, and (2) allow us to estimate the effect of emission changes on pollutant concentrations. These models are discussed further in Section 4.3.

3.2 Air Pollutants

Air pollutants can be classified as either primary or secondary. Primary pollutants are substances directly emitted from man-made processes, such as fossil fuel combustion, residential wood-burning, and cooking, or from natural sources such as wildfires, sea salt, and geologic dust. Secondary pollutants are not emitted directly. Rather, they form in the atmosphere when primary pollutants react or interact. An example of a secondary pollutant is ground-level ozone, which forms from nitrogen oxides (NO_x) and volatile organic compounds (VOCs), in the presence of sunlight. Another important example is the major components of fine particle pollution, which form from sulfur dioxide (SO₂), oxides of nitrogen (NO_x), and VOC emissions. Note that some pollutants, including PM, may be both primary and secondary: that is, they are both emitted directly and formed in the atmosphere from other primary pollutants.

Criteria Air Pollutants

At the federal level, under the Clean Air Act (CAA), the US EPA (EPA) regulates air pollution by setting limits on how much pollution can be in the air anywhere in the US. The EPA sets (and periodically reviews) National Ambient Air Quality Standards (NAAQS) for six air pollutants: ozone, particulate matter (PM), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and lead. EPA calls these pollutants “criteria” air pollutants because it regulates them by developing human health-based and/or environmentally based criteria (science-based guidelines) for setting permissible levels.

Particulate Matter

While all of the criteria pollutants are important from a health perspective, this report is focused on particulate matter (PM). The term “PM” describes a complex mixture of solid and liquid particles of various sizes in the atmosphere. The term total suspended particulate (TSP) is an outdated regulatory measure of the total mass concentration of PM in the air. TSP is no longer relied upon by any regulatory agencies for purposes of assessing air quality. Modern nomenclature describes PM in terms of particle size and chemical composition, both of which are important from a health perspective. Generally speaking, the smaller the particle size, the more deeply it can penetrate the respiratory system.

The size of particles in the atmosphere can vary tremendously. Particle sizes are often classified in three size ranges:

- Ultra-fine particles (<0.1 μm),

- Fine particles (0.1 to 2.5 μm), and
- Coarse particles (2.5 to 10 μm),

When one refers to $\text{PM}_{2.5}$, it means the concentration of particles that are less than 2.5 μm (i.e., particles in the fine and ultra-fine size ranges). PM_{10} includes the sum of $\text{PM}_{2.5}$ and coarse particles. For perspective, [Figure 3](#) provides a size comparison of $\text{PM}_{2.5}$ and PM_{10} particles to human hair and beach sand.

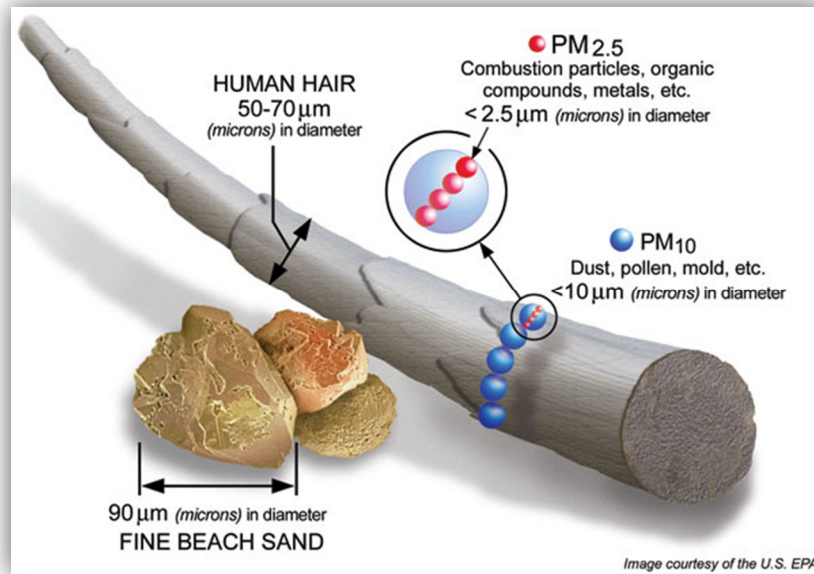


Figure 3. Size comparison of $\text{PM}_{2.5}$ and PM_{10} particles to human hair and beach sand.

PM is emitted by both man-made and natural sources including the burning of fossil fuels and motor vehicle exhaust; fugitive dust from handling “dusty” materials during industrial processes; and wind-blown dust or smoke from wildfires.

Coal Dust

Coal dust is a powdered form of coal that results from crushing or grinding coal during mining activities. Coal dust can also be emitted during the transport, handling, and storage of coal which is referred to as fugitive coal dust. Studies investigating the particle size distributions in fugitive coal dust have shown that coal dust is predominately comprised of coarse particles, or PM_{10} (Burkhart et al., 1987); however, the fine particle mass composition of coal dust, $\text{PM}_{2.5}$, which poses the greatest health concern, is generally low (Queensland Government Department of Environment and Heritage Protection, 2013).

Petroleum Coke Dust

Petcoke is a product of the oil refining process. Petcoke consists primarily of carbon and small amounts of metals and hydrocarbons. In its drier form, petcoke is similar to charcoal or coal and can produce fugitive dust emissions.

3.3 Overview of Air Quality

Air pollutants, such as those described previously, are emitted by both man-made and natural sources. Air quality refers to the degree to which the ambient air is polluted. Air pollution is measured and quantified through various monitoring networks that use instruments and methods to measure the concentrations of specific pollutants in the ambient air. The EPA's Office of Air Quality Planning and Standards (OAQPS) monitors criteria pollutants nationally through its Ambient Air Monitoring Program (AAMP). Through this program, air quality samples are collected to determine attainment of the NAAQS, to prevent or alleviate air pollution emergencies, to observe national and regional pollution trends, and to evaluate the effects of urban, land-use, and transportation planning relating to air pollution (U.S. Environmental Protection Agency, 2016b). State and local air quality agencies also implement air monitoring programs to measure air pollution and resulting air quality at the regional and local level.

In California, the California Air Resources Board (CARB) is responsible for ensuring that the state is meeting the air pollution standards established by EPA. CARB oversees and monitors the activity of California's 35 local air districts including the Bay Area Air Quality Management District (BAAQMD). The BAAQMD is a public agency responsible for air quality management for nine counties in the San Francisco Bay Area including Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, southwestern Solano, and southern Sonoma. The BAAQMD monitors air pollution throughout the district to meet state and federal air quality standards. The BAAQMD also permits and regulates stationary sources such as bulk terminals, refineries, and utilities and adopts air pollution regulations within the district.

Local, Regional, National, and Global Air Quality

For geographic context, air quality is generally discussed at four scales

- **Local** refers to the area in and around a community, city, urban area, or county;
- **Regional** refers to a larger area comprised of multiple counties or states;
- **National** refers to a nation or country; and
- **Global** refers to worldwide.

At each scale, the air pollution issues, geographic extent, and impact of air pollution vary. For example, at the local scale, individual facilities and local emissions sources have a more immediate and direct impact on local air quality. At the regional and national scale, long-range transport of pollution and downwind impacts are important. At the global scale, where air pollution is spread over continents, issues such as stratospheric ozone depletion and global warming become important. When assessing emissions and air quality, it is important that the contribution and impact of emissions and resulting air quality be placed in a geographic context.

4. Overview of Emissions and Air Quality Modeling

Air pollutants are emitted from many different types of sources including cars, trucks, and mobile equipment (mobile sources); area-wide small sources such as gas stations and drycleaners (area sources); and medium to large industrial facilities and power plants (stationary sources). A variety of scientific methods and tools can be used to quantify air emissions and resulting air quality impacts from these sources.

The following outlines a general process for assessing the air quality impacts from stationary sources:

- **Existing Air Quality:** Characterize ambient air quality conditions in the area around a facility by analyzing ambient air quality and meteorological data from monitoring sites in the city, county, or region where the facility is located;
- **Source Emissions:** Quantify the emissions associated with facility operations;
- **Modeled Impacts:** Analyze the near-field air quality impacts using an air quality model that uses local meteorological data and emissions as inputs to predict how emissions from a facility impact pollutant concentration levels in the atmosphere.

The emissions and modeled pollutant concentrations are then placed in context of current air quality conditions and how the facility's emissions might impact the area.

4.1 Characterizing Ambient Air Quality and Meteorology

The EPA tracks and monitors air quality throughout the nation based on data collected in different parts of the country. Ambient air quality in a particular area can be characterized by analyzing data collected by air monitoring sites and meteorological data and comparing pollutant concentrations to the NAAQS and/or state air quality standards. It is important to understand existing air quality conditions when assessing the potential impact from a new facility.

4.2 Quantifying Emissions

Air pollutant emissions from stationary sources can be quantified using a number of techniques depending on the data available. These techniques include estimating emissions using EPA-approved emissions factors and methods (U.S. Environmental Protection Agency, 2016a); using state or industry-specific emission factors; using emissions models developed specifically for a certain source type (e.g., landfill or power plant); using a material mass balance approach; measuring pollutant

emissions using source tests, or continuous emissions monitoring (CEM) data. If available, CEM data provide the most reliable estimate of emissions because they are based on actual measurements from a specific source type. However, often times CEM data are not available and obviously CEM data cannot exist for proposed facilities.

The emission factor approach is commonly used to estimate emissions, particularly for new or proposed point source facilities. Emission factors estimate the rate at which a pollutant is released to the atmosphere as a result of some process or industrial activity. In most cases, emission factors are expressed simply as a single number, with the underlying assumption that a linear relationship exists between emissions and the specified activity level over the probable range of application. Emission factors that are developed assuming no emissions controls are in place are referred to as “uncontrolled emission factors.” When emission factors are derived assuming emissions controls are in place, emission factors are referred to as “controlled emission factors” (Eastern Research Group, 2001). Emissions estimates are generally reported in mass per unit time (i.e., tons/year or lbs/day).

4.3 Analyzing Air Quality Impacts Using Modeling

Air quality models are mathematical descriptions of pollution transport, dispersion, and related processes in the atmosphere and have been in use for decades. Air quality models estimate the air pollutant concentration at many locations, which are referred to as receptors. The number of receptors in a model far exceeds the number of monitors one could typically afford to deploy in a monitoring study. Therefore, models provide a cost effective way to analyze impacts over a large geographic area where factors such as meteorology, topography, chemistry, and emissions could be important.

Air quality models are also appropriate tools to examine the air quality impacts of proposed regulations and policies. Air quality agencies and businesses regularly use these models to evaluate the sensitivity of air pollution concentrations to changes in emissions, which aids in decision making about the impacts of emissions from new facilities to local air quality. Predicting pollutant concentrations associated with future emission scenarios is another important use of air quality models.

There are many types of air quality models, and each type has its particular uses in assessing air quality impacts from emission sources. Three types of models commonly used in air quality assessment and management are (1) Gaussian plume models, (2) Lagrangian (trajectory) models, and (3) Eulerian (grid) models. Gaussian plume models are normally used to assess near-source, local impacts from primary pollutants, while Lagrangian and Eulerian photochemical models are suitable for urban- and regional-scale analyses and are generally much more computationally intensive.

Gaussian plume models, such as AERMOD, are mathematical models that are typically applied for stationary source emitters and industrial source complexes composed of point and/or area source emitters. Such models treat the dispersion of pollutant emissions from an emitter as a Gaussian

plume (Figure 4) with separate horizontal and vertical dispersion rates that are dependent on terrain characteristics and meteorology. Gaussian plume models produce pollutant concentration estimates at selected receptor locations but do not treat chemical transformations of pollutants. Gaussian plume models are suited for assessing air quality impacts of primary pollutants in the near-field, within approximately 50 km of an emission source.

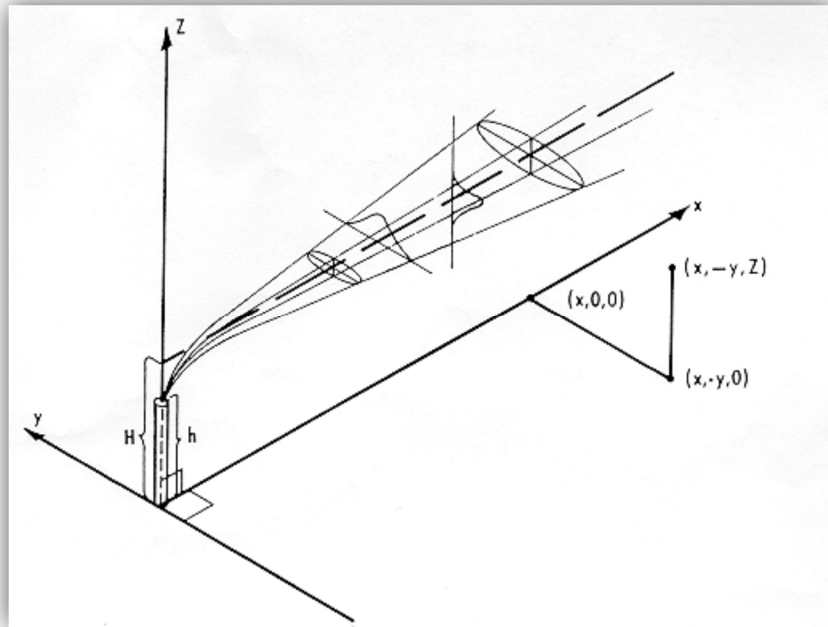


Figure 4. Representation of a Gaussian plume.

5. The Air Pollution Regulatory Framework

In addition to setting limits for and monitoring criteria pollutants throughout the US, the EPA also regulates emissions from large, industrial, or stationary sources such as power plants, refineries, and chemical plants under the New Source Review (NSR) permitting program. States, tribes, and local governments implement programs at the state and local level to comply with the regulations and NAAQS established by EPA (U.S. Environmental Protection Agency, 2017a). State and local agencies may implement more stringent air pollution standards than EPA's, but they may not have lower standards.

If the air quality in a geographic area meets or is cleaner than the NAAQS, EPA refers to the area as an attainment area. Areas that do not meet the NAAQS are called nonattainment areas. In some cases, EPA is not able to determine an area's status after evaluating the available information; these areas are designated "unclassifiable." Once designations take effect, state and local governments must develop implementation plans outlining how they will attain and maintain the NAAQS by reducing air pollutant emissions (U.S. Environmental Protection Agency, 2017c). [Table 1](#) lists the California Ambient Air Quality Standards (CAAQS), the NAAQS, and the BAAQMD's current attainment status for criteria pollutants.

Table 1. Summary of the CAAQS, the NAAQS for criteria pollutants, and the BAAQMD's attainment status as of September 2017.

Pollutant	Averaging Time	California Standards		National Standards	
		Concentration	Attainment Status	Concentration	Attainment Status
Ozone	8 Hour	0.070 ppm (137 $\mu\text{g}/\text{m}^3$)	N ⁹	0.070 ppm Primary same as secondary	N ⁴
	1 Hour	0.09 ppm (180 $\mu\text{g}/\text{m}^3$)	N		See Note #5
Carbon Monoxide	8 Hour	9.0 ppm (10 mg/ m^3)	A	9 ppm (10 mg/ m^3)	A ⁶
	1 Hour	20 ppm (23 mg/ m^3)	A	35 ppm (40 mg/ m^3)	A
Nitrogen Dioxide	1 Hour	0.18 ppm (339 $\mu\text{g}/\text{m}^3$)	A	0.100 ppm See Note #11	See Note #11
	Annual Arithmetic Mean	0.030 ppm (57 $\mu\text{g}/\text{m}^3$)		0.053 ppm (100 $\mu\text{g}/\text{m}^3$)	A
Sulfur Dioxide See Note #12	24 Hour	0.04 ppm (105 $\mu\text{g}/\text{m}^3$)	A	0.14 ppm (365 $\mu\text{g}/\text{m}^3$)	See Note #12
	1 Hour	0.25 ppm (655 $\mu\text{g}/\text{m}^3$)	A	0.075 ppm (196 $\mu\text{g}/\text{m}^3$)	See Note #12
	Annual Arithmetic Mean			0.030 ppm (80 $\mu\text{g}/\text{m}^3$)	See Note #12
Particulate Matter (PM ₁₀)	Annual Arithmetic Mean	20 $\mu\text{g}/\text{m}^3$	N ⁷		
	24 Hour	50 $\mu\text{g}/\text{m}^3$	N	150 $\mu\text{g}/\text{m}^3$	U
Particulate Matter - Fine (PM _{2.5})	Annual Arithmetic Mean	12 $\mu\text{g}/\text{m}^3$	N ⁷	12 $\mu\text{g}/\text{m}^3$ See Note #15	U/A
	24 Hour			35 $\mu\text{g}/\text{m}^3$	N See Note #10
Lead See Note #13	30 day Average	1.5 $\mu\text{g}/\text{m}^3$		-	A
	Calendar Quarter	-		1.5 $\mu\text{g}/\text{m}^3$	A
	Rolling 3 Month Average ¹⁴	-		0.15 $\mu\text{g}/\text{m}^3$	See Note #14

A=Attainment N=Nonattainment U=Unclassified

mg/ m^3 =milligrams per cubic meter

ppm=parts per million

$\mu\text{g}/\text{m}^3$ =micrograms per cubic meter

1. California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter - PM₁₀, and visibility reducing particles are values that are not to be exceeded. The standards for sulfates, Lake Tahoe carbon monoxide, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded. If the standard is for a 1-hour, 8-hour or 24-hour average (i.e., all standards except for lead and the PM₁₀ annual standard), then some measurements may be excluded. In particular, measurements are excluded that ARB determines would occur less than once per year on the average. The Lake Tahoe CO standard is 6.0 ppm, a level one-half the national standard and two-thirds the state standard.
2. National standards shown are the "primary standards" designed to protect public health. National standards other than for ozone, particulates and those based on annual averages are not to be exceeded more than once a year. The 1-hour ozone standard is attained if, during the most recent three-year period, the average number of days per year with maximum hourly concentrations above the standard is equal to or less than one. The 8-hour ozone standard is attained when the 3-year average of the 4th highest daily concentrations is 0.070 ppm (70 ppb) or less. The 24-hour PM₁₀ standard is attained when the 3-year average of the 99th percentile of monitored concentrations is less than 150 µg/m³. The 24-hour PM_{2.5} standard is attained when the 3-year average of 98th percentiles is less than 35 µg/m³.

Except for the national particulate standards, annual standards are met if the annual average falls below the standard at every site. The national annual particulate standard for PM₁₀ is met if the 3-year average falls below the standard at every site. The annual PM_{2.5} standard is met if the 3-year average of annual averages spatially-averaged across officially designed clusters of sites falls below the standard.

3. National air quality standards are set by US EPA at levels determined to be protective of public health with an adequate margin of safety.
4. On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm. An area will meet the standard if the fourth-highest maximum daily 8-hour ozone concentration per year, averaged over three years, is equal to or less than 0.070 ppm. EPA will make recommendations on attainment designations by October 1, 2016, and issue final designations October 1, 2017. Nonattainment areas will have until 2020 to late 2037 to meet the health standard, with attainment dates varying based on the ozone level in the area.
5. The national 1-hour ozone standard was revoked by U.S. EPA on June 15, 2005.
6. In April 1998, the Bay Area was redesignated to attainment for the national 8-hour carbon monoxide standard.
7. In June 2002, CARB established new annual standards for PM_{2.5} and PM₁₀.
8. Statewide VRP Standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.
9. The 8-hour CA ozone standard was approved by the Air Resources Board on April 28, 2005 and became effective on May 17, 2006.
10. On January 9, 2013, EPA issued a [final rule](#) to determine that the Bay Area attains the 24-hour PM_{2.5} national standard. This EPA rule suspends key SIP requirements as long as monitoring data continues to show that the Bay Area attains the standard. Despite this EPA action, the Bay Area will continue to be designated as "non-attainment" for the national 24-hour PM_{2.5} standard until such time as the Air District submits a "redesignation request" and a "maintenance plan" to EPA, and EPA approves the proposed redesignation.
11. To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100ppm (effective January 22, 2010). The US Environmental Protection Agency (EPA) expects to make a designation for the Bay Area by the end of 2017.
12. On June 2, 2010, the U.S. EPA established a new 1-hour SO₂ standard, effective August 23, 2010, which is based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations. The existing 0.030 ppm annual and 0.14 ppm 24-hour SO₂ NAAQS however must continue to be used until one year following U.S. EPA initial designations of the new 1-hour SO₂ NAAQS. EPA expects to make designation for the Bay Area by the end of 2017.
13. ARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure below which there are no adverse health effects determined.
14. National lead standard, rolling 3-month average: final rule signed October 15, 2008. Final designations effective December 31, 2011.
15. In December 2012, EPA strengthened the annual PM 2.5 National Ambient Air Quality Standards (NAAQS) from 15.0 to 12.0 micrograms per cubic meter (µg/m³). In December 2014, EPA issued final area designations for the 2012 primary annual PM 2.5 NAAQS. Areas designated "unclassifiable/attainment" must continue to take steps to prevent their air quality from deteriorating to unhealthy levels. The effective date of this standard is April 15, 2015.

6. Stationary Sources and Permitting

The federal NSR permitting program requires that all new or modified stationary sources of air pollution be permitted before construction. The purpose of NSR is to ensure that new or modified industries are as clean as possible and that advances in air pollution control occur concurrently with industrial expansion (U.S. Environmental Protection Agency, 2017b). Under the NSR, a source may have to meet one or more permitting requirements (U.S. Environmental Protection Agency, 2016c): for new sources in attainment or unclassifiable areas, the Prevention of Significant Deterioration (PSD) permit requirement applies. The PSD requires new sources to utilize Best Available Control Technology (BACT) and develop emissions estimates. If emissions estimates exceed established thresholds of significance,¹ then air quality modeling and analyses are required to quantify the impacts of the emissions on pollutant concentrations. The resulting pollutant concentrations are then compared to Significant Impact Level (SIL) values which are used as a way to screen projects that may have a significant adverse effect on air quality, public health, attainment of CAAQS and NAAQS, and to provide recommendations to mitigate those impacts (Tholen, 2009).

In California, the NSR and PSD permit requirements are implemented through the California Environmental Quality Act (CEQA). CEQA is a statute that requires state and local public agencies to identify the significant environmental impacts of any new construction, transportation, land development, and/or industrial project and to avoid or mitigate those impacts. CEQA provides the basis and guidelines for compliance with NSR and PSD requirements in California.

Within the nine counties of the BAAQMD, all existing and new stationary sources that emit air pollutants are required to obtain a Permit to Operate (PO) from the BAAQMD unless the facility is excluded or exempted from air district regulations. To obtain a PO, the facility operator(s) must comply with CEQA and corresponding guidelines developed by the BAAQMD to meet NSR and PSD requirements.

6.1 Emissions Limits and Significance Thresholds

As part of the permit application process, emissions must be quantified for each potential source of air pollution using best practice procedures and emission factors referenced in the BAAQMD's CEQA Guidelines (Broadbent et al., 2011) and Permit Handbook (Lee, 2006) documentation. Emissions estimates are required for all relevant criteria pollutants and toxic air contaminants (TACs), for all relevant time periods (e.g., annual, maximum daily, maximum hourly). In order for a permit to be approved, each source must be in compliance with emissions limits and applicable regulatory

¹ Thresholds of significance are designed to establish the level at which air pollution emissions would cause significant environmental impacts under CEQA.

requirements. A PO may be subject to permit condition(s). A condition could include, for example, limits on throughput, operating parameter ranges, or dust mitigation measures.

According to BAAQMD CEQA guidelines, if a project exceeds the emissions limits and significance thresholds, it may still be approved by implementing mitigation measures that help reduce or offset emissions in future operational years. For example, as documented in the 2012 Oakland Army Base Project EIR Addendum, there are outlined mitigation measures to help off-set Port-related emissions (i.e., retrofitting locomotive engines to meet current federal standards and/or by using reduced sulfur fuels in ships while the ships are in the San Francisco Bay) (LSA Associates, 2012).

6.2 Emissions Controls – Best Available Control Technology (BACT)

For new stationary sources, the BAAQMD requires that the Best Available Control Technology (BACT) permit conditions are applied. BACT are generally defined as the most effective emissions controls or the most stringent emissions limitations that apply to specific types of equipment or industrial processes as determined on a case-by-case basis by BAAQMD.

7. Overview of Covered Bulk Terminals

Dry bulk terminals are storage and handling facilities for imports or exports of dry bulk goods, or commodities, and are usually located at shipping ports. These storage and handling facilities and systems are either open or covered depending on the characteristics of the bulk product and potential environmental issues. For example, even though the degradability of coal stored in open air, or uncovered, is low, potential environmental concerns about fugitive dust often influence terminal layout and design, choice of storage facilities, and material handling practices for coal (Schott and Lodewijks, 2007).

To help reduce air, water, and noise pollution, covered, or enclosed, bulk terminals have become more widespread. Covered bulk terminals are handling / storage facilities where essentially all of the unloading, movement, handling, and transloading of material occur in covered or enclosed systems. These terminals also utilize dust mitigation technologies that reduce fugitive dust from terminal operations thereby improving the occupational environment, reducing equipment wear and maintenance costs, and reducing dust impacts on neighboring communities (Schott and Lodewijks, 2007).

7.1 Example Covered Bulk Storage Terminals in California

There are several covered bulk terminals currently operating in California, two of which are located in the most stringent air quality management districts in the state, the BAAQMD and the South Coast Air Quality Management District (SCAQMD). Koch Carbon, LLC operates these terminals located in Pittsburg (in the BAAQMD) and in Long Beach (in the SCAQMD). The Pittsburg facility is located in the same air district as the proposed OBOT marine terminal (in West Oakland).

The Pittsburg facility primarily handles petroleum coke (petcoke), which is a product of the oil refining process. Refineries sell petcoke as a fuel to operators of industrial boilers or power plants. Covered bulk terminals receive petcoke from local refineries, store it until it is ready for shipment, and ship the petcoke to its final destination. The Pittsburg facility has relatively low annual emissions and has received praise from community leaders and air regulators for being “very effective in eliminating fugitive coke dust” (Duazo, 2006). [Figure 5](#) shows two photographs of the Pittsburg facility: (left) covered domes used to store piles of petcoke and (right) enclosed conveyor systems used to transfer petcoke through the facility.



Figure 5. Photographs of the Koch Carbon, LLC Pittsburgh facility: (left) covered domes used to store piles of petcoke and (right) enclosed conveyor systems used to transfer petcoke through the facility.

The Long Beach bulk storage terminal is located at the Port of Long Beach and handles petcoke and prilled, or pelletized, sulfur. Similar to the Pittsburgh facility, the Long Beach facility has been praised by the SCAQMD as being the “best of its type in the world” and indicated that the facility “had reduced the potential for fugitive dust emissions to a level that others should emulate” (City of Pittsburgh, 2001).

7.2 The Proposed OBOT Facility

The OBOT facility is proposed to be a state-of-the-art, covered bulk terminal similar to those described above. According to the OBOT BOD and a sister report prepared for OBOT entitled *Best Practices for the Design of Multi-Commodity Loading Terminals*, referred to as the (the Cardno Report), the facility is proposed to be almost entirely enclosed and would consist of a railcar staging area and unloading system, conveyor systems, warehouse storage facilities, and ship loading equipment (Veilleux, 2015). These plans contemplate the facility being built utilizing industry standard, proven technologies and modern design as well as controls and operating practices that meet or exceed BACT. The OBOT facility operators also intend to use rail car covers to reduce fugitive dust emissions during rail transport and the staging of rail cars at the OBOT facility.

In the City of Oakland Agenda Report dated June 23, 2016 (Cappio, 2016), on page 5, footnote 1, the City refers to new regulations that BAAQMD is considering to address “health, safety, and/or general welfare issues.” Contrary to the City’s suggestion in footnote 1 of the Agenda Report, BAAQMD would require OBOT to implement BACT via permitting requirements irrespective of whether BAAQMD adopts its proposed rule. The ESA Report itself acknowledged that “[u]se of these control measures for fugitive coal dust would likely be considered Best Available Control Technology in the San Francisco Bay Area.” This is also confirmed by an internal draft of the ESA Report by Tim Rimpo (a preparer of the ESA Report) referring to ESA’s “discussion[s] with BAAQMD that the BACT measures that would be required would achieve a minimum of 90% control and likely would achieve 99%

control." Although ESA's discussion with BAAQMD was ultimately not mentioned in the ESA Report, it confirms that OBOT would be unable to obtain a permit to operate its facility without first receiving a BAAQMD permit which would require use of BACT, among other requirements as described in Section 6 above.

While the OBOT BOD document and the Cardno Report conceptually describe the facility and activity levels and do not represent the final, engineering design, the information in these documents is adequate to develop emissions estimates for uncontrolled and controlled emissions associated with the OBOT facility.

8. Project Area

The OBOT facility would be located at the northwestern end of the Oakland Army Base Redevelopment Plan Area at the Port of Oakland (see Figure 1). The facility would cover approximately 20 acres with about 12 acres of land area and 8 acres of wharf. **Figure 6** shows a map of the proposed OBOT facility, the rail spurs where rail cars will be staged for unloading (yellow), and the surrounding areas including portions of Emeryville and West Oakland.

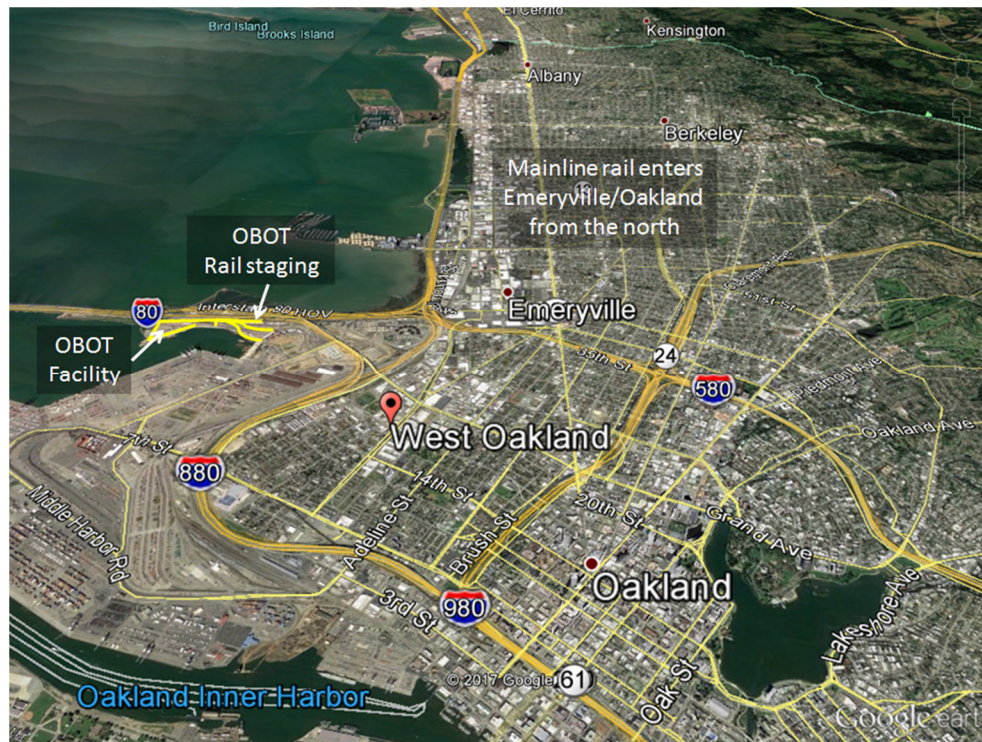


Figure 6. Location of the OBOT facility and spurs for staging rail cars (yellow).

The community of West Oakland is located in the BAAQMD in the northwestern portion of the City of Oakland. The community of West Oakland is situated along the waterfront and is bounded by the Port, the UP rail yard, and Interstates I-580, I-880, and I-980. West Oakland is zoned for both residential and industrial use.

8.1 Disadvantaged Communities

In 2004, the BAAQMD initiated the Community Air Risk Evaluation (CARE) to identify areas throughout the Bay Area with high concentrations of air pollution and populations most vulnerable to those burdens. These “impacted” areas have formed the foundation of the Clean Air Communities

Initiative (CACI), a program designed to bring resources from throughout the Air District to protect public health in impacted communities (Martien et al., 2014).

In 2014, CalEPA developed CalEnviroScreen, which is a methodology to identify “disadvantaged communities” based on several indicators including socioeconomic factors, environmental conditions, and vulnerability of people living in those communities. CalEPA boards and departments, and other state agencies use these designations to allocate resources and make policy decisions intended to benefit these disadvantaged communities. The area of West Oakland is a designated disadvantaged community as are many parts of California’s central San Joaquin Valley and Southern California (California Air Resources Board, 2017).

9. Analytical Framework for this Report

My approach to developing this report and the opinions contained herein, was to first review the public record containing information on the potential air quality and health impacts resulting from the OBOT facility operations. I conducted a review and scientific critique of two of the key reports written for the City of Oakland to address bulk storage and operations at the proposed OBOT facility including:

- the ESA Report of June 23, 2016 and
- the Chafe report of June 22, 2016.

In addition to the two reports listed above, I reviewed several other documents in the public record, including the June 14, 2016 Public Health Panel Report, and the City's findings and determinations in the Ordinance and Staff Report. My approach was to review each document focusing on emissions and air quality, and to provide a scientific critique of the methods and conclusions contained in the public record. As part of this critique, I identified statements and/or citations that warrant context, further clarification, supporting data, and/or information about underlying scientific assumptions. I focused my review on environmental air quality issues related to

- emission activity assumptions and data,
- emission factors and estimation methodologies used,
- emission control technologies assumptions and data,
- meteorological considerations and assumptions, and
- engineering judgement and common sense.

After reviewing the key documents in the public record, the City Ordinance and the City Staff Report, I used industry-standard scientific methods and air quality tools to evaluate the accuracy of the evidence in the public record used by the City to justify its findings.

10. Flaws in the City's "Findings" Underlying the Ordinance

It is my opinion is that the City's findings and determinations regarding the potential impacts of the OBOT facility on air quality and health in West Oakland are **flawed and in error**. They are based on assessments that are heavily biased, inadequate, based on false assumptions, and contain numerous calculation errors and inconsistencies. These flaws and errors may generally be grouped into the following categories:

- 1) the inappropriately narrow scope of review for the potential emissions and health impacts in the ESA assessment purportedly relied on by the City, including the failure to perform any air quality modeling in association with the City's conclusions despite air quality modeling being necessary to quantify the impact of emissions from a facility on ambient pollutant concentrations, and ultimately, the public's exposure to those pollutants;
- 2) the failure of the City and its consultants to take into account the proposed design and other measures to be implemented at the contemplated OBOT facility when attempting to quantify the impact of emissions from that facility;
- 3) the improper assumptions and basic mislabeling, typographical and mathematical errors in the primary calculations, at Table 5-7 on page 5-17 of the ESA Report, relied upon by the City for calculating potential emissions associated with the OBOT facility; and
- 4) flaws in the City's conclusions and analyses regarding potential greenhouse gas emissions resulting from operations at the proposed OBOT marine terminal.

10.1 Inappropriately Narrow Scope of the Assessment Performed by the City's Consultants

There is evidence contained in emails produced in this case that indicates the City's contractor ESA, who prepared the report on emissions which formed the basis for the City's findings, was directed by the City to conduct an assessment that was intentionally insufficient and biased.

Specifically, a series of email exchanges (internal to ESA) indicate that ESA had originally proposed a comprehensive study and health risk assessment. The scope of work for the originally proposed study was then whittled down to only producing a summary of public comments and emissions estimates for the OBOT facility which is reflected in the ESA Report. Emails imply that the City specifically requested that a comprehensive study not be conducted because they did not want the

results to suggest that fugitive dust from coal could have been mitigated using modern dust control technologies. For example, in an email dated January 22, 2016, after the original scope of work proposed by ESA had been reduced by the City, Brian Boxer of ESA sent this email to several ESA staff as follows (ESA_036076):

"Here are my suggested edits. Biggest thing is I think we remove all of Phase 2; they don't want us to scope that out now. If I were them, I would not want the quantitative scope for Phase 2 in there, because it looks like they did not do all of the work necessary. See my various edits and comments."

As another example, an email dated February 18, 2016 to several ESA staff read as follows (ESA_035748):

"All: An update:

Based on a (link here) one-page outline of our proposed scope of work, a resolution to hire ESA for the Coal Project (and specifically to further work with the City to figure out an approach) was on Tuesday's City Council's agenda for approval (the full version of which we just submitted back to the City). Based on a flood of community protestors, the City Manager pulled the item from the agenda during the meeting. Claudia (Deputy City Manager) and I communicated closely earlier in the day on Tuesday around the likelihood that would happen. While all parties oppose Coal thru Oakland, the public (at least those with the loudest voices on Tuesday) feels the City is "doing too much." The public does not want a long/costly effort that will result in a "study, analysis, regulations, mitigation measures, etc., which all allow for the possibility that that project will proceed with some conditions or mitigations. The public wants an out-and-out ban, and now. They say the City just needs to read all the information already submitted by the public (the big notebook the City gave us), and that the answer to whether there's a danger to public safety is in there. <http://sanfrancisco.cbslocal.com/2016/02/16/residents-protest-plan-for-coal-train-from-utahto-west-oakland/>

As of today, the City is regrouping around its overall approach and our most (link here) recently revised scope and how they might be modified to at least get it before the Council to get us contracted.; I anticipate that they will invite us into that conversation pretty shortly.

Crescentia Brown"

Following the email above, in response to the public meeting, an email and meeting invitation dated February 29, 2016 from Crescentia Brown, outlines the revised scope of work (and commentary) for the ESA Report as follows (ESA_035759):

"A. Scope Direction in Response to Public and City Council Concerns about Cost and Time

1. **REVIEW AND Cull:** *Focused on the few substantive comments/reports received to date and in the City's public record now (the binder), summarize the "evidence" already in hand that*

could support a "qualitative threshold and standard of substantial evidence" (that conditions would be substantially dangerous to nearby folks' health or safety).

2. **CROSS-REFERENCE WITH SCOPE:** *Sort this information across the few major considerations/tasks that we have currently scoped (primarily Tasks 1.5-1.8)*
3. **GAPS:** *Identify omissions in that information that would need to be filled (for a follow-up phase of work), presumably through consultation with the Air District, topical experts, mapping, and/or quantitative modeling.*

With that, the City would decide if (a) it's enough "substantial evidence" to take an action based upon, (b) the result suggests a direction it no longer wants to pursue, (c) more work is needed to fill the gaps.

B. Cost-Time Parameters

The City Council has directed that a lesser up-front effort is necessary and feasible (particular since apparently a Council staff has already made a pass at #1 and #2 above, and commented on the scope- input that Mark will receive and forward to us next week). While "palatable cost" was not defined, Mark suggest it something below \$100K. Also, something must be published in June 2016.

C. City's Expressed Defense of ESA/CEQA Consultants

We can discuss this Monday morning. In response to claims that ESA or any CEQA consultant are "hired guns" for developers, Mark has insistently explained that any work by any CEQA consultant is done at the direction of the lead agency. The outcome of our crude-by-rail work at Benicia is referenced frequently."

Finally, emails (and the resulting emissions estimates) indicate that throughout the production of the ESA Report, ESA developed conclusions that were unsupported, used biased assumptions that would result in high emissions estimates, and relied on data that would produce the results that the City was hoping for – that *any* handling of coal in Oakland would pose a health hazard. For example, the following is an excerpt from an email from Victoria Evans of ESA to several ESA staff (ESA_035458):

"Below is the link to a document I created with existing public comment information and citations. This is for internal review and proposals for addition of any more caveat language.

This is an example of available info that I see in the public comments that we can use for conclusion making, along with a big lack of info in the public domain (and scientific journals) for rail car covers and topper agents/surfactants. I would like to know if this type of information is enough for the City to use for their purposes.

I believe we have to emphasize that this makes us tech AQ types nervous at ESA, since we did not generate these original emission estimates, and we do not have a detailed project description to use to even make revisions to these emissions estimates."

These restrictions on scope and predetermined conclusions led to an assessment by ESA that was done without adequately performing a scientifically credible assessment of emissions, air quality, and/or health impacts from the proposed OBOT facility, as discussed further below. Most notably, Chapter 5 of the ESA Report is entitled "Health Effects"; however, no air quality modeling was done to characterize or quantify the public's exposure to pollutants from the OBOT facility as is required in a credible health risk assessment. Furthermore, there is no mention of particle size distributions in the discussion of the physical characteristics of coal, which is critical for evaluating air quality and health impacts from PM₁₀ and PM_{2.5} emissions.

In addition to the ESA Report, I also reviewed the June 22, 2016 report by Dr. Zoe Chafe (Chafe, 2016) and the June 14, 2016 Public Health Panel Report. As is the case with the ESA Report, the Chafe and Public Health Panel Reports provide no quantitative assessment of either emissions or air quality. The reports, in many cases, only reiterated the ESA Report's statements and conclusions and did not include any air quality modeling results to support conclusions about the public's exposure to coal dust. In both reports, discussions of health effects focus mostly on PM_{2.5}, not on coal dust. Although coal dust may contain a small amount of PM_{2.5}, coal dust consists primarily of PM₁₀ or larger particles. PM_{2.5} is typically a product of combustion (e.g., vehicle exhaust or wood smoke). Lastly, the Chafe Report discusses the impossibility of completely avoiding human exposure to coal dust, when in fact, permits are regularly issued for facilities that emit some levels of PM.

10.2 The Failure to Take Into Account Mitigation Measures Planned for the OBOT Terminal

The City and the ESA Report are incorrect in concluding that there are no effective means to prevent fugitive coal dust during rail transport to the proposed OBOT terminal, as many sources of information have shown rail car covers and surfactants to be effective during such transport.

The ESA Report discusses how TLS and OBOT anticipate using "covered bottom-release rail cars designed to release the commodities, including coal, into a deep underground transfer compartment with dust collection systems installed for total dust mitigation" for the terminal at the West Gateway. It further notes that "dust suppressants," also known as coal "topping agents," may be applied in order to control "dust emissions" during the shipment of coal.

However, the emissions calculations in ESA Report (relied on by the City) do not take into account these emission control efforts. As discussed in detail below, if the control technologies specified in the BOD and the Cardno Report are implemented, emissions estimates developed using current literature and EPA best practices indicate that fugitive coal dust emissions from the OBOT facility

would not exceed emissions thresholds of significance established by BAAQMD (Broadbent et al., 2011).

Nevertheless, the ESA Report did not take into account any of these control technologies specified in the BOD and the Cardno Report, despite the fact that scientific literature support their effectiveness including:

a) Effectiveness of Rail Car Covers on Fugitive Coal Dust

I have performed a literature review of current methods for quantifying fugitive dust emissions from rail cars transporting coal. I also reviewed the literature and conducted personal communications with industry representatives to understand if rail car covers are a) used to cover cars transporting coal, and b) if so, how effective are they. I reviewed more than a dozen sources of peer-review and gray literature related to fugitive coal dust emissions and rail car covers.

This literature I reviewed indicates that the optimal solution to reduce or eliminate fugitive coal dust is to cover rail cars transporting coal, and covers for rail cars exist and are used to cover other bulk commodities as OBOT has proposed. For example, studies from as early as 1973 have shown that rail car covers are effective at reducing or eliminating dust from other commodities during rail transport (Schwartz, 1974).

Additionally, one of the most recent and thorough reports I found - *Millennium Bulk Terminals – Longview SEPA Environmental Impact Statement – Coal Dust Emissions, Coal Spills Analysis, and Sulfur Dioxide and Mercury Emissions Analysis* - was released in April 2017 by ICF in collaboration with Cowlitz County Washington and the Washington State Department of Ecology, Southwest Region (the ICF report) (ICF International, 2017). The ICF report reviewed and references several of the same sources of information available in the peer-review and gray literature that I found and that are also referred to in the ESA Report.

The ICF Report examined a body of recent work to estimate fugitive dust emissions from rail cars and combined available information with actual air quality measurements and modeling to develop improved emissions estimation equations and control efficiencies. The emissions estimation methods used in the ICF Report were developed and improved using a combination of wind tunnel studies, air quality field measurements, and air quality modeling to arrive at an emission factor equation that accounts for the physical variables that most impact emissions - train speed and wind speed – and the size of U.S. rail cars. In addition, the emission factor equation developed by ICF, compares relatively well with other emissions estimation methodologies developed by EPA (U.S. Environmental Protection Agency, 1989). The ICF Report also examined a body of recent work and used a combination of air quality measurements and AERMOD air quality modeling to estimate a control efficiency of 61% for surfactant application. I relied on the ICF report to estimate fugitive coal dust from rail cars in transit, because the methods used in ICF Report reflect the current state of the science for fugitive coal dust from rail cars and effectiveness of surfactants.

Finally, even the Sierra Club, who has intervened as a defendant in this litigation, has confirmed the effectiveness of rail car covers in controlling emissions: in a recent lawsuit between the Sierra Club, several other environmental groups, and rail carrier BNSF, the Sierra Club stated: “there is a technologically feasible solution to prevent the discharge [of coal] from occurring: the use of covers on top of the rail cars that transport coal.” *Sierra Club v. BNSF Railway Co.*, 2:13-cv-00967-JCC, WD Wa., D.E. 350 at 8.

b) Effectiveness of Topping Agents on Fugitive Coal Dust

In addition to covering rail cars other effective measures exist, and topping agents and surfactants have been shown to control fugitive coal dust during the transport or storage of coal (BNSF Railway Company, 2016).

Rail operators recognized that fugitive coal dust from rail cars may create issues for operators because coal dust that settles on the rail lines may weaken rail tracks, which can ultimately cause derailments (BNSF Railway Company, 2017). For example, in 2011, the Surface Transportation Board (STB), an independent adjudicatory and economic-regulatory agency that has jurisdiction over railroads, issued a decision finding that coal dust is harmful to rail tracks and that rail line operators may require coal shippers to take reasonable steps to suppress coal dust emissions from open-top railcars (Surface Transportation Board, 2015).

To address this issue, almost a decade ago BNSF, one of the largest rail line operators, implemented a Coal Loading Rule that requires its customers/shippers to a) load coal into rail cars in a “bread loaf” shape to reduce issues with wind erosion and b) apply a topping agent, or surfactant, to the coal before it leaves the mine. Union Pacific, another of the largest rail line operators, issued a statement supporting the Coal Loading Rule (Glass, 2011). The Coal Loading Rule requires that coal dust losses in transit be reduced by at least 85% compared to rail cars with no remedial measures (BNSF Railway Company, 2017).

The control efficiency of surfactants varies depending on the type of surfactant and characteristics of the coal. Studies indicate that a control efficiency of 85% is achievable based on field measurements (BNSF Railway Company, 2010) and wind tunnel studies (Hatch, 2008). However, because surfactants are usually applied when trains leave the coal mine and the surfactants can erode as the coal settles and is exposed to wind in transit, the control efficiency can be reduced when coal is transported over long distances. For example, in the ICF study in Washington State, the 85% surfactant control efficiency was found to be too high when comparing fugitive dust measurements near railways to air quality modeling results for coal trains traveling through Washington State from the Powder River Basin in Montana and Wyoming (ICF International, 2017). ICF used a best-fit linear regression to the observed-modeled data, and estimated the control efficiency to be 61%.

In addition to the sources of information discussed above, a white paper prepared on September 15, 2015 by HDR Engineering entitled *Air Quality & Human Health and Safety Assessment of Potential Coal Dust Emissions* (Liebsch and Musso, 2015) provides an assessment of the potential human

health and safety impacts due to transporting and handling of coal as part of the operation of the proposed OBOT facility. While this white paper lacks an independent quantitative assessment of the emissions and air quality impacts of fugitive coal dust, it makes a number of relevant points related to the effectiveness of rail car load profiling and surfactants: fugitive dust emissions from covered bulk terminals can and have been controlled using state-of-the-art control technologies including those proposed for OBOT; facilities like OBOT have been permitted to operate in other areas and parts of the country; and it points out some major flaws in air quality modeling that was done in opposition of constructing the Port of Morrow Coyote Island Bulk Terminal (Source Watch, 2016) which nevertheless was issued air and water permits by the Oregon Department of Environmental Quality.

10.3 Flaws in the Emissions Calculations Relied on By the City

The emissions estimates, assumptions, and conclusions in the ESA Report lack scientific and engineering judgement and are unsupported.

According to ESA, Table 5-7 on page 5-17 of the ESA Report “summarizes estimated emissions for all of the sources that were discussed [in the ESA Report] for rail transport of coal and all activities for export of coal at the OBOT facility.” The estimated emissions in Table 5-7 form the basis upon which many of ESA’s conclusions are drawn from. However, Table 5-7 is peppered with mislabeling, typographical errors, and basic mathematical errors. In addition, several of the emissions estimates presented in Table 5-7 are not based on EPA best practices and/or are incorrect. The major issues in Table 5-7 include:

- **Basic mathematical errors:**
 - The “Subtotal Oakland” row in Table 5-7 is not consistently summed. For example, the PM₁₀ subtotal column is 116 tons/year which sums correctly if you add rail transport in Oakland and staging (38 tons/year + 78 tons/year = 116 tons/year). Following this logic, for PM_{2.5} if you sum rail transport in Oakland and staging it adds up to 24 tons/day, not 18 tons/day.
 - In Table 5-7, the conversion from tons/year to lbs/day (as you move from the left side of the table to the right) is incorrect and inconsistent. For example, 116 tons/year converted to lbs/day $[(116 \text{ tons/year} \times 2000 \text{ lbs/ton}) / 365 = 636 \text{ lbs/day}]$ should equal 636 lbs/day but it is reported in the table as 665 lbs/day.

- **Mislabeled:** The OBOT facility emissions reported in Table 5-7 (bottom portion of the table) are labeled as "controlled," but there are no control efficiencies applied to the calculations for these emissions sources in ESA's calculation spreadsheets.
- **Typographical errors:** Some of the emissions values reported in Table 5-7 appear to have typographical errors when compared to the emissions calculation spreadsheets. For example, PM₁₀ from staging is reported to be 78 tons/year in Table 5-7; however, in the emissions calculation spreadsheet (Coal-Staging) PM₁₀ emissions are 65 tons/year but PM₃₀ emissions are 78 tons/year.
- **Citation to Irrelevant Measures for Emissions:** In Table 5-7, ESA offered estimates of TSP (or "total suspended particulate") emissions. However, as noted above, TSP is an outdated regulatory measure that is no longer relied upon by any regulatory agencies for purposes of assessing air quality.
- **Inflated Emission Factors During Rail Transport:** For fugitive dust from mainline rail transport of coal, the emission factor chosen by ESA is based on work done in 1993 by Simpson Weather Associates. However, that emission factor approach over predicts emissions by a factor of ten when compared to other approaches, including ICF and EPA. Further, the emission factor chosen by ESA assumes a **constant** emission rate of 1lb coal dust/car/mile across all legs of the journey, neglecting important erosion considerations such as train speed, wind speed, and losses of erodible material that result in higher emission rates near the point of origin and lower emission rates as the trip progresses.
- **Inflated Emission Factors at the OBOT Facility:** For fugitive dust from rail cars staged at the OBOT facility for unloading, ESA's calculations constitute approximately 82% of the PM₁₀ and PM_{2.5} emissions associated with the OBOT facility (staging and operations from Table 5-7 in ESA Report). These calculations are based on EPA's AP-42 Chapter 13 Section 13.2.5 guidance for industrial wind erosion.
 - However, the emission factors used by ESA represent fugitive dust created during high wind gust events, not steady state erosion conditions. AP-42 Section 13.2.5-3 specifically states *"The resulting calculation is valid only for a time period as long as or longer than the period between disturbances. **Calculated emissions represent intermittent events and should not be input directly into dispersion models that assume steady-state emission rates.**"* Thus, the emission factors used are not the correct emission factors to physically represent wind erosion from staging of coal cars throughout the year.
 - Furthermore, when calculating the emissions from staging, ESA assumed a threshold friction velocity of 0.54 m/s (AP-42 13.2.5) which represents fine coal dust on a concrete pad, not coal. This friction velocity results in an erosion potential of 40 g/m³.

This assumption yields much higher emissions than if a more appropriate friction velocity were used. It should be noted that the emissions for staging reported in Table 5-7 of the ESA Report do not match ESA's calculation spreadsheet due to a typographical error made when filling in Table 5-7.

- **Incorrect Assumptions Regarding Moisture Content For Coal:** ESA's emissions estimates for the OBOT terminal (unloading, handling and storage, and transloading) assume a moisture content for coal of 2.7% (AP-42 Table 13.2.4-1), while the OBOT BOD provides the surface moisture of coal of 11%. The moisture content of coal has a direct impact on expected fugitive coal dust that may be released during transport or handling.
- **Failure to Consider Control Measures:** Finally, as discussed above, ESA did not take into account any of the contemplated control measures at the OBOT facility, and its calculations in its emissions spreadsheets confirm that it estimated "uncontrolled" emissions. Chapter 5 of the ESA Report is incorrect when, at times, it asserts that the emissions reported are "controlled" (Tables 5-6; bottom of page 5-1).

10.4 Flaws in the Conclusions Regarding Greenhouse Gas Emissions

The conclusions by the City and ESA regarding emissions, air quality, the long range transport of pollutants to the U.S. from Asia, and greenhouse gas emissions from the OBOT facility are flawed and unsupported.

The main use of coal (both domestically and overseas) is for power generation. When coal is combusted, greenhouse gasses (GHGs) are emitted. GHGs are gaseous compounds in the atmosphere such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) that are capable of absorbing infrared radiation, thereby trapping heat in the atmosphere. By increasing the heat in the atmosphere, GHGs are responsible for the greenhouse effect, which ultimately leads to global warming (Lallanilla, 2015).

Different GHGs have different global warming potentials (GWP), that is, they do not contribute to atmospheric heating equally. The term carbon dioxide equivalent, or CO₂e, is a term for describing different GHGs in a common unit. For any quantity and type of greenhouse gas, CO₂e indicates the amount of CO₂ that would have the equivalent global warming impact. A quantity of GHG can be expressed as CO₂e by multiplying the amount of the GHG by its GWP. For example, if 1 kilogram of methane is emitted, this can be expressed as 25 kilograms of CO₂e (1kg CH₄ * 25 = 25kg CO₂e) .

Chapter 7 of the ESA Report claims that:

"There is potential for an incremental increase of GHG emissions globally with resulting local impacts from global warming (e.g. sea level rise), and for transported air pollutants resulting from coal combustion overseas to adversely impact local air quality."

However, this conclusion is not supported by technical analyses nor placed in context of global GHG emissions and air quality.

To quantify GHG emissions from burning OBOT-exported coal overseas, I relied on emission factors for CO₂, CH₄, and N₂O obtained from AP-42 Chapter 1 – *External Combustion Sources*. I calculated GHG emissions assuming a "worst case scenario" using the highest emission factors and no emissions controls. I assumed that a total of 5,000,000 metric tons of coal would be consumed overseas. For CO₂, the emission factor for low-volatile bituminous coal was used. For CH₄, the emission factor for hand-fed units was used and for N₂O, the emission factor for a fluid bed combustor (circulating bed) was used. The resulting emissions for CH₄ and N₂O were converted to CO₂e by multiplying their emissions by their GWP. [Table 2](#) includes a summary of the data parameters used to calculate GHG emissions from OBOT-exported coal.

Table 2. Summary of data parameters used to calculate GHG emissions from OBOT-exported coal.

Data Parameter	CO ₂	CH ₄	N ₂ O
Emission factor (tons/ton)	3.13	0.0025	0.00175
Global warming potential	1	25	298
Emissions (tons/year)	17,246,300	13,775	9,643
Emissions (metric tons/year)	15,644,119	12,495	8,747
Emissions CO ₂ e (metric tons/year)	15,644,119	312,383	2,606,520
Total GHG emissions (CO₂e)	18,563,022 metric tons/year		

The total GHG emissions from burning 5 million metric tons of coal are approximately 18.6 million metric tons of CO₂e. Based on global GHG emissions data from EPA (U.S. Environmental Protection Agency, 2016d), in 2010, total global GHG emissions were approximately 45,863 million metric tons of CO₂e. Burning 5 million metric tons of coal would contribute **0.04%** to total global GHG emissions. Note that this is a conservative estimate since the emissions calculations described above assumed no emissions controls.

Burning OBOT-exported coal overseas will produce GHG emissions and contribute to global GHGs. However, the coal exported from OBOT would contribute a very small fraction of GHG emissions on a global scale, less than one tenth of one percent. The ESA Report concludes that GHG emissions from

OBOT-exported coal would directly contribute to sea-level rise in Oakland; however, the report provides no data regarding sea level rise or evidence to support this conclusion.

Sulfur is found in coal in varying amounts based on the region from which the coal is mined. Sulfur dioxide (SO₂) is emitted during coal combustion and can contribute to the formation of PM_{2.5} aerosol sulfate in the atmosphere. Studies have been done to attempt to estimate the intercontinental transport of air pollutants to the western U.S. and Canada from Asia. These studies have found that episodic, long-range transport events from Asia can contribute concentrations in the range of 1.5 µg/m³ of aerosol sulfate to coastal western Canada surface concentrations. The non-episodic, springtime mean contribution of the long-range transport of sulfate from Asia to surface PM levels in western Canada was estimated to be approximately 0.3 µg/m³ (National Research Council, 2010). These estimates reflect the mixing and long-range transport of all emissions in Asia, not only emissions from coal combustion.

A study using multi-model ensemble data has shown that reducing primary PM_{2.5} and PM_{2.5} precursors by 20% in East Asia could potentially reduce PM_{2.5} concentrations in North America by 0.02 µg/m³ where the majority of the reduced PM_{2.5} is sulfate (Anenberg et al., 2014). SO₂ emissions estimates vary between emissions inventories used for different models long-range transport models, but on average they are approximately 40 Tg/yr in East Asia (Yu et al., 2013).

I calculated the levels of PM_{2.5} that could *possibly* impact North America from burning OBOT-exported coal in Asia. These calculations should be treated as theoretical and highly uncertain; however, they help provide context. Emissions of SO₂ were calculated for the combustion of 5 million metric tons of coal following methodologies in AP-42 Chapter 1.1 and assuming a worst-case emissions scenario by using the highest emission factor for SO₂ and assuming no emissions controls. The sulfur content of OBOT-exported coal is 0.58% (Bowie Resource Partners, 2017). [Table 3](#) summarizes the parameters used for the SO₂ emissions calculation.

Table 3. Parameters used for calculating SO₂ emissions from OBOT-exported coal.

Data Parameter	Value
Metric tons of coal	5,000,000
Tons of coal	5,511,550
Sulfur content of coal	0.58%
Emission factor (lbs SO ₂ /ton of coal)	38

Emissions of SO₂ were calculated using the following equation:

$$\text{SO}_2 = (\text{tons of coal}) \times (38\text{S lbs/ton}) \quad \text{Equation 5}$$

Where:

S = sulfur content of coal

Emissions of SO₂ were calculated to be 60,700 tons/year or, 0.06 teragrams per year (Tg/year).

Assuming a linear response between a 20% change in East Asian SO₂ emissions and the contribution to North American PM_{2.5} concentrations, the ratio between the concentration and the emissions reduction is constant using the following equation:

$$\text{PM}_{2.5} (\mu\text{g}/\text{m}^3) / (0.06 \text{ Tg SO}_2) = (0.02 \mu\text{g}/\text{m}^3) / (40 \text{ Tg SO}_2 \times 0.20) \quad \text{Equation 6}$$

Where:

PM_{2.5} = Estimated change in North American concentrations by burning OBOT-exported coal

0.06 Tg SO₂ = East Asian SO₂ emissions (calculated using Equation 5)

0.02 μg/m³ = Reduction in North American concentrations by reducing East Asian emissions by 20% (Anenberg et al., 2014)

40 Tg SO₂ x 0.20 is the 20% reduction in average SO₂ emissions in East Asia (Yu et al., 2013)

Rearranging Equation 6 to solve for PM_{2.5}:

$$\text{PM}_{2.5} = (0.02 \times 0.06) / (40 \times 0.2) = 0.0001 (\mu\text{g}/\text{m}^3)$$

Therefore, burning 5 million metric tons of coal in East Asia could theoretically cause an increase of 0.0001 μg/m³ of PM_{2.5} in North America. Again, this estimate is highly uncertain and for contextual purposes only. The value of 0.0001 μg/m³ is approximately 350,000 times lower than the 24-hour NAAQS of 35 μg/m³ which is far too small of an impact to accurately measure or estimate.

Records obtained via subpoena indicate that a senior ESA staff member commented on ESA's conclusion regarding long-range transport of pollution from Asia. [Figure 7](#) contains an excerpt from a draft of the ESA Report showing comments from the ESA staff person regarding this conclusion (ESA_036618). The comment in Figure 7 reads as follows: "Not addressed in public comments. Too small of an long range transport impact to effectively measure."

Air pollutants can be transported long distances from the point where they were are emitted. However, characterizing the magnitude and impacts of transported pollution is difficult, but some of the impacts could be considered 'significant' from a regulatory and public health perspective. Characteristics of long-range transport vary by pollutant. For ozone, a broad, diffuse increase in background concentrations occurs. For PM, episodic, concentrated pollution plumes occur. The amount of pollution being transported on international scales is generally quite small compared to domestic sources. For mercury and organic compounds, these pollutants can gradually accumulate in the ecosystem.¹³ IS THIS THE SAME AS THE TRACE METALS THAT WOULD NOT BIO-ACCUMULATE? IF SO DOES THIS MEAN THAT THEY WOULD ACCUMULATE BUT WOULD NOT BE HARMFUL?	Comment [VE12]: Not addressed in public comments. Too small of an long range transport impact to effectively measure.
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Figure 7. Excerpt from a draft of the ESA Report containing comments from a senior ESA staff person regarding the conclusion about long-range transport from Asia increasing PM concentrations in Oakland.

11. Independent Air Quality Assessment for the OBOT Facility

11.1 Overview

In addition to providing the above critique of the City and ESA's flawed findings regarding potential emissions at the proposed OBOT facility, I have performed my own independent assessment of those potential emissions. Various scientific analysis methods and tools were used to evaluate emissions and air quality impacts from the OBOT facility. I first performed air quality and meteorological data analyses to understand current air quality conditions in the greater Bay Area and in West Oakland. Next, I performed an independent literature review of the current methods for estimating coal dust emissions from rail cars and dust mitigation technologies. Next, I developed an emission inventory for fugitive coal dust for the OBOT facility and for the activities associated with transporting coal by rail to the facility. I then used the OBOT emission inventory to perform air quality modeling using AERMOD to assess the impacts of the facility on local air quality and the community of West Oakland. The following is a summary of my expert opinions based on these emissions estimates and air quality modeling results:

- Appropriate air quality modeling shows that fugitive coal dust emissions from the OBOT facility would result in ambient concentrations of PM₁₀ and PM_{2.5} that are far below the NAAQS and would not cause exceedances of the NAAQS.
- Appropriate air quality modeling shows that 24-hour average PM₁₀ and PM_{2.5} concentrations resulting from the OBOT facility would be far below the NAAQS at the nearest community/residential receptors of concern.

11.2 Air Quality Data Analysis

To provide context for the results of the OBOT emissions and air quality modeling analyses, air quality data analyses were performed to characterize current air quality conditions in the Bay Area and West Oakland.

The BAAQMD conducts air quality monitoring at over 30 sites located throughout the Bay Area. PM₁₀ is currently monitored at 5 locations and PM_{2.5} is monitored at 8 locations. In West Oakland, the BAAQMD operates one site (Oakland West) that monitors PM₁₀ and PM_{2.5} and there are three sites that measure PM_{2.5} (AQM1, AQM2, AQM3). The AQM1, AQM2, and AQM3 sites are non-regulatory, special purpose monitoring sites established by the SCAMMRP to collect local-scale air quality data

before and during the 2012 Oakland Army Base Project. The 2012 Oakland Army Base Project monitoring program is operated by a private entity and was developed with the assistance of the BAAQMD (Northgate Environmental Management, 2016).

Meteorology influences air quality. In West Oakland, there is one meteorological station collocated at the AQM1 site. The next nearest meteorological site is located at the Oakland International Airport (KOAK), approximately 9 miles to the southeast of the AQM1 site. [Figure 8](#) shows a map of the PM_{2.5} monitoring sites in West Oakland, the meteorological site at AQM1, and the meteorological site at the Oakland Airport.



Figure 8. Map of the PM_{2.5} monitoring sites and meteorological sites in the West Oakland area.

To characterize air quality in West Oakland in the context of regional air quality throughout the greater Bay Area, PM₁₀ and PM_{2.5} data were acquired for all sites operated by BAAQMD. The data were analyzed to assess the number of exceedance days for each pollutant. PM_{2.5} data from the special purpose sites (AQM1, AQM2, AQM3) and the BAAQMD site in West Oakland were acquired and analyzed to assess how they compare to each other and to the NAAQS for PM_{2.5}. Meteorological data were acquired and analyzed to understand local meteorological conditions in West Oakland.

11.3 Emission Inventory Development

Emissions estimates were developed for sources of PM fugitive dust associated with 1) the transport of coal to the OBOT facility by mainline rail, and 2) operations at the OBOT facility including the staging of rail cars and terminal operations. The BOD document mentions two commodities. For the purposes of this report, we assumed commodity A (coal) and commodity B (petcoke). Since it is unknown at this time if the OBOT facility will handle petcoke, I focused my emissions estimates and modeling on fugitive dust from coal.

As discussed above, I have performed a literature review of current methods for quantifying fugitive dust emissions from rail cars transporting coal, including regarding the use of rail car covers or, alternatively, other topping agents to control emissions, which I have taken into account in my analysis. I further considered:

Transport of Coal by Mainline Rail

Coal will be transported to the OBOT facility by rail from Utah. Most of the time, trains enter West Oakland from the north through Sacramento down to Emeryville and Oakland via the Union Pacific Rail Road (UPRR) mainline, and leave in the same direction via a northbound route through Richmond and onto BNSF lines out of the Bay Area toward Stockton (Aguilar et al., 2014). There is a secondary route to the south and east of Oakland that runs through San Leandro and is sometimes used when the primary route is not available.

For my analysis, I estimated fugitive dust from rail cars for two geographic extents: 1) the point that trains enter the jurisdiction of the BAAQMD and arrive in West Oakland; and 2) the point that trains arrive in and travel through West Oakland. [Figure 9](#) shows a map of the main rail lines by which coal would be transported into California from Utah and the geographic extents for which fugitive dust emissions were calculated.

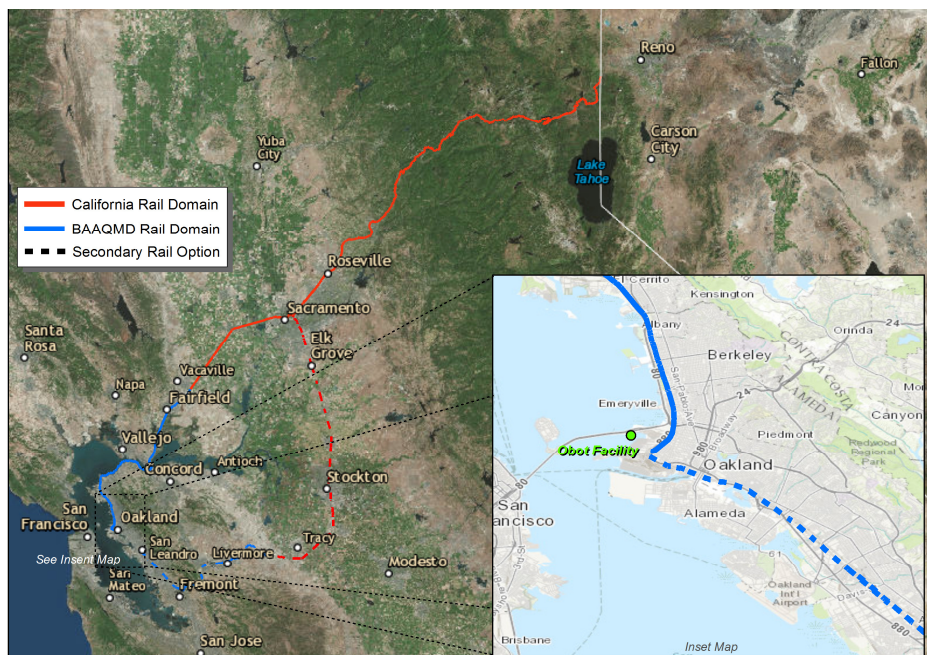


Figure 9. Map of main rail lines and the geographic extents for which fugitive dust from mainline rail cars were calculated.

Methods

The method that was used to estimate fugitive dust from mainline rail cars is based on work performed in Queensland, Australia by Connell Hatch (Hatch, 2008) and was adapted in recent work done in Washington by ICF. The emissions estimation methods from this work were developed using a combination of air quality measurements collected near rail lines transporting coal (Ferreira et al., 2003), wind tunnel experiments (Witt et al., 2002, 1999), and air quality dispersion modeling. The emissions estimates (and resulting pollutant concentrations) based on this approach have been shown to compare well with modeled concentrations and measurements collected along rail lines transporting coal (ICF International, 2017).

Based on the Hatch report, it was found that the key factor that contributes to the emission rate of coal dust from rail cars is the speed of air passing over the surface of the coal which is influenced by the train speed and the ambient wind speed. Fugitive dust from mainline rail cars was estimated using an emission factor derived from the train speed and wind speed (Hatch, 2008). The emission factor equation is:

$$EF = 1.34 \times 0.0000378V^2 - 0.0000126V + 0.000063 \quad \text{Equation 1}$$

Where:

EF = Emission Factor (grams/metric ton/kilometer),

$V = \text{train speed (kilometers/hour)} + \text{vector average wind speed (kilometers/hour)},$

and 1.34 is an adjustment factor to account for the size of US railcars.

Equation 1 was originally developed based on rail cars in Portugal which are smaller than US rail cars. To adjust for the size of US rail cars, an adjustment factor of 1.34 was applied to the equation and used successfully in the ICF Washington study (ICF International, 2017). The air speed was calculated as the vector sum of the wind speed and train speed.

Using the emission factor from Equation 1, emissions were then calculated by multiplying the emission factor times the weight of the coal and the length of the rail line using the following equation:

$$E = EF \times W \times L \quad \text{Equation 2}$$

Where:

W is the weight of coal

L is the length of the railway

Table 4 summarizes the data parameters used in Equations 1 and 2 to calculate fugitive dust emissions from rail cars. Note that the throughput of coal and the wind speed and direction data listed in Table 4 were also used to calculate emissions from other source types described below.

Table 4. Summary of the data parameters, sources of data, and comments about the data used to calculate fugitive dust from mainline rail cars.

Data Parameter	Data Source	Comments
Throughput (or weight) of coal (commodity A)	OBOT BOD	- 5,000,000 metric tons (5,511,550 tons)
Throughput (or weight) of commodity B	OBOT BOD	- 1,500,000 metric tons (1,653,450 tons)
Wind speed and direction	Oakland International Airport Meteorological Site (KOAK)	- Hourly data were acquired for 2016 - Annual vector mean from the predominant wind direction was calculated to represent winds in West Oakland

Data Parameter	Data Source	Comments
Train speed	Union Pacific Railroad Performance Measures	- Train speed data for 53 weeks were acquired and averaged to represent average train speed
GIS train route and distance data	ESRI US National Transportation Atlas Railroads Shapefile	- Train route, direction, and distance traveled data were processed for the five geographic extents (Figure 8)

Assumptions

My assumptions for estimating fugitive coal dust from mainline rail cars are summarized below.

- For trains travelling into Oakland, I assumed that 95% of the time the trains would enter the OBOT facility from the north and would travel through Emeryville and 5% of the time trains would enter the OBOT facility from the southeast through San Leandro.
- To calculate emissions for PM₁₀ and PM_{2.5} from TSP, particle size multipliers of 0.35 for PM₁₀ and 0.053 for PM_{2.5} were used based on AP-42 Chapter 13.2.4.

Control Technology and Efficiency

In order to present highly conservative results, my emissions estimates for main line rail transport assume **open rail cars** with **no covers or surfactant**.

Operations at the OBOT Facility

When rail cars carrying coal (or other commodities) arrive at the OBOT facility, they will be staged on a network of rail spurs while they wait to be unloaded. They will be unloaded systematically in a rail car unloading system that is a covered building with mechanisms that unload the cars from the bottom to underground conveyors. The coal will then be moved to different parts of the OBOT facility by a system of enclosed conveyors. Coal will be transferred to two enclosed storage buildings and one dome storage building. In the two enclosed storage buildings, bulldozers will handle and prepare the coal for placement onto the ship loading conveyor which, based on the Cardno Report, will be enclosed. The coal will then be moved to the ship loader for transloading (placement into cargo ships). [Figure 10](#) shows a map of the 2012 Oakland Army Base Project area, the OBOT facility, staging rail spurs, and emissions source locations.

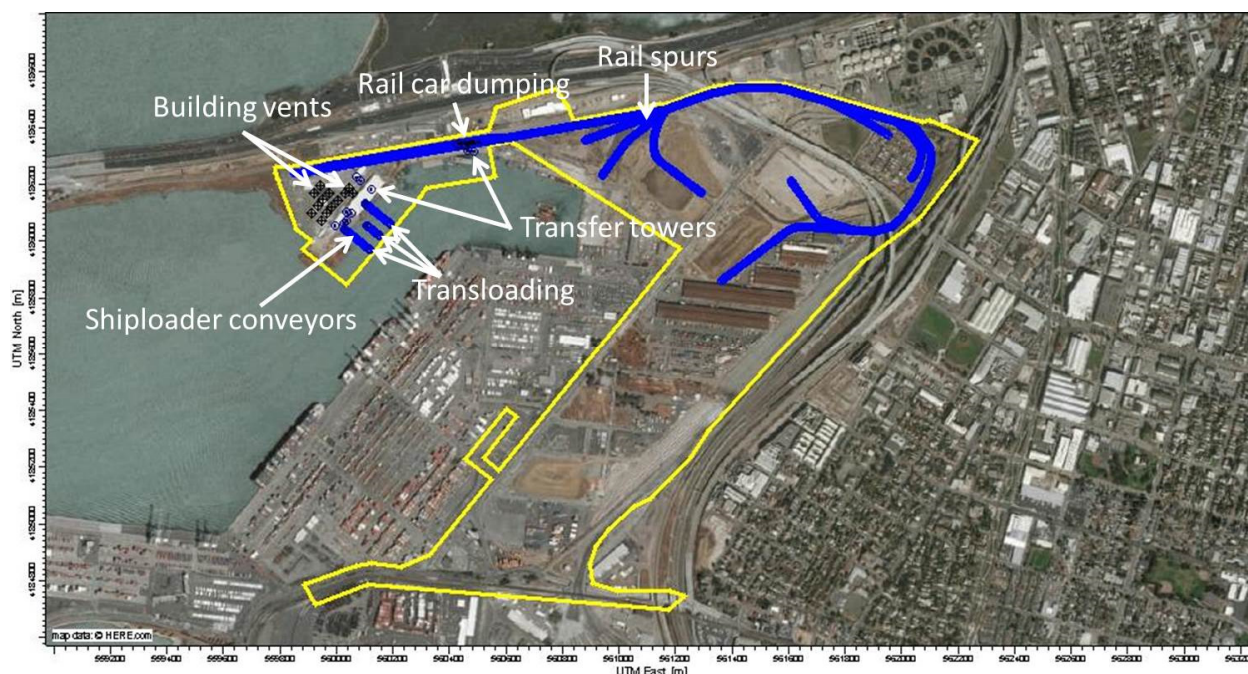


Figure 10. Map of the 2012 Oakland Army Base Project area (yellow boundary), the OBOT facility, staging rail spurs, and emissions source locations.

The five main sources of fugitive coal dust emissions associated with the OBOT facility are: 1) emissions due to wind erosion when rail cars are staged for unloading at the OBOT facility; 2) emissions from the unloading of rail cars; 3) emissions from the movement and storage of material in the storage buildings; 4) the loading of material onto cargo ships; and 5) movement of coal by bulldozer during storage. Emissions of fugitive dust PM_{10} and $PM_{2.5}$ were calculated for these emissions sources using methodologies from EPA's *AP-42 Compilation of Air Pollutant Emission Factors* guidance documents (U.S. Environmental Protection Agency, 2010). [Table 5](#) summarizes the emission sources, estimation methods, source types, and the number of sources at the OBOT facility. Emissions estimation methods are described in detail in the sections below.

Table 5. Summary of emission sources, estimation methods, source types, and the number of sources at the OBOT facility.

Emissions Source	No. of Sources	Method(s)
Wind erosion from staging of rail cars	N/A	AP-42 Section 11.9
<u>Drop Operations:</u>		
Unloading of rail cars	2	AP-42 Section 13.2.4.3
Transfer towers	15	
Ship loading	3	

Emissions Source	No. of Sources	Method(s)
Movement (by bulldozer) and storage of material	2 3	AP-42 Section 11.9

Because the OBOT facility does not yet exist and there is still some uncertainty about exactly which commodities in what quantities will be handled and whether or not rail car covers will be used, I developed emissions estimates for four scenarios described in [Table 6](#). In all four scenarios I assumed that the OBOT terminal will have the controls described in the BOD and Cardno Report.

The first scenario (5MM-uncontrolled staging) assumes a throughput of coal of 5 million metric tons, emissions controls at the OBOT terminal as described in the BOD and Cardno Report, and uncontrolled emissions from the staging of rail cars. The second scenario (6.5MM-uncontrolled staging) assumes a higher throughput of coal of 6.5 million metric tons (assuming the total throughput of commodities A and B), emissions controls at the OBOT terminal, and uncontrolled emissions from the staging of rail cars. The third scenario (6.5MM-controlled staging 95%) assumes a throughput of coal of 6.5 million metric tons, emissions controls at the OBOT terminal, and covered rail cars during staging assuming a control efficiency of 95%. The fourth scenario (6.5MM-controlled staging 61%) assumes a throughput of coal of 6.5 million metric tons, emissions controls at the OBOT terminal, and surfactant applied to rail cars assuming a control efficiency of 61%.

Table 6. Summary of the OBOT emissions scenarios.

Scenario	Description
1) 5MM-uncontrolled staging	For coal (5 million metric tons): uncontrolled staging emissions and controlled OBOT terminal emissions
2) 6.5MM-uncontrolled staging	For coal (6.5 million metric tons): uncontrolled staging emissions and controlled OBOT terminal emissions
3) 6.5MM-controlled staging 95%	For coal (6.5 million metric tons): controlled staging emissions assuming rail car covers with 95% control efficiency and controlled OBOT terminal emissions
4) 6.5MM-controlled staging 61%	For coal (6.5 million metric tons): controlled staging emissions assuming surfactant with 61% control efficiency and controlled OBOT terminal emissions

Wind Erosion during the Staging of Rail Cars

The OBOT facility will have a network of rail spurs where rail cars carrying coal (or other commodities) will be staged for unloading to the OBOT terminal. Based on the BOD design, and throughput, on average 1.2 trains per day will arrive at the OBOT facility with approximately 104 rail cars per train that will be staged for unloading. During the staging process, assuming that the rail cars are uncovered, some fugitive dust may escape from the top of the rail cars as the tops of the coal piles are exposed to wind erosion. If rail car covers are used, wind erosion would be minimal.

In calculating fugitive dust emissions from the staging of rail cars for the four emissions scenarios, I assumed the following:

- 5MM-uncontrolled staging: I assumed no emissions controls from rail car covers or surfactants;
- 6.5MM-uncontrolled staging: I assumed no emissions controls from rail car covers or surfactants;
- 6.5MM-controlled staging 95%: I assumed rail car covers would be used with an emissions control efficiency of 95%; and
- 6.5MM-controlled staging 61%: I assumed surfactant would be used with an emissions control efficiency of 61%.

Methods

Fugitive dust from wind erosion was estimated using guidance in AP-42 Section 11.9 – *Western Surface Coal Mining* (U.S. Environmental Protection Agency, 1998) and the emission factor equation for active coal storage piles (wind erosion and maintenance):

$$EF = 0.72 \times u \quad \text{Equation 3}$$

Where:

EF = Emission Factor [lb/(acre)(hr)]

u = wind speed (mph)

The active coal storage pile emission factor physically represents a condition under which coal piles are stored and exposed to steady-state wind erosion; therefore, Equation 3 uses average wind speed as an input value. The same wind speed data listed in Table 4 were used to calculate the average wind speed of 10.6 mph. The emission factor from Equation 3 was then used to calculate the

amount of fugitive dust emitted based on the throughput of coal and the surface area of the exposed coal as it is staged in the rail cars.

Assumptions

My assumptions for estimating fugitive coal dust from the staging of rail cars are summarized below.

- Based on the BOD and the throughput for coal (Table 4), I assumed that on average, 1.2 trains per day will arrive at the OBOT facility and each train will have 104 full rail cars that will be staged.
- Based on the BOD and the throughput for commodity B (Table 4), I assumed that on average, 0.36 trains per day will arrive at the OBOT facility and will be staged. For my emissions calculations, I have assumed that commodity B will also be coal.
- The exposed surface area for each rail car was calculated to be 693 ft².
- To calculate emissions for PM₁₀ and PM_{2.5} from TSP, particle size multipliers of 0.5 for PM₁₀ and 0.075 for PM_{2.5} were used based on AP-42 Chapter 13.2.5.

Control Technology and Efficiency

For emissions scenarios 1 and 2 (5MM-uncontrolled staging and 6.5MM uncontrolled staging), I assumed a control efficiency of 0 to represent uncovered, or uncontrolled, rail cars during staging. For emissions scenarios 3 and 4 (6.5MM-controlled staging 95% and 6.5MM-controlled staging 61%), I applied control efficiencies of 95% to represent covered rail cars and 61% to represent cars with surfactant.

Drop Operations at the OBOT Terminal

To estimate emissions and control efficiencies from drop operations at the OBOT terminal, AP-42 Section 13.2.4.3 - – *Aggregate Handling and Storage Piles* (U.S. Environmental Protection Agency, 2006), the Cardno Report, and permit information from the proposed Morrow Pacific Coyote Island Terminal located in Oregon (Source Watch, 2016) were used. The proposed Coyote Island Terminal was a bulk terminal that was proposed to be built at the Port of Morrow in Oregon but was not built because the State of Oregon decided that the terminal would potentially interfere with tribal fishing rights. The terminal was issued air and water permits by the Oregon Department of Environmental Quality but was never built due to the fishing rights issue (Tran, 2012). The Coyote Island Terminal was similar in design and operation to the proposed OBOT facility. For the purpose of calculating emissions, the permit information for the Coyote Island Terminal was used to determine operational parameters within the terminal such as indoor wind speed and emissions control efficiencies.

Methods

Drop operations occur as material is moved throughout the terminal and dropped from one point to another. Drop operations include rail car unloading, movement of material from conveyors into storage buildings, and transloading. The emission factor used for OBOT drop operations is based on methods in AP-42 Section 13.2.4.3 – *Aggregate Handling and Storage Piles* (U.S. Environmental Protection Agency, 2006) and has the following equation:

$$EF = k (0.0032) \times (U/5)^{1.3} / (M/2)^{1.4} \quad (\text{lbs/ton}) \quad \text{Equation 4}$$

Where:

EF = Emission Factor (lbs/ton)

k = particle size multiplier

U = mean wind speed (mph)

M = material moisture content (%)

Assumptions

My assumptions for estimating fugitive coal dust from drop operations are summarized below.

- Based on the BOD and Cardno Report, I assumed that
 - the storage buildings for coal are enclosed
 - the storage dome for commodity B is enclosed
 - bottom dump hopper type rail cars will be used and the unloading building is partially enclosed
 - the transfer towers are enclosed
 - the ship loaders are covered and have fogging devices to control dust
- I assumed a wind speed of 4 mph for covered drop points and a wind speed of 2 mph for enclosed drop points with the exception of the ship loader which is more exposed to the ambient outdoor wind. For the ship loader, I used the average outdoor wind speed of 10.6 mph.

Control Technology and Efficiency

The BOD indicates that the rail car unloading facility will use dry fogging mechanisms to control dust. Based on the Cardno Report, the control efficiency for dry fogging is 99%; however, to be conservative, I assumed a control efficiency of 95% for dry fogging. The Coyote Island Terminal permit reports control efficiencies for enclosed transfer towers to be 95% and the control efficiency for covered ship loading chutes to be 80%. A dry fog system will be applied at the ship loading chutes which, based on the Cardno Report, has a control efficiency of 99%. To be conservative, I used an average of 90% as the control efficiency for ship loading. All four of the emissions scenarios assume the control technologies and efficiencies described here.

Handling of Coal by Bulldozer

Methods

For the purposes of estimating emissions, I assumed that two bulldozers would move and handle coal inside the storage buildings for commodity A. To calculate the emission factor for bulldozing activities, the material silt content and moisture content of coal must be known. Based on guidance in AP-42 Chapter 13.2.4 – *Aggregate Handling and Storage Piles* Table 13.2.4-1 for Coal-fired Power Plant, a value of 2.2% was used as the silt content for coal and a moisture content of 11% was used based on the BOD (U.S. Environmental Protection Agency, 2006). Emission factor equations from AP-42 Chapter 11.9 – *Western Surface Coal Mining* were used to calculate the emission factors for bulldozing (Table 7).

Table 7. Emission factor equations for bulldozing (AP-42 Chapter 11.9).

Operation	Emission factor equations ^a		Scaling factors		Units
	TSP $\leq 30 \mu m$	$\leq 15 \mu m$	$\leq 10 \mu m^b$	$\leq 2.5 \mu m^c$	
Bulldozing	$\frac{78.4(s)^{1.2}}{(M)^{1.3}}$	$\frac{18.6(s)^{1.2}}{(M)^{1.4}}$	0.75	0.022	lb/hr

Where:

s = material silt content (%)

M = material moisture content (%)

u = wind speed (mph)

Assumptions

My assumptions for estimating fugitive coal dust from bulldozing are summarized below.

- Using information in the BOD, I assumed that bulldozers will be used in the two storage buildings for coal (commodity A).
- I assumed that the OBOT facility would use one bulldozer in each of the coal storage buildings and that each bulldozer can move 300 metric tons of coal per hour. The daily throughput of coal is approximately 13,200 metric tons which must be moved from the storage buildings each day.

Control Technology and Efficiency

For all emissions scenarios I assumed a control efficiency for bulldozing activity of 95% as dry fogging systems will be used in the coal storage buildings.

11.4 AERMOD Dispersion Modeling

Dispersion modeling uses emissions data to model the resulting pollutant concentrations in the ambient air based on atmospheric dynamics, meteorology, and the proximity of emissions sources to receptors. For my evaluation of near-field impacts of emissions from the OBOT facility, I used the AERMOD dispersion model, which was promulgated as the EPA-preferred near-field regulatory model in 2005, replacing the Industrial Source Complex (ISCST3) model. I ran AERMOD using the PM₁₀ and PM_{2.5} fugitive dust emissions inventory developed for OBOT (described in Section 13.3) and with meteorological data collected at the Oakland Airport.

Overview of AERMOD

AERMOD (Cimorelli et al., 2004) is a peer-reviewed, steady-state, Gaussian plume model designed to evaluate near-field (<50 km) impacts of air pollutant emissions from stationary sources. AERMOD contains algorithms for dispersion in both the convective and stable boundary layers; plume rise and buoyancy; plume penetration into elevated inversions; computation of vertical profiles of wind, turbulence, and temperature; the treatment of building wake effects; and the treatment of plume meander.

The AERMOD modeling system includes two input data processors: AERMET (U.S. Environmental Protection Agency, 2004), a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence and scaling concepts; and AERMAP, a terrain data preprocessor that incorporates complex terrain, if applicable, using U.S. Geological Survey digital

elevation data. AERMOD has undergone extensive validation based on detailed tracer release experiments designed and performed specifically for assessing air dispersion models.

AERMOD configuration and inputs

Project Area

The project area used for the AERMOD modeling includes the proposed OBOT facility and associated rail spurs connecting OBOT with the Port Railyard and for staging of rail cars as defined in the EIR Addendum report (LSA Associates, 2012). The AERMOD modeling domain covers a 13.5 square mile area, extending approximately 2.5 miles to the east, 1.2 miles to the north and south, and 0.6 miles to the west of the project area. The modeling domain extents are based on the predominant winds in the area and the distance at which the modeled concentrations decrease from the project area.

Figure 11 shows a satellite image of the AERMOD modeling domain.

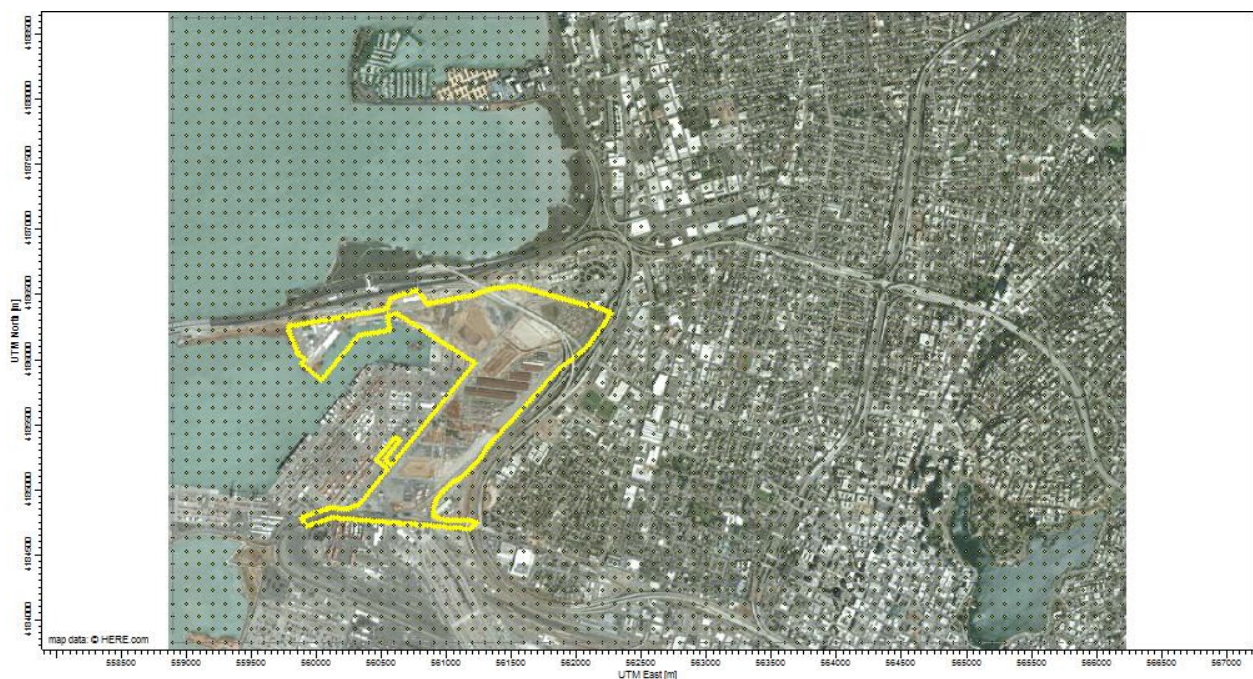


Figure 11. AERMOD modeling domain with the 2012 Oakland Army Base Project area outlined in yellow.

Meteorological data

Surface and upper air meteorological data from Oakland International Airport (KOAK) for the most recent five years of complete data (2012 - 2016) were processed through the latest version of

AERMET, version 16216, (U.S. Environmental Protection Agency, 2004) for use in AERMOD. Hourly and 1-minute surface meteorological data were obtained from the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI)², formerly National Climatic Data Center (NCDC), and upper air data were obtained from the NOAA Earth System Research Laboratory (ESRL) radiosonde database (National Oceanic and Atmospheric Administration, 2017). The 1-minute surface data was processed through the latest version of AERMINUTE, version 15272 (U.S. Environmental Protection Agency, 2011), using a 0.5 m/s anemometer threshold, and the u^* adjustment to adjust surface friction velocity during low wind speeds (a default model option per Appendix W, the Environmental Protection Agency (EPA) Guideline on Air Quality Models). The latest version of AERSURFACE, version 13016 (U.S. Environmental Protection Agency, 2008), was used with 12 land-use sectors and a radius of 1 km around KOAK and a monthly temporal resolution to develop surface characteristic inputs for AERMET, and precipitation was assumed to be average. [Figure 12](#) is a wind rose for the KOAK meteorological data, which shows predominant westerly winds.

² <ftp://ftp.ncdc.noaa.gov/pub/data/noaa/>; <ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin/>.

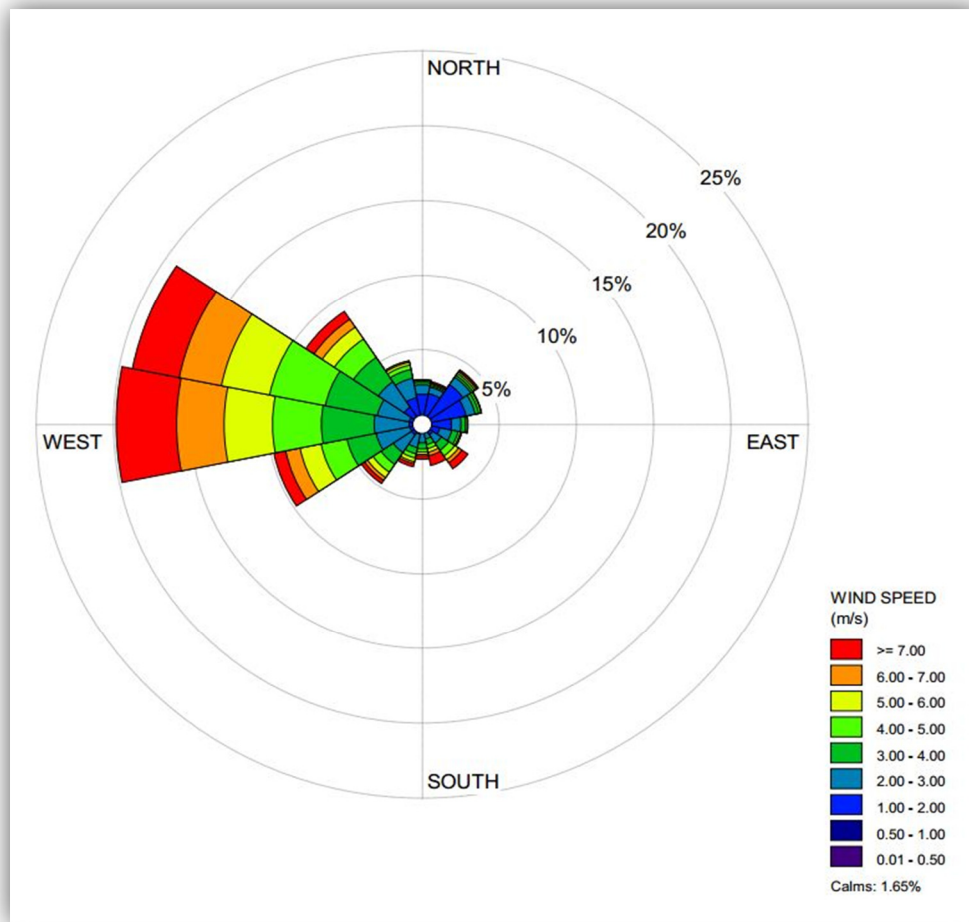


Figure 12. Wind rose for the Oakland International Airport (KOAK) meteorological data (2012-2016) used for the AERMOD modeling.

The meteorological data shown in Figure 12 is similar to the meteorological data from the AQM1 site (located where the proposed OBOT facility is planned to be built) as you will see in [Figure 17](#). However, AERMOD requires five years of meteorological data and the AQM1 site has less than five years of available data.

Emission Source Data

Five potential fugitive dust emission sources included in the OBOT BOD were modeled with AERMOD. These sources include (1) wind erosion from staged rail cars on the OBOT rail spurs; (2) unloading of coal and petcoke from rail cars at the OBOT facility; (3) transfer and storage of material, (4) transloading (transfer of material from the ship loading conveyors to cargo ships); and (5) venting from storage buildings. The BOD and conceptual drawings for the facility indicate that all conveyors will be enclosed (pipe conveyors), so these conveyors were not modeled as emission sources.

[Table 8](#) summarizes the types of AERMOD sources used to model the above emission sources, as

well as comments on the source input parameters. [Figure 13](#) shows part of the modeling domain, and illustrates where each type of source is located within the OBOT facility.

Table 8. Summary of emission sources and related AERMOD inputs.

Source	AERMOD Source Type	Source Input Parameters
Rail spurs for movement and staging of rail cars	Series of surface-based volumes	• Location and length of spurs estimated from Figure 2-3 in City of Oakland Staff Report (Oakland Planning and Building Department, June 2016) • Vertical dimension = $1.7 \times$ rail car height (15.5 ft for CSX covered rail car) • Width = width of car (10.67 ft for CSX rail car) • Release height = $0.5 \times$ Vertical dimension = 4.0 ft
Rail car unloading	Area	• Location and lateral dimensions estimated from OBOT Conceptual Drawings • Ground-level release height and no initial vertical dimension
Commodity transfer towers	Volume	• Location, width (W), and release height (H) estimated from OBOT Conceptual Drawings • Initial lateral dimension, $\sigma_y = W/4.3$ • Initial vertical dimension, $\sigma_z = H/2.15$
Transloading	Volume	• Location assumed to be at height and laterally adjacent to drop end of ship loader conveyor • Width assumed to be equal to width of conveyor (W = 48 in) • Vertical dimension = vertical dimension of conveyor (6.2 ft) • Initial lateral dimension, $\sigma_y = W/4.3$ • Initial vertical dimension, $\sigma_z =$ vertical dimension/4.3 • Release heights = release heights of ship loader conveyors

Source	AERMOD Source Type	Source Input Parameters
Storage building venting from the movement and storage of coal/petcoke	Point	- Locations assumed to be equally spaced longitudinally at lateral midpoint height of storage buildings for commodity A, and equally spaced concentrically at midpoint height of storage dome for commodity B - Stack diameter assumed to be 1.1 m, and exit flow rate assumed to be 9.1 m³/s, based on average values for industrial exhaust fans - Exit temperature assumed to be ambient temperature, corresponding to assumption of venting of ambient air inside storage buildings (no temperature control)

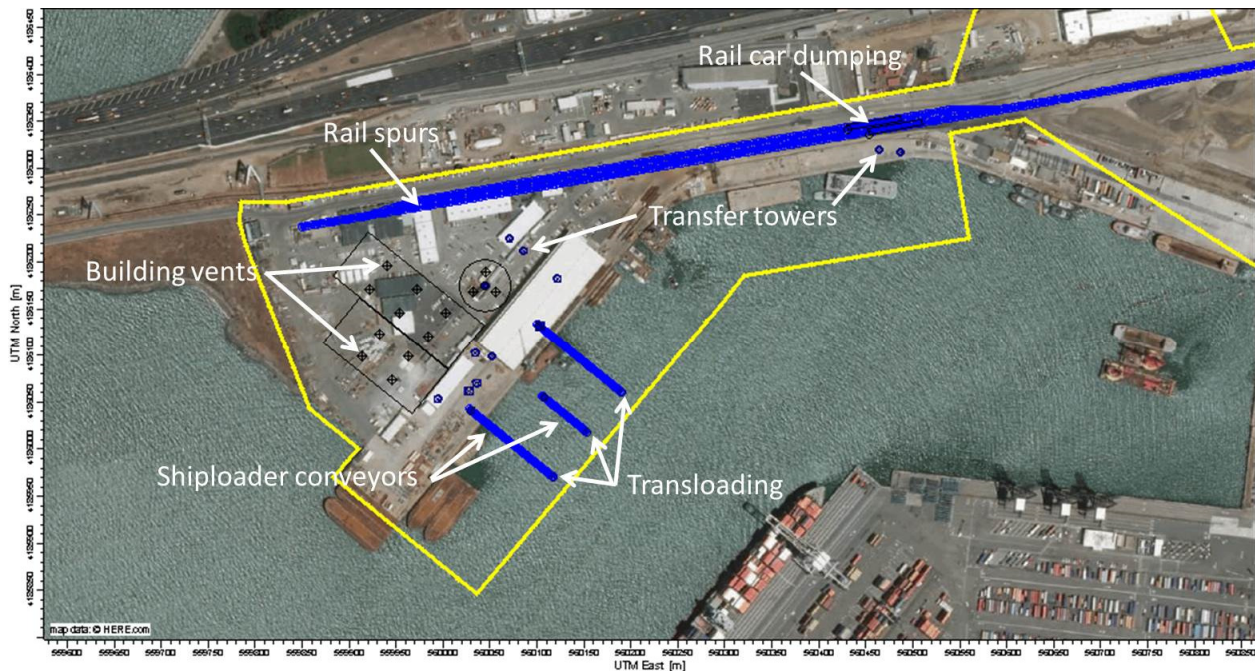


Figure 13. OBOT facility sources modeled with AERMOD. The figure shows only a portion of the modeling domain, rail spurs, and fence line boundary (represented by the yellow line), focusing on the six modeled source types. Area sources (rail car dumping) are represented by dashed black rectangles; series of volume sources (rail spurs and ship loading conveyors) are represented by blue lines; volume sources (transfer towers and transloading) are represented by blue circles; and point sources (building vents) are represented by black plus symbols.

Receptors

AERMOD estimates pollutant concentrations at model receptors. To capture concentration impacts nearest to the facility at the fence line, as well as in the adjacent communities, a receptor spacing of 25 m along the fence line of the OBOT facility, including the rail spurs, was used, and a uniform grid of receptors with 100 m spacing was used throughout the rest of the modeling domain. The locations of receptors are shown as black dots in Figure 11. A 1.8 m “flag pole” height, representative of average breathing height, was used for all receptors. The modeling included a total of 3,927 receptors.

Post-processing

The Lakes Environmental AERMOD View software was used to set up and execute the model runs (using the Lakes MPI version of AERMOD), as well as to visualize model results. The overall maximum modeled concentrations from each model run were identified in the standard AERMOD output file. The maximum modeled concentrations among residential receptors closest to the project area were identified by using the AERMOD View “Posting” functionality, which labels the peak concentrations at each receptor in the AERMOD View graphical user interface (GUI).

12. Results of Independent Air Quality Assessment

This section describes the results of the data analysis, emissions inventory development, and near-field AERMOD modeling for the OBOT facility.

12.1 Air Quality in the Bay Area and West Oakland

To place the OBOT emissions and modeling results in the context of ambient air quality conditions, ambient PM_{2.5} data from monitoring sites in the Bay Area and West Oakland were analyzed. The BAAQMD is in attainment of the NAAQS for all regulated pollutants except for ozone and is in attainment for all CAAQS, except for ozone and PM which have stricter standards than the NAAQS but hold less regulatory weight. The BAAQMD has never exceeded the PM₁₀ NAAQS and PM₁₀ is not considered an issue except for localized sources of dust. The BAAQMD recently achieved attainment of the federal PM_{2.5} standard of 35 µg/m³ for 24-hr average concentrations (Flannigan, 2017) and PM_{2.5} concentrations have generally been improving throughout the Bay Area over the past several years. Throughout the Bay Area, PM_{2.5} is primarily a wintertime issue associated with residential wood burning; however, PM_{2.5} concentrations can be high in some industrial areas and the Bay Area sometimes experiences elevated PM_{2.5} from wild fires during fire season (spring through fall).

EPA has established design values which are a statistical measure that describes the air quality status of a given location relative to the NAAQS. Design values are defined to be pollutant specific and consistent with the individual NAAQS. Based on EPA's requirements, the 24-hour PM_{2.5} standard is attained when the 3-year average of 98th percentile concentrations is less than 35 µg/m³. The average 24-hour PM_{2.5} design value for the San Francisco Bay Area is 25 µg/m³ (U.S. Environmental Protection Agency, 2017d). Because of the way design values are calculated, a site may occasionally exceed the NAAQS but remain in attainment; however, if concentrations are frequently above the NAAQS, then a region will be designated non-attainment.

Generally, PM_{2.5} concentrations vary across the Bay Area with some communities experiencing higher PM_{2.5} levels than others. Over the past two decades, significant improvements in PM_{2.5} air quality have been measured regionally. [Figure 14](#) shows the number of days with a 24-hr PM_{2.5} concentration above the NAAQS at any BAAQMD monitoring site. The trend in PM_{2.5} exceedances is generally improving. While 3 years of data is not enough to indicate a trend, a similar graph for the four West Oakland monitors is provided in [Figure 15](#) for 2015 through 2017.

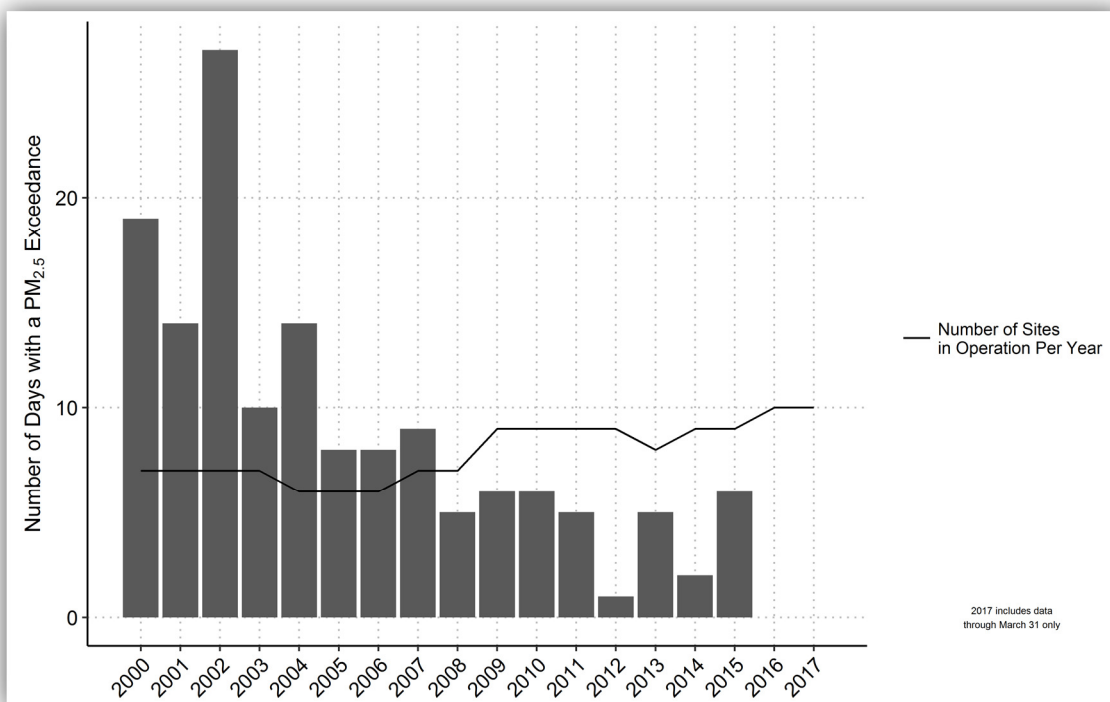


Figure 14. Number of days with a 24-hr PM_{2.5} concentration above the NAAQS at any BAAQMD monitoring site from 2000 to 2015 (the most recently available data).

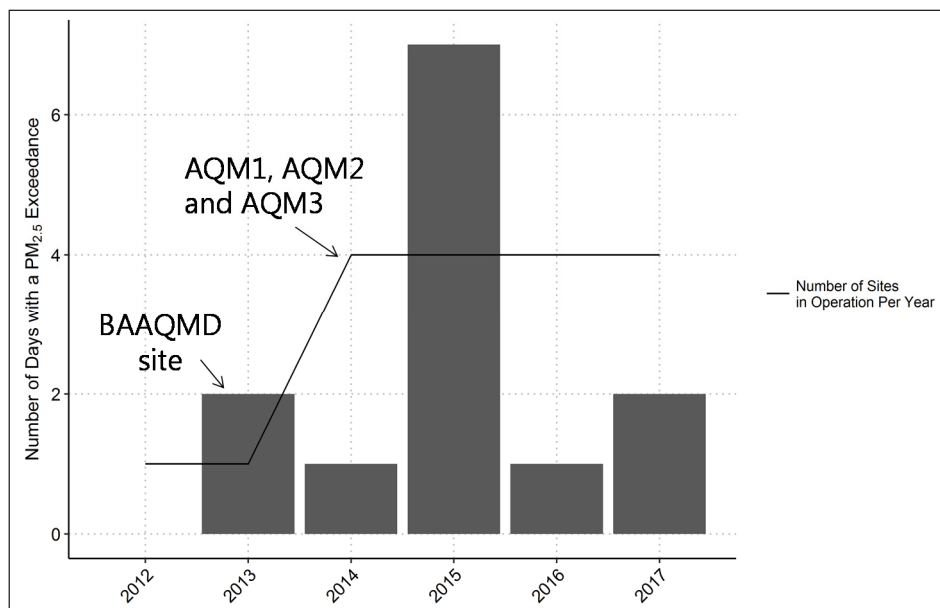


Figure 15. Number of days with a 24-hr PM_{2.5} concentration above the NAAQS at the four air quality sites located in West Oakland from 2015-2017. Note that 2013 includes data from the BAAQMD's Oakland West site and the three special purpose monitors began operation in 2014.

PM_{2.5} concentration data by site in West Oakland are shown in [Figure 16](#). While West Oakland does experience some exceedances, on average, concentrations are in the range of 20-25 µg/m³ which is below the NAAQS for PM_{2.5}. As shown in [Figures 15 and 16](#), the number of PM_{2.5} exceedances in 2015 was higher than in other years with all exceedances occurring in January. During this time, a high-pressure weather system was positioned over the region for most of January and February, resulting in cold, stagnant air. The exceedances observed at the OAB monitors coincided with Bay Area "Spare the Air" days issued by the BAAQMD, which began on January 2 and continued for a total of 17 dates through February 3. During this period, the BAAQMD recorded 24-hour average exceedances at many of their other stations throughout the Bay Area (Northgate Environmental Management, 2015). In late 2016, there were three days when the daily ambient PM_{2.5} measurements exceeded the EPA 24-hour average PM_{2.5} standard at AQM1 (i.e., November 15, December 8, and December 14). Elevated PM_{2.5} concentrations recorded at AQM1 were attributed to local activities in the Caltrans staging area related to the dismantling of the steel cantilever sections of the deconstructed Bay Bridge (Northgate Environmental Management, 2017).

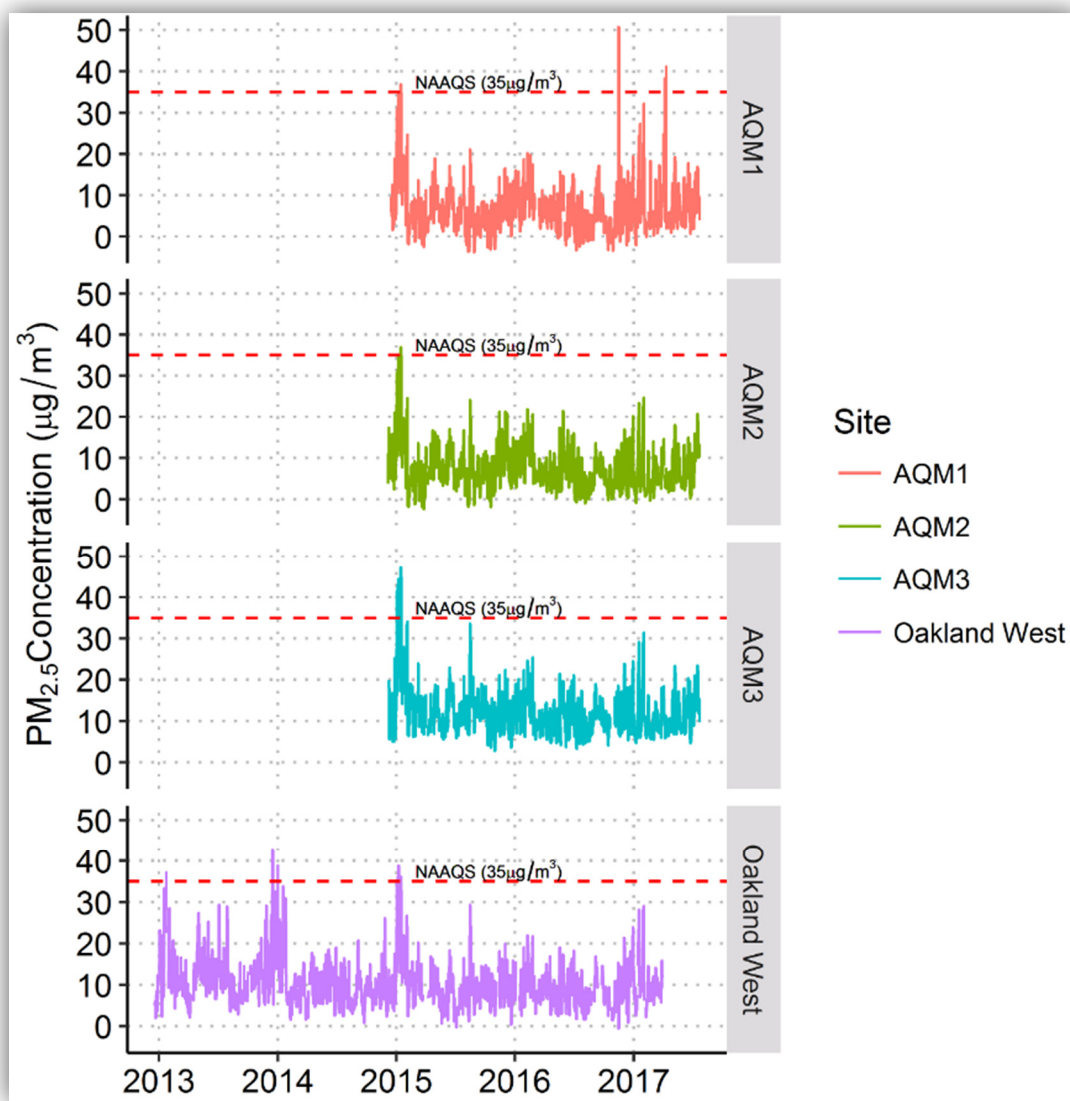


Figure 16. PM_{2.5} concentration data for the four monitoring sites in West Oakland.

Winds at the West Oakland sites are predominantly westerly. **Figure 17** shows a wind rose based on data collected at the AQM1 site. Wind roses show the frequency of hours that winds were from each wind quadrant. The petals also show the percent of time that winds fall into different speed bins. Winds are strongest and most commonly from the west although high wind speeds can occur from any direction.

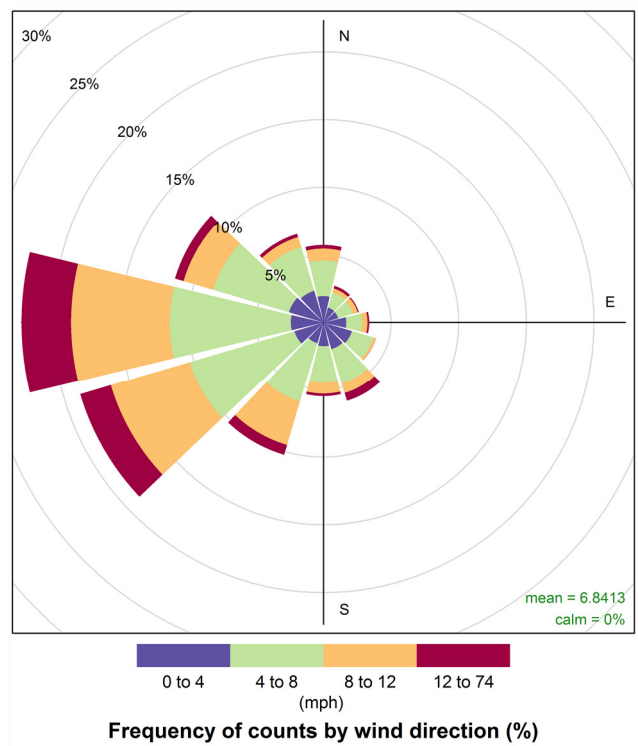


Figure 17. Wind rose for meteorological data collected at the AQM1 “West Gateway” site.

A pollution rose is shown in [Figure 18](#) using meteorological data from AQM1 and PM_{2.5} data from AQM3. A pollution rose shows the frequency at which PM_{2.5} concentrations are observed by wind direction. As shown in [Figure 18](#), concentrations vary from low to high from any wind direction.

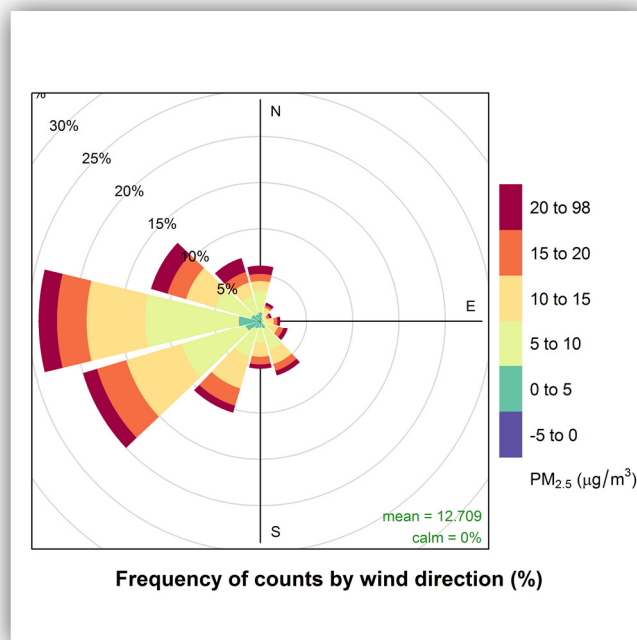


Figure 18. Pollution rose using meteorological data collected at the AQM1 site and PM_{2.5} concentration data from the AQM3 site.

The results of the air quality and meteorological analyses show that the BAAQMD is in attainment of the NAAQS for PM_{2.5} and PM₁₀. Average PM_{2.5} concentrations in West Oakland are in the range of 20-25 µg/m³. While there have been some elevated PM_{2.5} concentrations and exceedances of the NAAQS recorded at sites in West Oakland, they appear to occur during regional air quality events and “Spare the Air” days or when construction or deconstruction activities occur near the monitoring sites.

12.2 Emissions Inventory Results

Emissions estimates were developed for the OBOT facility (i.e., staging and terminal operations) and were used as input to the AERMOD air quality dispersion model to model near-field air quality impacts from the OBOT facility. Emissions of fugitive dust from main line rail transport were calculated for comparison purposes only, but were not modeled as they are regulated by federal interstate transportation laws, not at the city level, and they would not be considered as part of the permitted facility. It is important to note that regardless of the commodity handled by the OBOT facility, any dry bulk commodity that has the potential to generate dust will have fugitive dust PM emissions associated with it.

The fugitive coal dust emissions estimates for main line rail transport within the BAAQMD jurisdiction and through West Oakland are summarized in [Table 9](#). The estimates in [Table 9](#) assume a throughput of coal of 6.5 million metric tons and represent no rail car covers or surfactant.

Table 9. Summary of the emissions from main line rail transport of coal within the BAAQMD jurisdiction and through West Oakland.

Mainline Rail Route	Emissions (tons/year)	
	PM ₁₀	PM _{2.5}
BAAQMD	22.8	3.4
West Oakland	0.86	0.13

Main line rail emissions of PM₁₀ and PM_{2.5} fugitive coal dust within the BAAQMD jurisdiction are estimated to be 22.8 and 3.4 tons/year (respectively). These estimates are based on an emission factor equation that has been shown to correlate relatively well with fugitive dust measurements near rail lines transporting coal and with model predictions (Hatch, 2008). These estimates are approximately 43 times lower than ESA's estimates for main line rail emissions as reported in Table 5-7 of the ESA Report.³

The results of the emissions estimates for fugitive coal dust associated with the OBOT facility for the four emissions scenarios are summarized in [Table 10](#). Emissions scenario 1 is designed to parallel the emissions estimates reported in Table 5-7 of the ESA Report in that the scenario assumes a throughput of 5 million metric tons of coal, uncontrolled staging emissions, and controlled OBOT terminal emissions.

The summary of emissions in [Table 10](#) for 5MM-uncontrolled staging shows that when emissions are calculated using appropriate assumptions, emission factors, and methodologies, total PM₁₀ emissions are 8 tons/year and total PM_{2.5} emissions are 1.2 tons/year. These results are twelve times lower for PM₁₀ and seventeen times lower for PM_{2.5} when compared to ESA's estimates.⁴ To put ESA's emissions estimates into context, [Figure 19](#) shows a comparison of OBOT emissions estimates from Table 5-7 of the ESA Report, the 5MM-uncontrolled staging emissions estimates, annual emissions from all traffic on the Bay Bridge, and emissions from an unpaved, dirt lot with the same acreage as the OBOT facility.

³ Table 5-7 of the ESA report shows main line rail emissions in the BAAQMD of 988 tons/year for PM₁₀ and 148 tons/year for PM_{2.5}.

⁴ Table 5-7 of the ESA report shows OBOT emissions estimates of 95 tons/year for PM₁₀ and 20.7 tons/year for PM_{2.5} for emissions from staging and OBOT operations.

Approximately 98 million vehicles cross the Bay Bridge annually (California Department of Transportation, 2017). Even when compared to all of the vehicles on the Bay Bridge for one year, ESA's estimates for PM₁₀ are approximately four times higher and approximately two times higher for PM_{2.5} for a single facility. For context, [Figure 19](#) shows the annual PM₁₀ and PM_{2.5} emissions for an unpaved dirt lot which is intended to represent emissions in the instance that the OBOT facility is not built and the land remains undeveloped. Note that annual emissions for an unpaved dirt lot with the same acreage as the proposed OBOT facility would generate more PM than the OBOT facility.

For context, I compared my emissions estimates for the OBOT terminal to the annual PM emissions from the Koch Carbon Long Beach bulk terminal facility. I do not have throughput information for the Long Beach facility, so a direct comparison is not possible. However, emissions from similar facilities can be used to determine if my estimates are within the same range as other facilities like OBOT. Total PM emissions reported for the Long Beach facility for 2016 are 3.2 tons/year (South Coast Air Quality Management District, 2017). This number includes emissions from fugitive dust *and* all other sources of PM. PM emissions for the Long Beach facility are higher than my estimate of 1.1 tons/year of PM₁₀ for the OBOT terminal; however, these emissions levels are in the same range.

Table 10. Summary of PM₁₀ and PM_{2.5} fugitive coal dust emissions associated with the OBOT facility for each of the four emissions scenarios.

Emission Source	5MM-uncontrolled staging (tons/year)		6.5MM-uncontrolled staging (tons/year)		6.5 MM-controlled staging 95% (tons/year)		6.5 MM-controlled staging 61% (tons/year)	
	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
OBOT Staging								
Staging	7.2	1.1	9.4	1.4	0.47	0.07	3.7	0.55
OBOT Terminal								
Unloading	0.01	0.002	0.01	0.00	0.01	0.00	0.01	0.00
Storage	0.00	0.001	0.01	0.00	0.01	0.00	0.01	0.00
Transfer	0.03	0.004	0.05	0.01	0.05	0.01	0.05	0.01
Transloading	0.08	0.01	0.41	0.06	0.41	0.06	0.41	0.06
Bulldozing	0.64	0.08	0.64	0.08	0.64	0.08	0.64	0.08
Total OBOT Terminal	0.76	0.10	1.1	0.15	1.1	0.15	1.1	0.15
Total OBOT Staging and Terminal	8.0	1.2	10.5	1.6	1.6	0.2	4.8	0.70

5MM-uncontrolled staging: Assumes throughput of 5MM metric tons of coal, uncontrolled staging emissions, and controlled OBOT terminal emissions.

6.5MM-uncontrolled staging: Assumes throughput of 6.5 MM metric tons of coal, uncontrolled staging emissions, and controlled OBOT terminal emissions.

6.5MM-controlled staging 95%: Assumes throughput of 6.5 MM metric tons of coal, controlled staging emissions assuming rail car covers with 95% control efficiency, and controlled OBOT terminal emissions.

6.5MM-controlled staging 61%: Assumes throughput of 6.5 MM metric tons of coal, controlled staging emissions assuming surfactant with 61% control efficiency, and controlled OBOT terminal emissions.

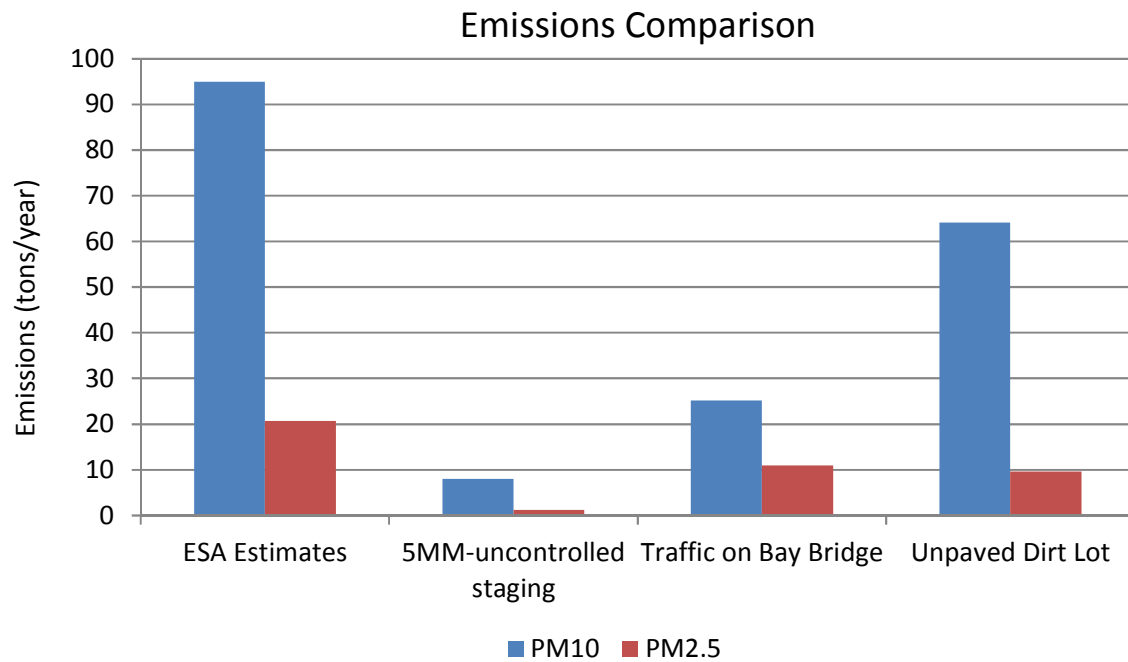


Figure 19. Comparison of ESA's OBOT emissions estimates, 5MM-uncontrolled staging emissions, annual emissions of traffic on the Bay Bridge, and emissions from an unpaved dirt lot with the same acreage as the OBOT facility.

The results of the emissions scenarios in Table 10 are shown graphically in [Figure 20](#) relative to the BAAQMD's emissions thresholds of significance for PM₁₀ and PM_{2.5} as outlined in the BAAQMD's CEQA Guidelines. A threshold of significance for a given environmental impact defines the level of effect above which the BAAQMD would consider impacts to be significant, and below which it will consider impacts to be less than significant (Broadbent et al., 2011). As shown in Figure 20, none of the four emissions scenarios – with staging emissions controlled or uncontrolled – exceed the emissions thresholds of significance.

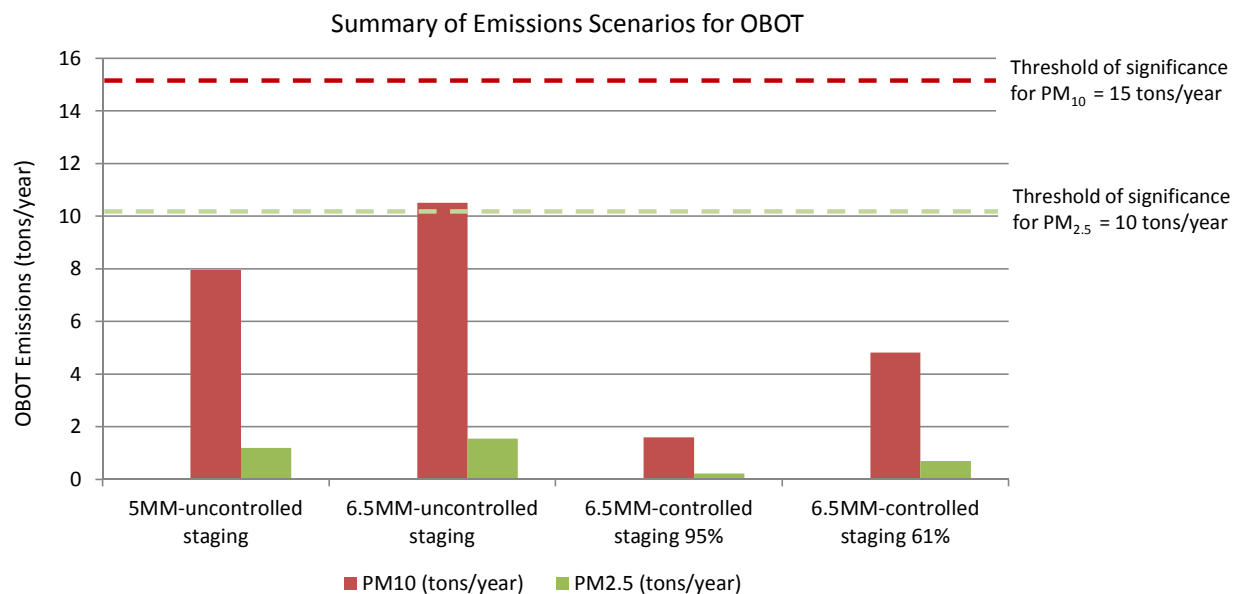


Figure 20. Summary of total fugitive coal dust PM_{10} and $PM_{2.5}$ emissions from the OBOT facility for the four emissions scenarios.

I focused my emissions and air quality modeling on coal; however, from an emissions calculation perspective, coal and petcoke have similar characteristics and similar emissions methodologies can be applied to both. Overall, emissions from petcoke are similar on a per ton of throughput basis as coal.

12.3 Air Quality Modeling Results

The emissions estimates discussed above were used as input to the AERMOD dispersion model to assess near-field PM_{10} and $PM_{2.5}$ concentrations resulting from the OBOT facility. When modeling potential air quality impacts from a facility, it is important to model the maximum predicted concentrations at the facility fence line and at the maximum predicted concentrations at the nearest community or residential receptor location. [Table 11](#) provides a summary of the modeling results of the peak PM_{10} and $PM_{2.5}$ concentrations at the OBOT fence line and at the nearest community receptor for the four scenarios.

Table 11. Summary of AERMOD model outputs for peak PM₁₀ and PM_{2.5} concentrations at the OBOT facility fence line and at the nearest community receptor for four model scenarios.

Pollutant (Scenario)	Fence Line Maximum Peak Concentration (µg/m ³)		Maximum Residential Concentration (µg/m ³)	
	24-hour Average	Annual Average	24-hour Average	Annual Average
PM ₁₀ (5MM-uncontrolled staging)	12.7	4.20	2.09	0.58
PM _{2.5} (5MM-uncontrolled staging)	1.91	0.63	0.31	0.09
PM ₁₀ (6.5MM-uncontrolled staging)	14.7	6.41	2.51	0.70
PM _{2.5} (6.5MM-uncontrolled staging)	2.21	0.96	0.38	0.10
PM ₁₀ (6.5MM-controlled staging 95%)	1.33	0.51	0.17	0.05
PM _{2.5} (6.5MM-controlled staging 95%)	0.20	0.08	0.02	0.01
PM ₁₀ (6.5MM-controlled staging 61%)	8.96	3.73	1.16	0.32
PM _{2.5} (6.5MM-controlled staging 61%)	1.34	0.56	0.17	0.05

Figures 21 and 22 graphically show the model output data in Table 11, the peak modeled PM₁₀ and PM_{2.5} concentrations at the OBOT fence line (blue bars) and at the nearest residential receptor (red bars) relative to the NAAQS. As shown in Figures 21 and 22, the modeled maximum concentrations for both PM₁₀ and PM_{2.5} are far below the NAAQS at both the OBOT fence line and at the nearest community/residential receptor.

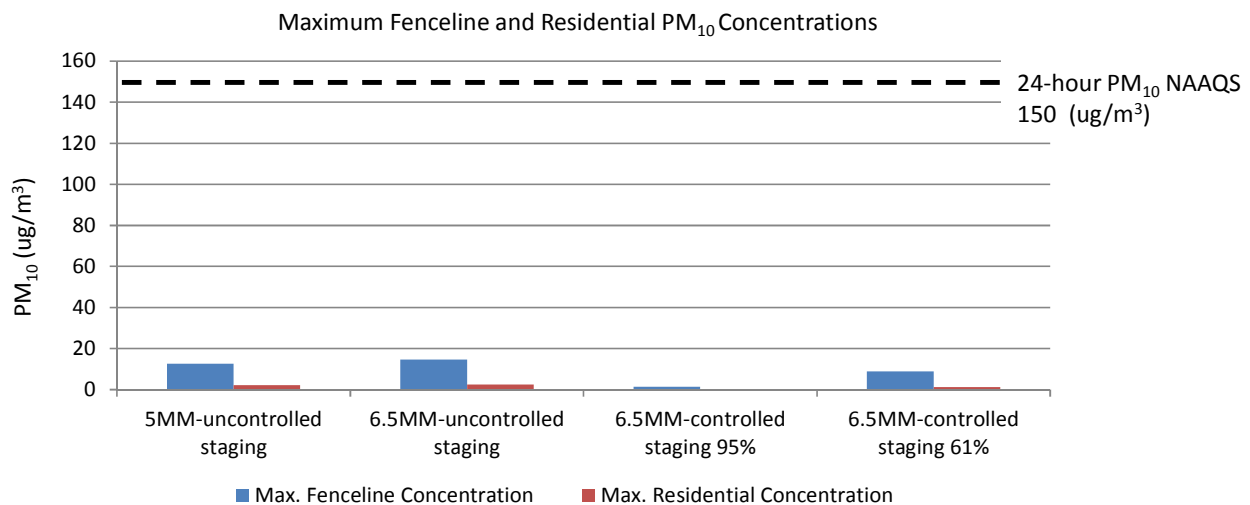


Figure 21. Maximum PM₁₀ modeled concentrations at the OBOT fence line (blue) and at the nearest residential receptor (red) relative to the PM₁₀ 24-hour NAAQS (dotted line) for the four model scenarios.

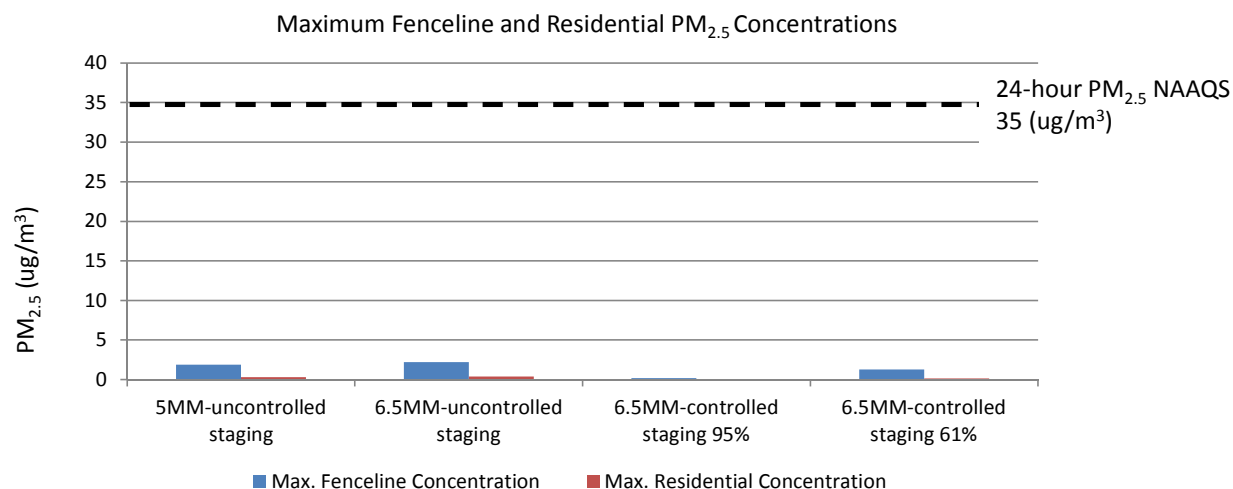


Figure 22. Maximum PM_{2.5} modeled concentrations at the OBOT fence line (blue) and at the nearest residential receptor (red) relative to the PM_{2.5} 24-hour NAAQS for the four model scenarios.

The following sections present the AERMOD spatial outputs that show mapped concentrations of PM₁₀ and PM_{2.5}. For presentation purposes, output maps are only shown for 6.5MM-uncontrolled staging as this scenario represents uncontrolled emissions from the staging of rail cars and yields the highest modeled concentrations. All other model scenarios, as shown in Table 11 and Figures 21 and 22, result in lower modeled concentrations.

The maps presented in the following sections show modeled PM concentrations at the domain-wide level and the overall peaks along the OBOT facility and 2012 Oakland Army Base Project boundary and in the nearby residential area. Each figure shows a contour plot of the modeled peak concentrations overlaid on a map of the facility and modeling domain. The overall peaks at the facility boundary and in the residential area are marked with red and black stars in the corresponding figures.

PM₁₀ Results for 6.5MM-uncontrolled staging

Figure 23 shows the domain wide modeled peak 24-hour average PM₁₀ concentrations for 6.5MM-uncontrolled staging. The scale for the contours extends up to 150 µg/m³, which is the NAAQS threshold for 24-hour average PM₁₀ (the 150 µg/m³ threshold is not to be exceeded more than once per year on average over three years). As the figure shows, all modeled peak concentrations are far below this threshold.

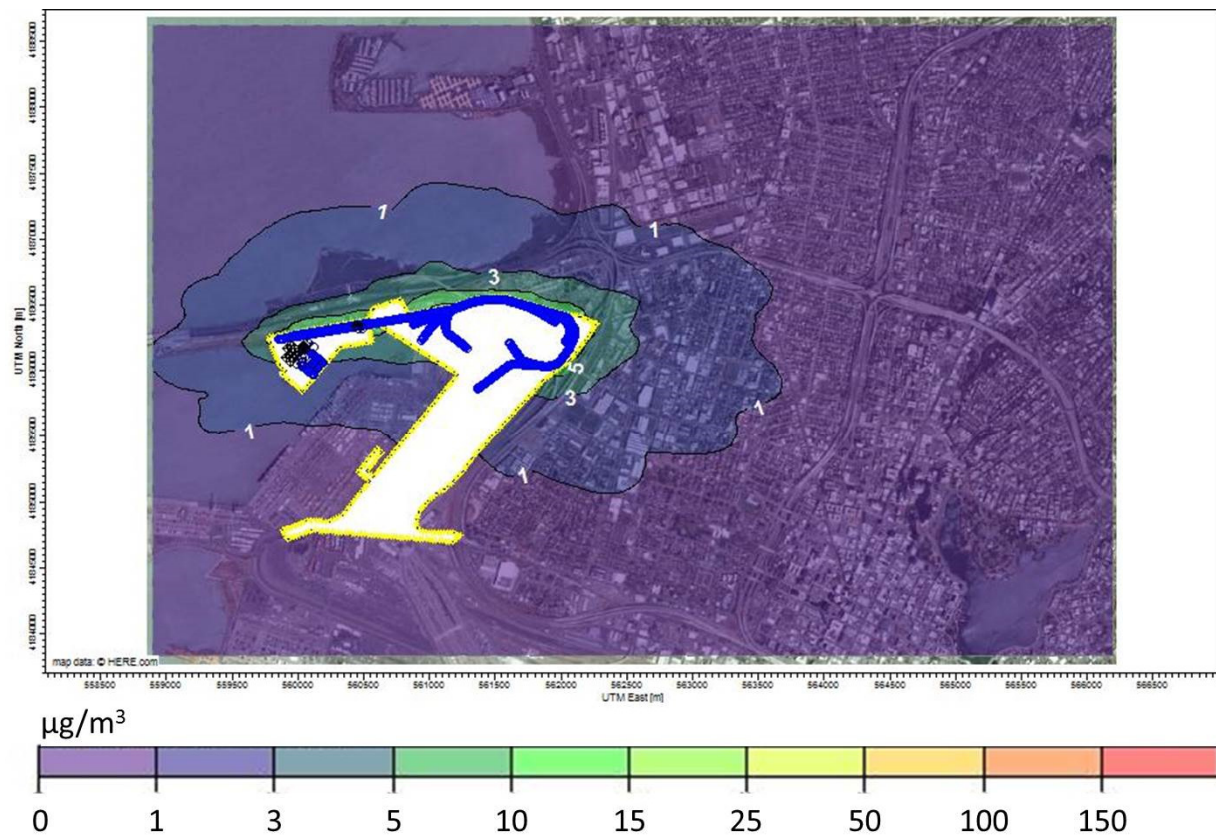


Figure 23. Domain wide contour map of modeled peak 24-hour average PM₁₀ concentrations for 6.5MM-uncontrolled staging. The 2012 Oakland Army Base Project boundary is represented by the yellow line, and the white area covers the project property. OBOT facility sources and features appear as blue and black objects within the facility property.

Figure 24 shows an enlarged area of the contour plot in Figure 23 where the overall maximum of modeled peak 24-hour average PM₁₀ concentrations is located. The location is along the facility boundary and highlighted by the red and black star. This area is where rail cars will be staged for unloading at the OBOT terminal. Predicted concentrations would be highest at this location as 6.5MM-uncontrolled staging represents uncontrolled, open rail cars during staging and the emissions from staging are substantially higher than emissions from all other sources at the OBOT terminal. The maximum value is 14.7 µg/m³, and represents the highest 24-hour average PM₁₀ value throughout the modeling domain for 6.5MM-uncontrolled staging.

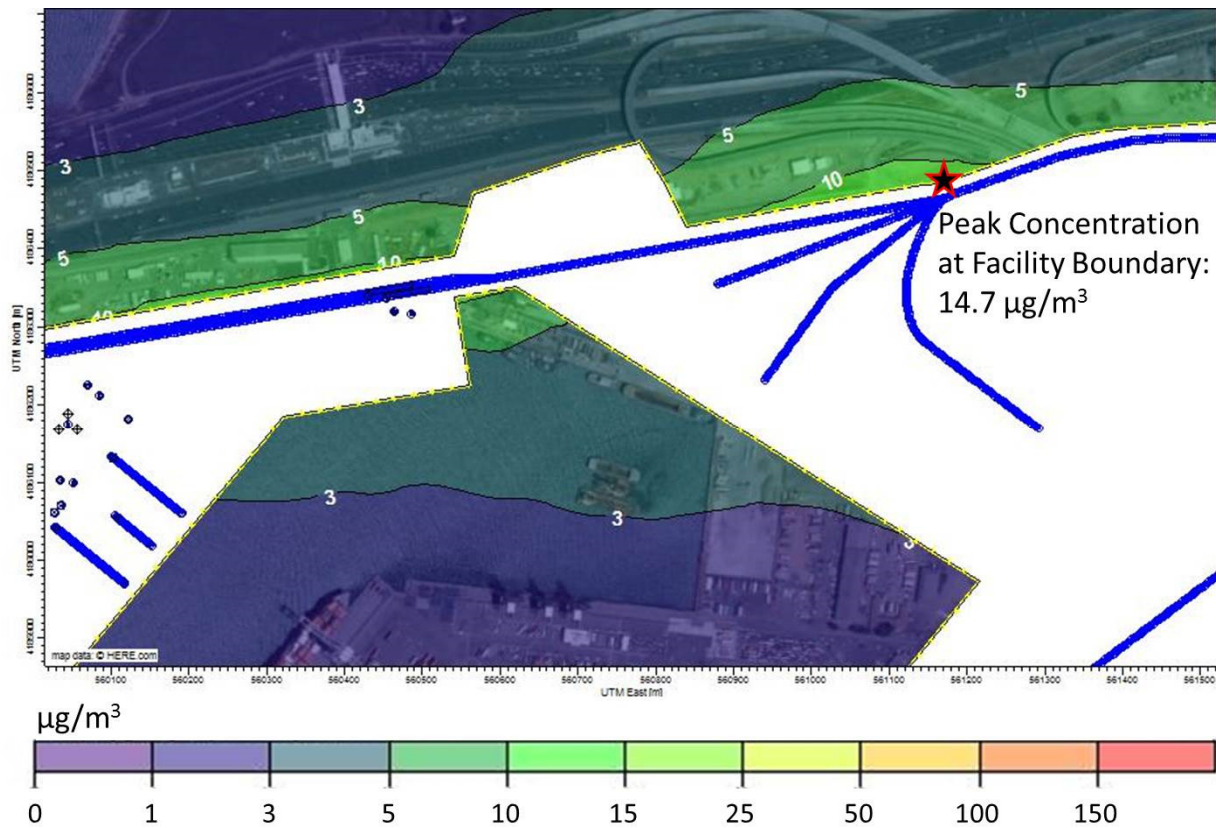


Figure 24. Enlarged area of the contour map in Figure 22, showing the overall maximum modeled peak 24-hour PM₁₀ concentration for 6.5MM-uncontrolled staging located along the 2012 Oakland Army Base Project boundary.

Figure 25 also shows an enlarged area of the contour plot in Figure 23. This figure focuses on the residential area closest to the facility boundary. The maximum of modeled peak 24-hour average PM₁₀ concentrations in this nearby residential area is 2.51 µg/m³, and its location is highlighted by the red and black star.

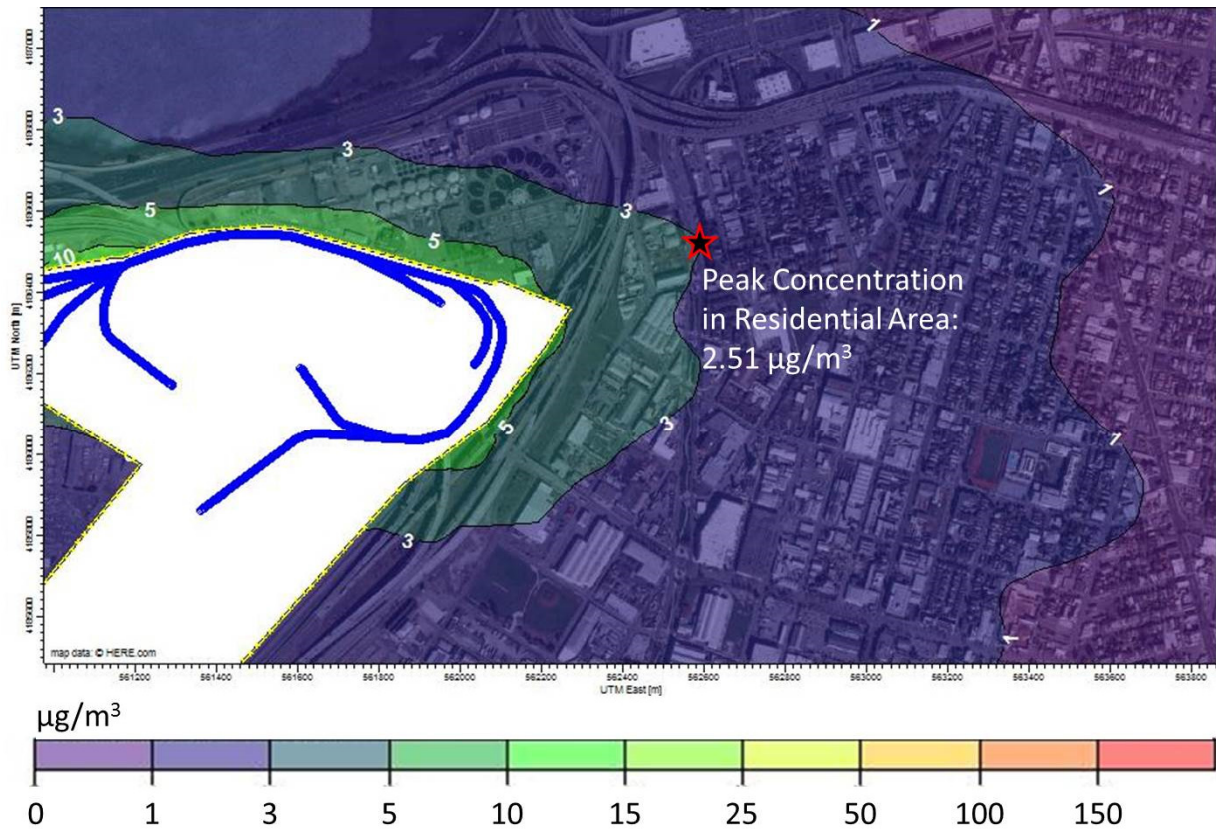


Figure 25. Enlarged area of the contour map in Figure 22, showing the maximum modeled peak 24-hour PM₁₀ concentration for 6.5MM-uncontrolled staging that is located in the residential area closest to the facility.

24-hour Average PM_{2.5} Results for 6.5MM-uncontrolled staging

Figure 26 shows the domain wide modeled peak 24-hour average PM_{2.5} concentrations for 6.5MM-uncontrolled staging. The scale for the contours extends up to 35 µg/m³, which is the NAAQS threshold for 24-hour average PM_{2.5}. As the figure shows, all modeled peak concentrations are far below this threshold.

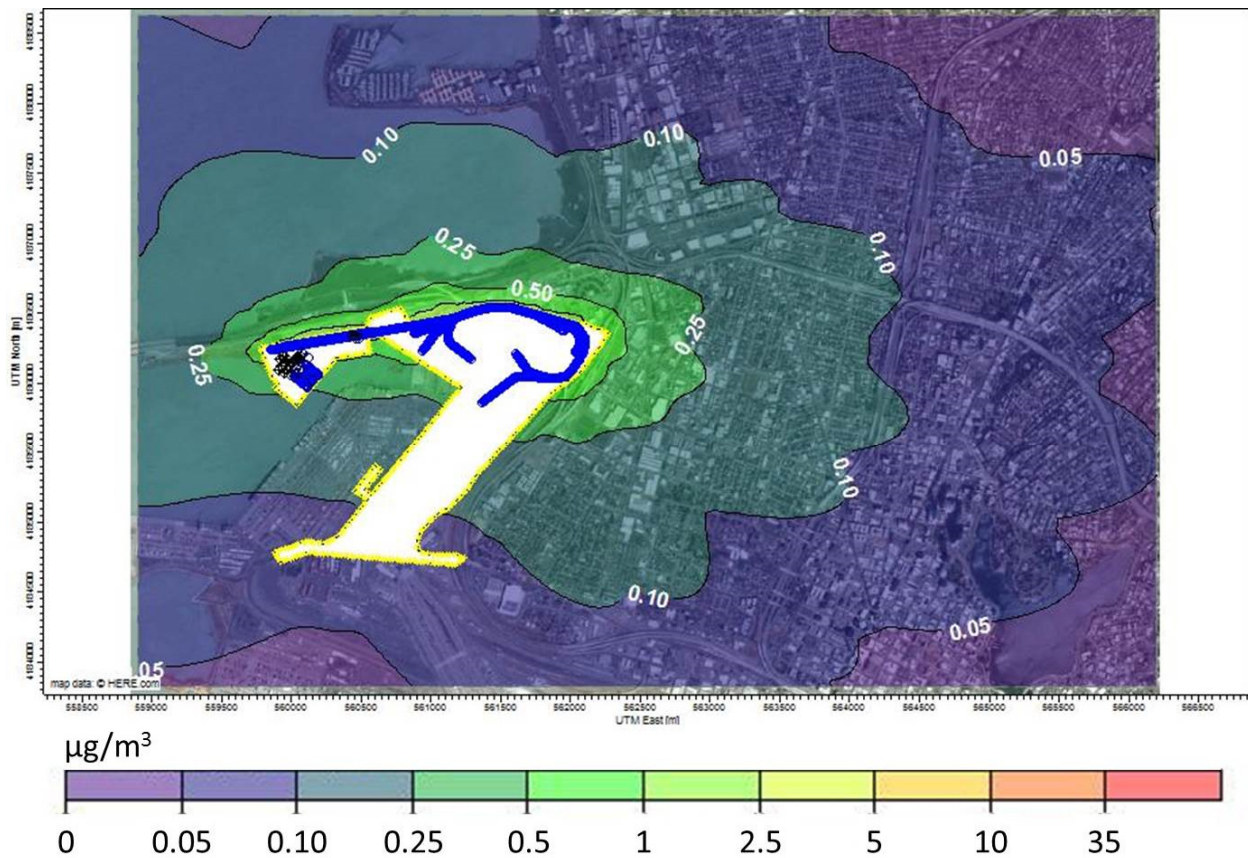


Figure 26. Domain wide contour map of modeled peak 24-hour average PM_{2.5} concentrations for 6.5MM-uncontrolled staging. The 2012 Oakland Army Base Project boundary is represented by the yellow line, and the white area covers the project property. OBOT facility sources and features appear as blue and black objects within the facility property.

Figure 27 shows an enlarged area of the contour plot in Figure 26 where the overall maximum of modeled peak 24-hour average PM_{2.5} concentrations is located. The location is along the facility boundary and highlighted by the red and black star. The maximum value is 2.21 µg/m³, and represents the highest 24-hour average PM_{2.5} value throughout the modeling domain for 6.5MM-uncontrolled staging.

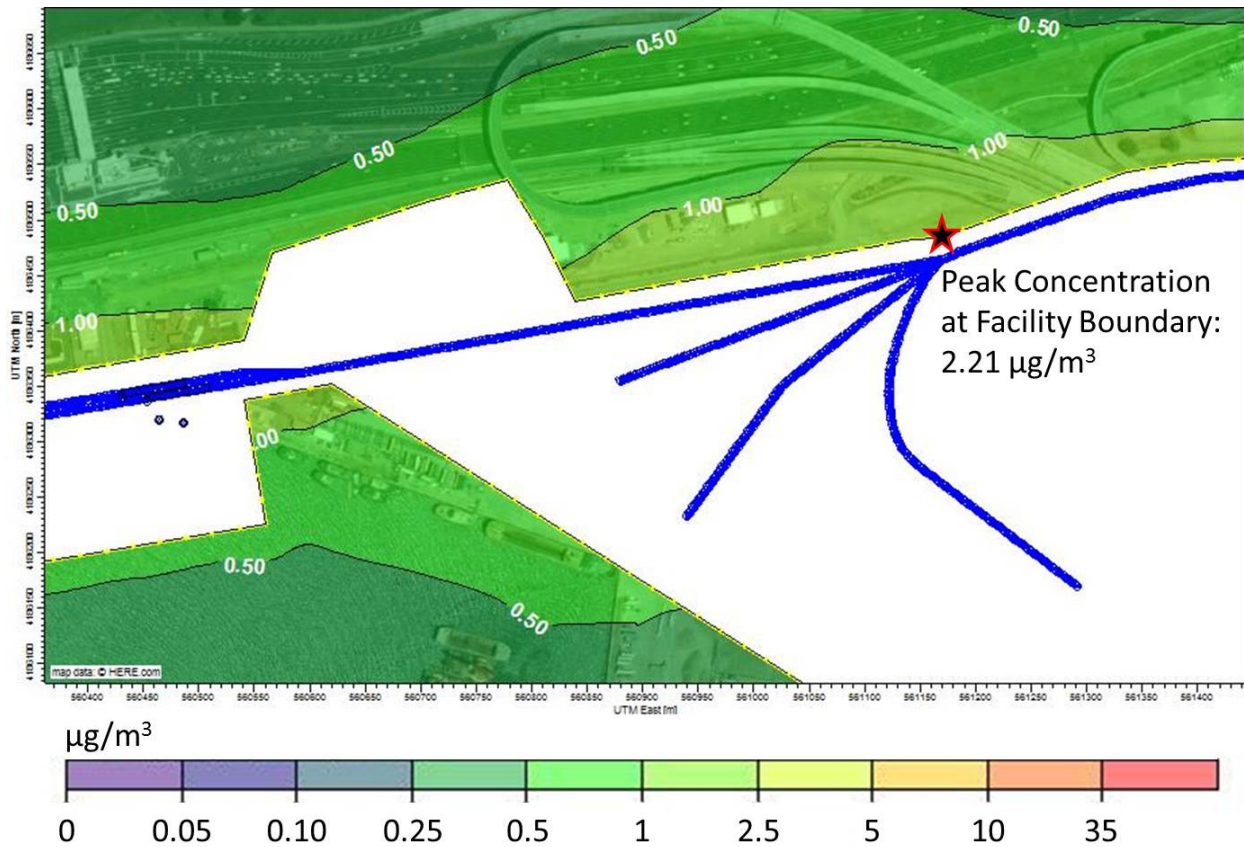


Figure 27. Enlarged area of the contour map in Figure 7, showing the overall maximum modeled peak 24-hour $\text{PM}_{2.5}$ concentration for 6.5MM-uncontrolled staging located along the 2012 Oakland Army Base Project boundary and OBOT facility.

Figure 28 also shows an enlarged area of the contour plot in Figure 26. This figure focuses on the residential area closest to the facility boundary. The maximum of modeled peak 24-hour average $\text{PM}_{2.5}$ concentrations in this nearby residential area is 0.38 $\mu\text{g}/\text{m}^3$, and its location is highlighted by the red and black star.

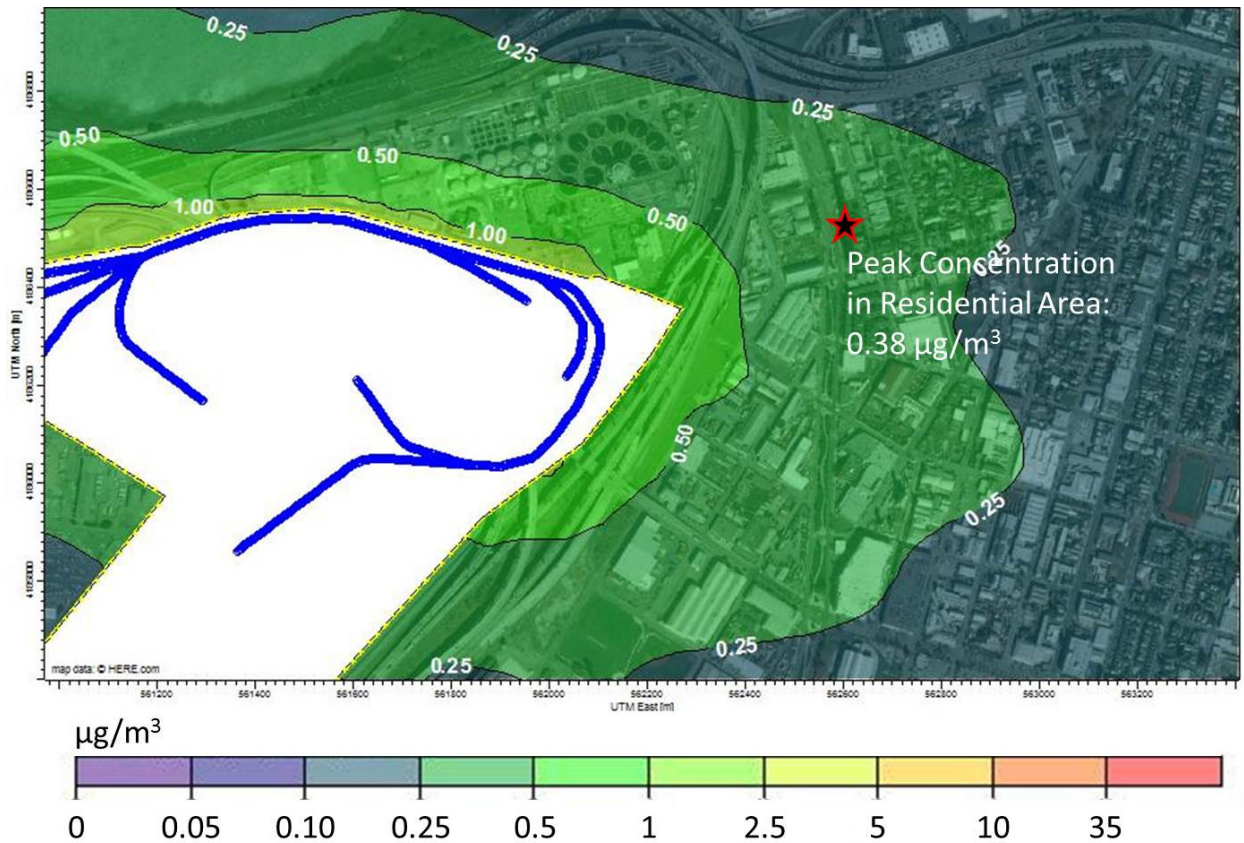


Figure 28. Enlarged area of the contour map in Figure 28, showing the maximum modeled peak 24-hour $\text{PM}_{2.5}$ concentration for 6.5MM-uncontrolled staging that is located in the residential area closest to the facility.

Annual Average $\text{PM}_{2.5}$ Results for 6.5MM-uncontrolled staging

Figure 29 shows the domain wide modeled peak annual average $\text{PM}_{2.5}$ concentrations for 6.5MM-uncontrolled staging. The scale for the contours extends up to $12 \mu\text{g}/\text{m}^3$, which is the NAAQS threshold for annual average $\text{PM}_{2.5}$. As the figure shows, all modeled peak concentrations are far below this threshold.

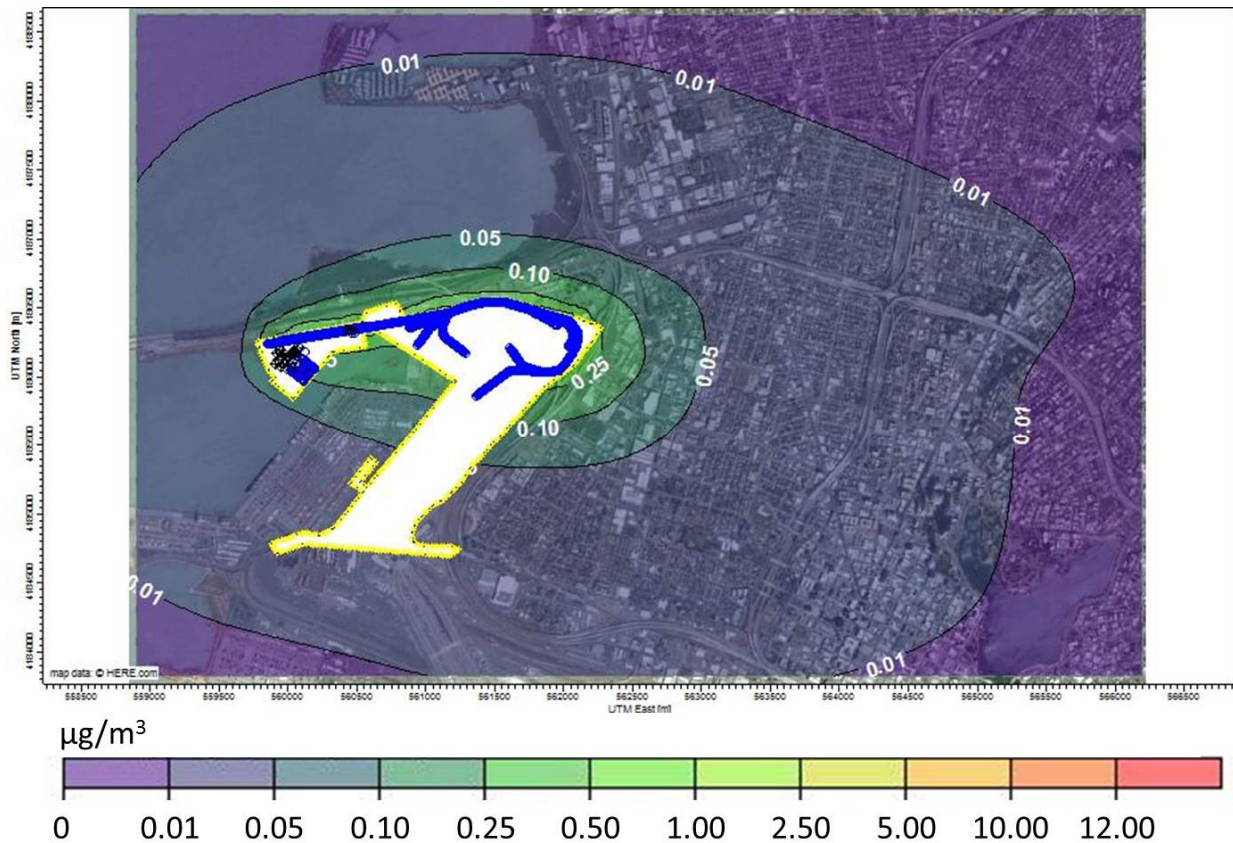


Figure 29. Domain wide contour map of modeled peak annual average PM_{2.5} concentrations for 6.5MM-uncontrolled staging. The 2012 Oakland Army Base Project boundary is represented by the yellow line, and the white area covers the facility property. OBOT facility sources and features appear as blue and black objects within the facility property.

Figure 30 shows an enlarged area of the contour plot in Figure 29 where the overall maximum of modeled peak 24-hour average PM_{2.5} concentrations is located. The location is along the facility boundary and highlighted by the red and black star. The maximum value is 0.96 µg/m³, and represents the highest annual average PM_{2.5} value throughout the modeling domain for 6.5MM-uncontrolled staging.

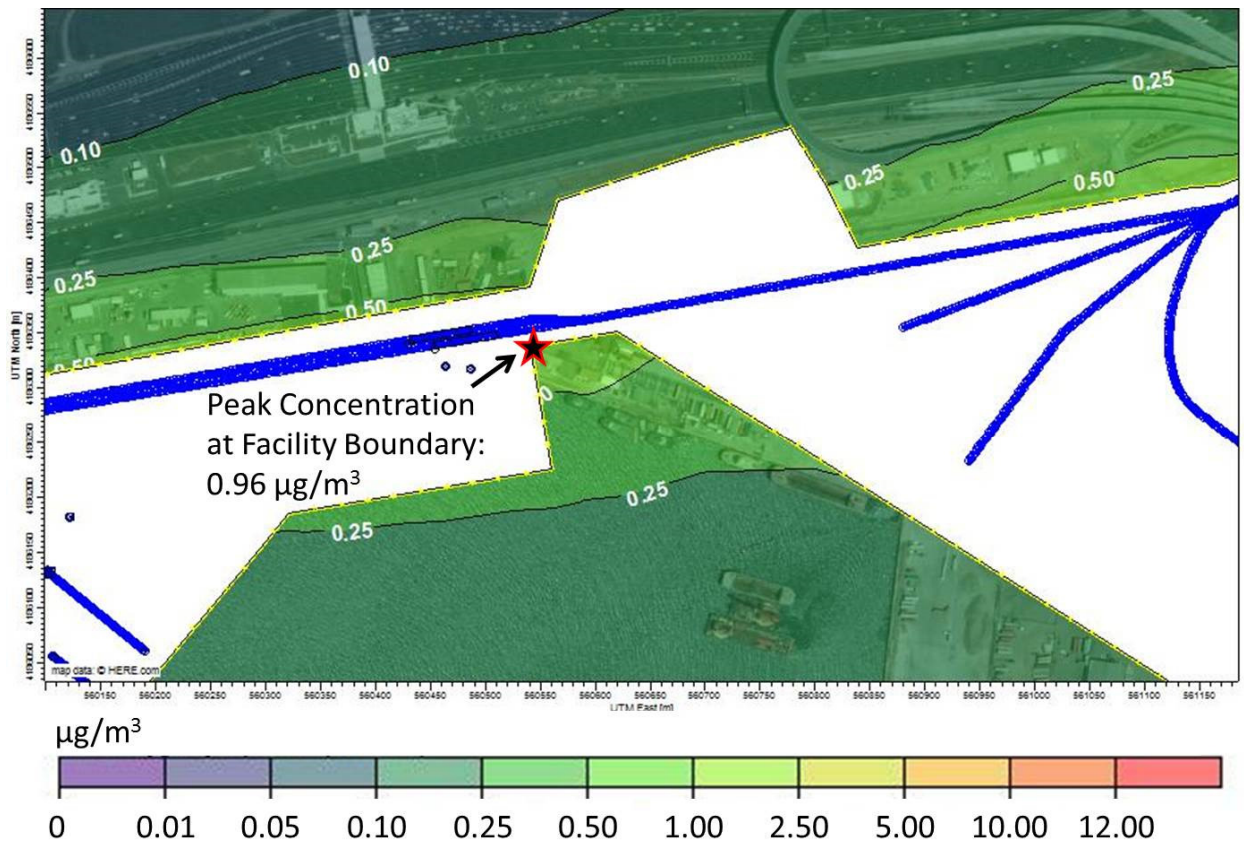


Figure 30. Enlarged area of the contour map in Figure 13, showing the overall maximum modeled peak annual $\text{PM}_{2.5}$ concentration for 6.5MM-uncontrolled staging located along the 2012 Oakland Army Base Project and OBOT facility boundary.

Figure 31 also shows an enlarged area of the contour plot in Figure 29. This figure focuses on the residential area closest to the facility boundary. The maximum of modeled peak annual average $\text{PM}_{2.5}$ concentrations in this nearby residential area is $0.10 \mu\text{g}/\text{m}^3$, and its location is highlighted by the red and black star.

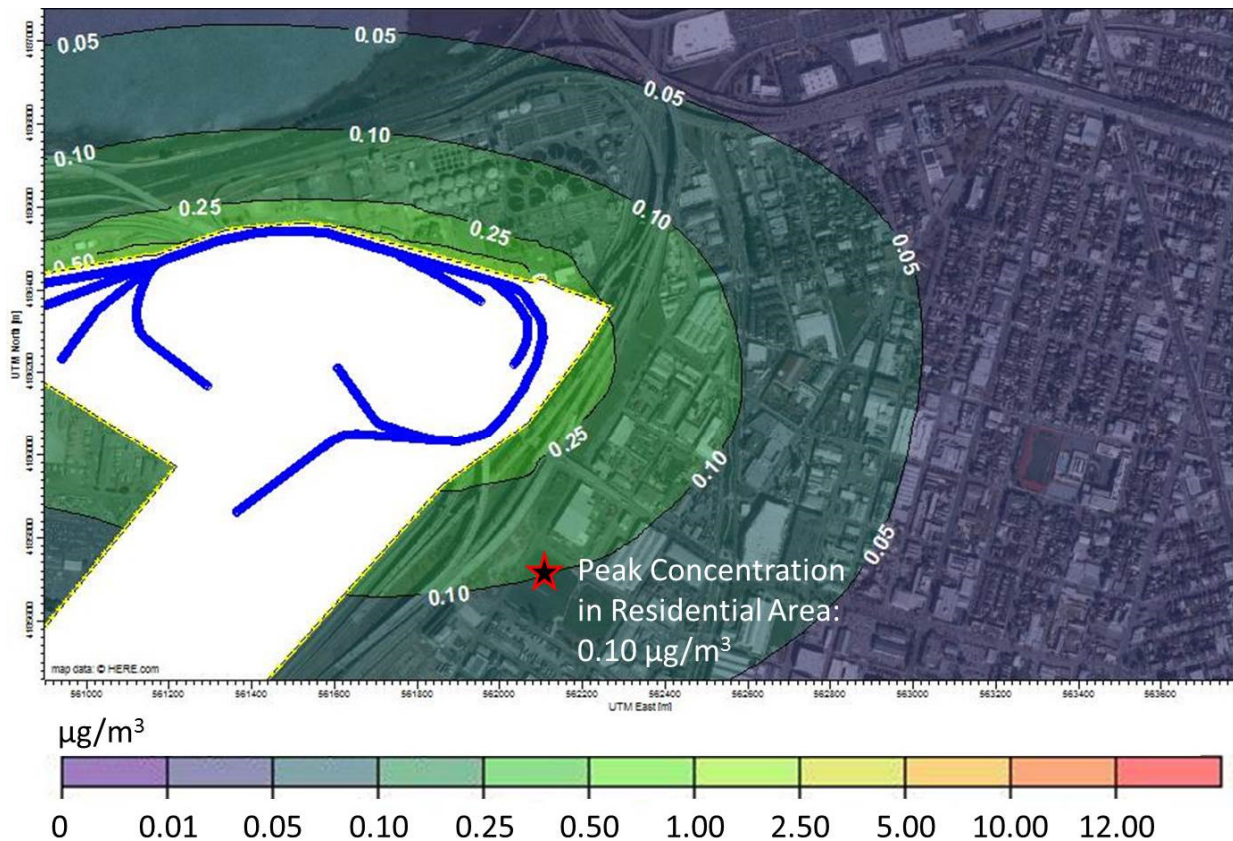


Figure 31. Enlarged area of the contour map in Figure 34, showing the maximum modeled peak annual PM_{2.5} concentration for 6.5MM-uncontrolled staging that is located in the residential area closest to the facility.

As shown in the AERMOD spatial output data, the modeled concentrations for 6.5MM-uncontrolled staging assuming uncontrolled staging emissions are far below the NAAQS at both the OBOT fence line and the nearest community/residential receptor. Modeled concentrations for all other scenarios are even lower than those predicted for 6.5MM-uncontrolled staging.

12.4 Air Quality Modeling Results for Coal Dust and Exhaust Emissions

The previous sections report the results of my analysis for the fugitive coal dust PM emissions and resulting air quality PM concentrations. While the focus of this report was on fugitive coal dust emissions and the associated air quality impacts, for completeness, I made an estimate of the total air quality impacts based on estimates of OBOT exhaust emissions combined with my modeling analysis.

To estimate total emissions (including both PM fugitive dust and PM exhaust emissions), I used exhaust emissions reported in Table 3.3-8 of the 2012 EIR Addendum (LSA Associates, 2012). [Table 12](#) shows the PM fugitive dust and exhaust emissions for the worst case (6.5MM uncontrolled staging) and the most likely case (6.5MM controlled staging 95%) scenarios.

Table 12. Summary of PM fugitive dust and exhaust emissions for the worst case (6.5MM uncontrolled staging) and the most likely case (6.5MM controlled staging 95%) emissions scenarios.

Emissions Source	Emissions (Tons/Year)	
	PM ₁₀	PM _{2.5}
OBOT fugitive coal dust, 6.5MM uncontrolled staging*	10.5	1.6
OBOT exhaust*	2.8	2.7
Total	13.3	4.3
OBOT fugitive coal dust, 6.5MM controlled staging 95%*	1.6	0.2
OBOT exhaust*	2.8	2.7
Total	4.4	2.9

*(LSA Associates, 2012)

As shown in Table 12, the total PM₁₀ and PM_{2.5} emissions including both fugitive dust and exhaust for 6.5MM uncontrolled staging are 13.3 and 4.3 tons/year (respectively). The total PM₁₀ and PM_{2.5} emissions including both fugitive dust and exhaust for 6.5MM controlled staging 95% are 4.4 and 2.9 tons/year (respectively). Note these emissions are below the BAAQMD CEQA emission thresholds of 15 and 10 tons/year for PM₁₀ and PM_{2.5} (respectively).

AERMOD is a Gaussian dispersion model that relies upon the assumption of linearity of emission rates and proportional air quality impacts. To estimate the facility wide air quality impact, I used the ratio of the fugitive dust and exhaust emissions to scale the existing AERMOD model outputs for PM. [Table 13](#) shows the modeled PM₁₀ and PM_{2.5} fugitive dust concentrations, the estimated PM₁₀ and PM_{2.5} exhaust concentrations, and the estimated total PM₁₀ and PM_{2.5} concentrations resulting from the OBOT facility.

Table 13. Summary of the modeled PM₁₀ and PM_{2.5} fugitive dust concentrations, the estimated PM₁₀ and PM_{2.5} exhaust concentrations, and the estimated total PM₁₀ and PM_{2.5} concentrations resulting from the OBOT facility.

Emissions Scenario	Fence line Maximum				Residential Maximum			
	PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)		PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)	
	24-hour Avg.	Annual Avg.	24-hour Avg.	Annual Avg.	24-hour Avg.	Annual Avg.	24-hour Avg.	Annual Avg.
6.5MM uncontrolled staging	14.7	6.41	2.21	0.96	2.51	0.7	0.38	0.1
OBOT exhaust	3.9	1.7	3.7	1.6	0.7	0.2	0.6	0.2
Total	18.6	8.1	5.9	2.6	3.2	0.9	1.0	0.3
6.5MM controlled staging 95%	1.33	0.51	0.2	0.08	0.17	0.05	0.02	0.01
OBOT exhaust	2.3	0.9	2.7	1.1	0.3	0.1	0.3	0.1
Total	3.6	1.4	2.9	1.2	0.5	0.1	0.3	0.1

To put the estimated total PM₁₀ and PM_{2.5} concentrations in Table 13 into context, I summarized ambient PM_{2.5} data for the AQM1, the BAAQMD Oakland West, and all BAAQMD PM₁₀ monitoring sites to present average ambient concentrations for data collected between 2014 and 2016 (Table 14). The data in Table 14 represent ambient concentrations without considering the impact of the OBOT facility.

Table 14. Summary of ambient PM_{2.5} data for the AQM1 the BAAQMD Oakland West, and all BAAQMD PM₁₀ monitoring sites for data collected between 2014 and 2016.

Observed Data	Fenceline Max				Residential Max			
	Average PM ₁₀ (µg/m ³)		Average PM _{2.5} (µg/m ³)		Average PM ₁₀ (µg/m ³)		Average PM _{2.5} (µg/m ³)	
	24-hour	Annual	24-hour	Annual	24-hour	Annual	24-hour	Annual
AQM1 - West Gateway*	n/a	n/a	20.9	6.0	n/a	n/a	--	--
BAAQMD Oakland West**	n/a	n/a	--	--	n/a	n/a	25	8.7
BAAQMD Bay Area Average***	29.9	15.3	--	--	29.9	15.3	--	--

*data for 2015-2016

**data for 2014-2016 (Bay Area Air Quality Management District, 2016)

***data for 2016 (Bay Area Air Quality Management District, 2016)

To estimate the potential air quality impact of the OBOT facility, I added the modeled PM₁₀ and PM_{2.5} concentrations from the OBOT facility (Table 13) to the observed ambient concentration data (Table 14) to arrive at an estimated total concentration. Table 15 summarizes the OBOT modeled PM₁₀ and PM_{2.5} concentrations plus the observed ambient concentrations, the PM NAAQS, and the difference between the two values.

Table 15. Summary of the OBOT modeled PM₁₀ and PM_{2.5} concentrations plus the observed ambient concentrations, the PM NAAQS, and the difference between the two values.

	Fenceline Max				Residential Max			
	Average PM ₁₀ (µg/m ³)		Average PM _{2.5} (µg/m ³)		Average PM ₁₀ (µg/m ³)		Average PM _{2.5} (µg/m ³)	
	24-hour	Annual	24-hour	Annual	24-hour	Annual	24-hour	Annual
6.5MM uncontrolled staging (modeled plus observed concentration)	48.5	23.4	26.8	8.6	33.0	16.2	26.0	9.0
PM NAAQS	150	n/a	35	12	150	n/a	35	12
Difference	-101.5	n/a	-8.2	-3.4	-117.0	n/a	-9.0	-3.0
6.5MM controlled staging 95% (modeled plus observed concentration)	33.5	16.7	23.8	7.2	30.3	15.4	25.3	8.8
PM NAAQS	150	n/a	35	12	150	n/a	35	12
Difference	-116.5	n/a	-11.2	-4.8	-119.7	n/a	-9.7	-3.2

As shown in Table 15, for the worst case 6.5MM uncontrolled staging scenario, the total modeled plus observed PM₁₀ concentrations are approximately 70-80% below the PM₁₀ NAAQS at both the OBOT fence line and in the community/residential area of West Oakland. For PM_{2.5}, the 24-hour average concentrations are approximately 8-9 µg/m³, or 25%, below the NAAQS at both the fence line and in the community/residential area of West Oakland. Annual average maximum PM_{2.5} concentrations at both the fence line and in the community/residential area of West Oakland are approximately 3µg/m³ lower, or approximately 25% less than the NAAQS. For the most likely scenario, assuming rail car covers (6.5MM controlled staging 95%), the total modeled plus observed PM₁₀ and PM_{2.5} concentrations are even further below the NAAQS at both the fenceline and in the community/residential area of West Oakland.

13. Discussion and Conclusions

13.1 Discussion of Results

Air Quality in West Oakland

The results of the air quality analyses for West Oakland show that the BAAQMD is in attainment of the NAAQS for both PM₁₀ and PM_{2.5}. The 24-hour average concentrations are in the range of 20-25 µg/m³, which is below the standard of 35 µg/m³. The 24-hour average design value for PM_{2.5} in the San Francisco Bay Area is 25 µg/m³ which is 10 µg/m³ below the NAAQS. The OBOT facility operators have agreed to use state-of-the-art, modern engineering and emissions controls to minimize PM emissions to the extent possible. Even being conservative and assuming that rail car covers or surfactants are **not** used during staging, despite OBOT's intention to use such control measures, PM_{2.5} increases are still predicted to be less than 1 µg/m³. If rail covers or surfactant are used, predicted concentrations would be even lower and would not result in exceedances of the PM_{2.5} NAAQS.

Emissions Inventory Results

The emissions estimates (for the four emissions scenarios) I developed for the OBOT facility provide a range of potential emissions from the OBOT facility assuming both uncontrolled and controlled emissions from the staging of rail cars at the OBOT facility. The emissions results show that if rail car surfactants or covers are **not** used, total fugitive dust emissions from the OBOT facility would still be *below* the BAAQMD's thresholds of significance for PM₁₀ and PM_{2.5} by 30% and 85% (respectively). Assuming the OBOT facility operators use rail car covers or surfactants to control fugitive dust from rail car staging, emissions would be even farther below the thresholds of significance.

AERMOD Results

The air quality modeling results indicate that fugitive dust emissions from the OBOT facility would not result in incremental PM concentrations that would cause exceedances of the NAAQS. For 6.5MM-uncontrolled staging, assuming uncontrolled emissions from staging of rail cars, the predicted maximum peak 24-hour average PM₁₀ and PM_{2.5} concentrations at the OBOT fence line are 14.7 µg/m³ and 2.21 µg/m³. At the nearest community/residential receptors predicted peak concentrations are 2.51 µg/m³ and 0.38 µg/m³ and are far below the NAAQS. Maximum peak concentrations predicted for the other three scenarios are even lower.

The total estimated PM₁₀ and PM_{2.5} concentrations, considering both ambient PM concentrations and the incremental addition of OBOT modeled concentrations, are below the NAAQS at both the OBOT fence line and at the nearest community/residential receptors. Overall, PM₁₀ concentrations are approximately 70-80% lower than the NAAQS and PM_{2.5} concentrations are approximately 25-40% lower than the NAAQS.

13.2 Conclusions

The technical analysis conducted in this report using state-of-the-science air quality data analysis and modeling tools showed that fugitive coal dust emissions associated with rail car staging and OBOT terminal operations would not exceed the BAAQMD's thresholds of significance for any of the emissions scenarios, both controlled and uncontrolled. Air quality modeling was performed with the AERMOD dispersion model and the modeling results were used to quantify the impact of the emissions from the OBOT facility on PM₁₀ and PM_{2.5} concentrations in the region.

Based on my knowledge, experience, and the results of the data and modeling analyses performed for this case, I have reached the following conclusions:

- Based on the results of the AERMOD dispersion modeling, it is expected that the emissions from the OBOT facility will have a very small impact on local PM₁₀ and PM_{2.5} concentrations, and will not result in exceedances of the PM₁₀ or PM_{2.5} NAAQS.
- Based on the AERMOD dispersion modeling results for 6.5MM-uncontrolled staging, the most conservative scenario, which assumes a throughput of coal of 6.5 million metric tons/year, uncontrolled rail car fugitive coal dust emissions, and controlled OBOT terminal emissions; peak PM concentrations are as follows
 - Predicted peak 24-hr average fence line concentrations of PM₁₀ and PM_{2.5} are 14.7 µg/m³ and 2.21 µg/m³ (respectively). The predicted concentration levels are far below the PM₁₀ and PM_{2.5} 24-hour average NAAQS of 150 µg/m³ and 35 µg/m³ (respectively).
 - A predicted peak annual average fence line concentration of PM_{2.5} is 0.96 µg/m³ which is far below the PM_{2.5} annual average NAAQS of 12 µg/m³.
 - Predicted peak 24-hr average residential concentrations of PM₁₀ and PM_{2.5} are 2.51 µg/m³ and 0.38 µg/m³ (respectively). The predicted concentration levels are far below the PM₁₀ and PM_{2.5} 24-hour average NAAQS of 150 µg/m³ and 35 µg/m³ (respectively).
 - A predicted peak annual average fence line concentration of PM_{2.5} is 0.1 µg/m³ which is far below the PM_{2.5} annual average NAAQS of 12 µg/m³.

- Based on the AERMOD dispersion modeling results for 6.5MM-controlled staging 95%, which assumes a throughput of coal of 6.5 million metric tons/year, controlled rail car fugitive coal dust emissions at 95% control efficiency, and controlled OBOT terminal emissions; peak PM concentrations are as follows
 - Predicted peak 24-hr average fence line concentrations of PM₁₀ and PM_{2.5} are 1.33 µg/m³ and 0.2 µg/m³ (respectively). The predicted concentration levels are far below the PM₁₀ and PM_{2.5} 24-hour average NAAQS of 150 µg/m³ and 35 µg/m³ (respectively).
 - A predicted peak annual average fence line concentration of PM_{2.5} is 0.08 µg/m³ which is far below the PM_{2.5} annual average NAAQS of 12 µg/m³.
 - Predicted peak 24-hr average residential concentrations of PM₁₀ and PM_{2.5} are 0.17 µg/m³ and 0.02 µg/m³ (respectively). The predicted concentration levels are far below the PM₁₀ and PM_{2.5} 24-hour average NAAQS of 150 µg/m³ and 35 µg/m³ (respectively).
 - A predicted peak annual average fence line concentration of PM_{2.5} is 0.01 µg/m³ which is far below the PM_{2.5} annual average NAAQS of 12 µg/m³.
- Whether the most likely scenario or the worst case scenario occurs, the air quality impacts shown in my work are below federal government regulatory levels of concern.
- Based on my knowledge, experience, and familiarity with emissions control technologies, I believe rail car covers and surfactants to be effective at mitigating fugitive coal dust emissions.

14. Supplementation

1. I reserve the right to supplement or amend my opinions in response to opinions expressed by Defendants' experts, or in light of additional evidence, testimony, discovery, or other information that may be provided to me after the date of this report.
2. I also reserve the right to offer additional testimony, if necessary, concerning the subject matter of this report and the opinions discussed herein.
3. In addition, I expect that I may be asked to consider and testify about issues that may be raised by Defendants' fact witnesses and technical experts at trial or in expert reports or declarations. It may also be necessary for me to supplement my opinions as a result of ongoing discovery, Court rulings, and testimony at trial.

15. Trial Exhibits

1. I may rely on visual aids and demonstrative exhibits that demonstrate the bases for my opinions. These visual aids and demonstrative exhibits may include, for example, interrogatory responses, deposition testimony and exhibits, as well as charts, photographs, diagrams, videos, and animated or computer-generated videos.

16. References

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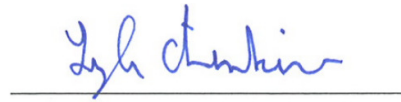
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17. Materials Considered

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Executed this 6th day of October 2017. I declare under the penalty of perjury that the foregoing is true and correct.



Lyle Chinkin

Appendix A – Chinkin Resume

Appendix B – Chinkin List of Publications

Appendix C – Previous Expert Testimony

Appendix D – Statement of Compensation

Appendix A: Lyle R. Chinkin Resume



Lyle R. Chinkin

Chief Scientist

President Emeritus



Mr. Chinkin joined Sonoma Technology, Inc. (STI) in 1992. He has over 35 years of professional experience in air quality, including five years of experience at the California Air Resources Board, and he is currently the managing director of litigation support at STI.

He is a nationally recognized expert in the preparation and assessment of emissions inventories of air pollutants and air quality analysis. He has worked on projects for federal, state, and local government agencies; universities; public and private research consortiums; and major corporations. Many of his projects involve the use of computerized air quality modeling simulations using Gaussian dispersion models as well as one-atmosphere, full-chemistry photochemical grid models. His areas of expertise include (1) developing regional emissions inventories; (2) providing independent assessments of emissions inventories using bottom-up and top-down evaluation techniques; (3) obtaining real-world data and improving activity estimates; (4) conducting scoping studies to develop conceptual models of community-scale air quality; (5) assisting with state implementation plan (SIP) development; and (6) providing expert testimony and presentations to public boards. He has been appointed to the National Research Council of the National Academy of Sciences Committee on the Effects of Changes in New Source Review Programs for Stationary Sources of Air Pollutants and to a panel to review "Improving Emission Inventories for Effective Air Quality Management Across North America, a NARSTO Assessment" (2005). Mr. Chinkin has authored one book chapter; published six peer-reviewed journal papers and over 200 scientific reports; and made over 100 presentations at conferences and public meetings.

Mr. Chinkin served as an EPA-invited peer reviewer three times, including for the EPA particulate matter (PM) National Ambient Air Quality Standards Criteria Document, the 2006 draft "EPA Report on the Environment," and an EPA report on air quality impacts from a railyard operated in an urban environment. He also served as an expert panel member for the review of the Valdez Air Health Study; and as an expert witness for the U.S. Department of Justice and the Attorney General's Office of the State of North Carolina on environmental enforcement actions. Mr. Chinkin was the project manager and co-author of the EPA national guidance document on the preparation of emission inputs for photochemical air quality simulation models. In addition, his projects have included improving estimates of PM and ammonia emissions, determining air toxic emissions from wood-preservation activities, and improving natural source emission estimation tools, including biogenic VOCs and smoke

Education

- BS, Atmospheric Science, *summa cum laude*, University of California at Davis
- MS, Atmospheric Science, University of California at Davis

Memberships

- Air & Waste Management Association
- American Meteorological Society (1979-1984, 2012)
- California Registered Environmental Assessor (REA-00715) (1984-1989)
- International Association of Wildland Fire
- Served on three EPA peer-review panels and one NARSTO peer review panel
- Served on one National Academy of Sciences Committee

from wild and prescribed fires. He frequently directs studies that combine public- and private-sector participation, including an assessment and ground-truth study of industrial emissions in the Houston Ship Channel under the joint direction of the Texas Natural Resource Conservation Commission (now Texas Commission on Environmental Quality) and local industry. Mr. Chinkin has also assisted numerous industrial clients with projects such as development of emission-estimation tools for the American Petroleum Institute and top-down evaluations of emissions inventories for the Coordinating Research Council.

Mr. Chinkin is frequently called upon by clients to explain complicated technical information to other professionals, advisory boards, and members of the public. He has presented research findings to public advisory committees in Ohio, Kansas, and Missouri and to senior federal and state government officials in Minnesota and at numerous scientific conferences. The EPA selected Mr. Chinkin to help prepare a summary of the proceedings of the 2003 NARSTO air quality research conference. Mr. Chinkin helps oversee STI's role in running the EPA's award winning AirNow program, which disseminates air quality data in near-real time throughout the entire U.S.

Chronology of Education and Work Experience

- 1978-1979: Assistant Weather Producer, KCRA-TV Channel 3, Sacramento, CA
 - Decoded weather data and prepared in-studio weather displays for broadcast
- 1979-1981: Student Assistant, Meteorology Section, California Air Resources Board
 - Evaluated meteorological data
 - Analyzed isobaric pressure charts and wind flow patterns
- 1980: Weather Reporter, KDVS Radio Station, Davis, CA
 - Prepared and presented weather broadcasts for California
- 1980: Instrument Technician, Air Quality Group, University of California, Davis
 - Maintained and calibrated particulate samplers in remote areas of the western United States
- 1981: BS, Atmospheric Science, *summa cum laude*, University of California, Davis
- 1981-1982: Air Pollution Specialist, Analysis and Projects Section, California Air Resources Board
 - Prepared comprehensive technical reports requiring computer programming and statistical analyses
 - Produced the "California Air Quality Data Report"
- 1982-1984: Assistant Meteorologist, Meteorology Section, California Air Resources Board
 - Conducted climatological studies relating to air pollution in California
 - Applied meteorological principles to engineering evaluations and statistical analyses
 - Developed guidelines for agricultural burning
- 1984: MS, Atmospheric Science, University of California, Davis
- 1984-1989: Senior Atmospheric Scientist, Systems Applications, Inc., San Rafael, CA
 - Conducted emissions inventory studies relating to air pollution in various regions of the U.S.
 - Developed software to process emissions inventory data into model-ready inputs for comprehensive 3-dimensional photochemical models

- 1989-1992: Manager of Emissions Modeling Group, Systems Applications, Inc., San Rafael, CA
 - Managed emissions inventory studies relating to air pollution throughout the U.S. and Asia
 - Conducted air quality studies for government and private industry
- 1992-1998: Manager of Emissions Modeling, Sonoma Technology, Inc., Petaluma, CA
 - Managed emissions inventory studies relating to air pollution worldwide
 - Managed air quality studies for government and private industry
 - Managed a multi-million dollar level-of-effort contract with the U.S. Environmental Protection Agency for air quality modeling assistance
- 1998-2002: Vice President, Sonoma Technology, Inc., Petaluma, CA
 - Managed emissions modeling group and meteorological programs group
- 1999-2002: Vice President and General Manager, Sonoma Technology, Inc., Petaluma, CA
 - Managed emissions modeling group and meteorological programs group
 - Responsible for financial oversight of company operations including financial performance (e.g., cash flow, profit and loss, backlog, and overhead rates)
- 2000: Appointed to the Board of Directors, Sonoma Technology, Inc., Petaluma, CA
- 2002-2006: Senior Vice President, Sonoma Technology, Inc., Petaluma, CA
- 2004: Appointed to the National Research Council of the National Academy of Sciences Committee on the Effects of Changes in New Source Review Programs for Stationary Sources of Air Pollutants
- 2005: Selected as peer reviewer for North American Research Strategy for Tropospheric Ozone (NARSTO) report, "Improving Emission Inventories for Effective Air Quality Management Across North America"
- 2006-2017: President, Sonoma Technology, Inc., Petaluma, CA
- 2017-Present: Managing Director of Litigation Support, Chief Scientist, President Emeritus, Sonoma Technology, Inc., Petaluma, CA

Professional Memberships

- Air & Waste Management Association
- American Meteorological Society (1979-1984, 2012)
- California Registered Environmental Assessor (REA-00715) (1984-1989)
- International Association of Wildland Fire

Professional Development

- 1982: Statistics for Decision Makers
- 1982: Air Pollution Enforcement Symposium, California Air Resources Board
- 2001: Understanding Finance and Accounting

Peer Reviewer

- U.S. Environmental Protection Agency
- Journal of the Air and Waste Management Association
- International Journal of Environmental Studies
- North American Research Strategy for Tropospheric Ozone (NARSTO)

Appendix B: List of Publications

Journal Articles

- Dourson M.L., Chinkin L.R., MacIntosh D.L., Finn J.A., Brown K.W., Reid S.B., and Martinez J.M. (2016) A case study of potential human health impacts from petroleum coke transfer facilities. *J. Air Waste Manage.*, doi: 10.1080/10962247.2016.118032 (STI-6508).
- McCarthy M.C., Hafner H.R., Chinkin L.R., and Charrier J.G. (2007) Temporal variability of selected air toxics in the United States. *Atmos. Environ.*, doi:10.1016/j.atmosenv.2007.1005.1037 (STI-2894).

Meeting Presentations and Conference Proceedings

- Brown S.G., Chinkin L.R., Bai S., Roberts P.T., McCarthy M.C., and Vaughn D.L. (2015) Changes in black carbon outdoors and indoors at near-roadway schools in Las Vegas: 2008 to 2013. Presented at the *34th Annual AAAR Conference, Minneapolis, MN, October 12-16*, by Sonoma Technology, Inc., Petaluma, CA. STI-6256.
- Drury S.A. and Chinkin L.R. (2015) Modeling potential fire behavior changes due to fuel breaks in the Monterey Ranger District, Los Padres National Forest, California. Poster presented at the *13th International Wildland Safety Summit and 4th Human Dimensions of Wildland Fire Conference, Boise, ID, April 20-24*, by Sonoma Technology, Inc., Petaluma, CA. STI-6178.
- Drury S.A., Weyenberg S., Huang S., Raffuse S.M., and Chinkin L.R. (2015) Modeling fire behavior, fire effects, and smoke concentrations for prescribed burns on the Indiana Dunes National Lakeshore. Poster presented at the *Midwest Fire Conference: Keeping Fire Working for the Land, Dubuque, IA, February 17-19*. STI-6167.
- Drury S.A. and Chinkin L.R. (2014) Modeling potential fire behavior changes due to fuel breaks in the Monterey Ranger District, Los Padres National Forest, California. Poster presented at the *A Future with Fire Conference, McClellan, CA, December 2-3*, by Sonoma Technology, Inc., Petaluma, CA. STI-6136.
- Chinkin L.R., Noha D.J., and Haste T.L. (2013) IFTDSS system architecture. Presented to the Joint Fire Science Program, Software Engineering Institute, Boise, Idaho, STI-910925-5633, April 23.
- Drury S.A., Haste T.L., Banwell E.M., Noha D.J., and Chinkin L.R. (2012) Interagency Fuels Treatment Decision Support System (IFTDSS). Presented at *5th International Fire Ecology and Management Congress, Portland, OR, December 3-7* (STI-5456).
- Raffuse S.M., Larkin N.K., Strand T.T., Drury S.A., Solomon R.C., Sullivan D.C., Wheeler N.J.M., and Chinkin L.R. (2010) Developing an improved wildland fire emissions inventory for the United States. Poster presented at the *International Workshop on Air Quality Forecasting Research, Quebec City, Canada, November 16-18* (STI-4034).
- Wheeler N., Funk T., Raffuse S., Drury S., Nuss P., Unger K., Yahdav L., Pryden D., Healy A., Haderman M., Chinkin L., Cissel J., and Rauscher H.M. (2010) A new decision support system based on a service-oriented architecture. Paper presented at the *9th Annual CMAS Conference, Chapel Hill, NC, October*

11 by Sonoma Technology, Inc., Petaluma, CA, Joint Fire Science Program, Boise, ID, and Rauscher Enterprises LLC, Leicester, NC (STI 3896).

Reid S.B., Pollard E.K., Du Y., Chinkin L.R., Hammond D., and Norris G. (2010) Development of a local-scale emissions inventory for the Cleveland Multiple Air Pollutant Study. Presented to the *19th International Emissions Inventory Conference, San Antonio, TX, September 28*, by Sonoma Technology, Inc., Petaluma, CA and U.S. Environmental Protection Agency, Research Triangle Park, NC (STI-3943).

Reid S.B., Pollard E.K., Du Y., Chinkin L.R., Hammond D., and Norris G. (2010) Development of a local-scale emissions inventory for the Cleveland Multiple Air Pollutant Study. Paper presented at the *19th International Emissions Inventory Conference, San Antonio, Texas, September 27-30*, by Sonoma Technology, Inc., Petaluma, CA and U.S. Environmental Protection Agency, Research Triangle Park, NC (STI-3944).

Chinkin L.R., Sullivan D.C., Raffuse S.M., Strand T., Larkin N., and Solomon R. (2009) Enhancements to the BlueSky Emissions Assessment and Air Quality Prediction System. Presented at the *National Air Quality Conference, Dallas, TX, March 2-5*. (STI-3545).

Raffuse S., Gilliland E., Sullivan D., Wheeler N., Chinkin L., Larkin S., Solomon R., Strand T., and Pace T. (2008) Development of wildland fire emission inventories with the BlueSky Smoke Modeling Framework. Presented at the *7th Annual Community Modeling and Analysis System (CMAS) Conference Chapel Hill, NC, October 7*, by Sonoma Technology, Inc., Petaluma, CA; U.S. Forest Service AirFire Team, Seattle, WA; and U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC (STI-3457).

Larkin N.K., Strand T., Solomon R., Raffuse S., Sullivan D.C., Chinkin L., Brown T., O'Neill S., Friedl L., and Knighton R. (2008) The state of smoke tools: What we know now. Presented at the *International Association of Wildland Fire, The '88 Fires: Yellowstone & Beyond, Jackson Hole, WY, September 22-27*, by the U.S. Forest Service AirFire Team, Seattle, WA; Sonoma Technology, Inc., Petaluma, CA; Desert Research Institute, Reno, NV; USDA Natural Resource Conservation Service, Portland, OR; NASA, Washington, DC; and USDA Cooperative State Research, Education, and Extension Service, Washington, DC.

Raffuse S.M., Sullivan D.C., Gilliland E.K., Chinkin L.R., Larkin S., Solomon R., and Pace T. (2008) Development of wildland fire emission inventories for 2003-2006 and sensitivity analyses. Presentation made at the *U.S. Environmental Protection Agency's 17th International Emission Inventory Conference, Portland, OR, June 5*, by Sonoma Technology, Inc., Petaluma, CA; U.S. Forest Service AirFire Team, Seattle, WA; and U.S. Environmental Protection Agency Office of Air Quality Planning and Standards, Research Triangle Park, NC (STI-905028-3377).

Sullivan D.C., Raffuse S.M., Pryden D.A., Craig K.J., Reid S.B., Wheeler N.J.M., Chinkin L.R., Larkin N.K., Solomon R., and Strand T. (2008) Development and applications of systems for modeling emissions and smoke from fires: the BlueSky smoke modeling framework and SMARTFIRE. Paper presented at the *17th International Emissions Inventory Conference, Portland, OR, June 5*, by Sonoma Technology, Inc., Petaluma, CA, and the U.S. Forest Service, Seattle, WA (STI-3378).

Wheeler N.J.M., Craig K.J., Reid S.B., Gilliland E.K., Sullivan D.C., and Chinkin L.R. (2008) The BlueSky Gateway air quality forecast system for fire management. Presented at the *BlueSky Smoke Modeling Framework Stakeholders' Meeting, Boise, ID, May 20-22* (STI-905028-3367).

- Raffuse S.M., Sullivan D.C., Chinkin L.R., Pryden D.A., Wheeler N.J.M., Larkin N.K., Solomon R., and Soja A. (2007) Integration and reconciliation of satellite-detected and incident command-reported wildfire information in the BlueSky smoke modeling framework. Presented at the *6th Annual CMAS Conference, Chapel Hill, NC, October 1-3*, by Sonoma Technology, Inc., Petaluma, CA, the U.S. Forest Service AirFire Team, Seattle, WA, and the National Institute of Aerospace, Hampton, VA (STI-3227).
- Raffuse S.M., Sullivan D.C., Chinkin L.R., Larkin N.K., Solomon R., and Soja A. (2007) Integration of satellite-detected and incident command-reported wildfire information into BlueSky. Paper No. 205 presented at the *Air & Waste Management Association's 100th Annual Conference & Exhibition, Pittsburgh, PA, June 26-29* (STI-3127).
- Reid S.B., Chinkin L.R., Penfold B.M., and Gilliland E.K. (2007) Emissions inventory validation and improvement: a Central California case study. Conference paper prepared for the *U.S. Environmental Protection Agency's 16th Annual Emission Inventory Conference, Raleigh, NC, May 14-17*, by Sonoma Technology, Inc., Petaluma, CA (STI-3109).
- Raffuse S.M., Sullivan D.C., Chinkin L.R., Larkin S., Solomon R., and Soja A. (2007) Integration of satellite detected and incident command reported wildfire information into BlueSky. Presented at the *BlueSky Annual Meeting, Winthrop, WA, May 22*, by Sonoma Technology, Inc., Petaluma, CA, U.S. Forest Service AirFire Team, Seattle, WA, and the National Institute of Aerospace, Hampton, VA (STI-3086).

Formal Reports

- Reid S.B. and Chinkin L.R. (2010) Assessment of local-scale emissions inventory development by state and local agencies. Final Report prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC by Sonoma Technology, Inc., Petaluma, CA, STI-910120-3972-FR, October.
- Sullivan D.C., Raffuse S.M., Pryden D.A., Craig K., Wheeler N.J.M., Chinkin L.R., Larkin N.K., Strand T., and Solomon R. (2009) Enhancements to the BlueSky emissions assessment and air quality prediction system. Benchmark report prepared for the National Aeronautics and Space Administration, Washington, DC, by Sonoma Technology, Inc., Petaluma, CA, and the AirFire Team, Pacific Northwest Research Lab, US Forest Service, Seattle, WA, STI-905028-3753-BMR, November.
- Funk T.H., Raffuse S.M., Chinkin L.R., and Rauscher H.M. (2009) The development of an Interagency Fuels Treatment Decision Support System. Presentation made to the Joint Fire Science Program, The National Interagency Fuels Coordination Group, Boise, ID by Sonoma Technology, Inc., Petaluma, CA, and the Joint Fire Science Program, Boise, ID, STI-908038-3587, March 31.
- Funk T.H., Rauscher M., Raffuse S.M., and Chinkin L.R. (2008) Findings of the current practices and needs assessment for the Interagency Fuels Treatment Decision Support System (IFT-DSS) project. Technical memorandum prepared for the Interagency Fuels Treatment Work Group (IFTWG), by Sonoma Technology, Inc., Petaluma, CA, and the Air Fire Science Team, Seattle, WA, STI-908038.01-3504, December.
- Chinkin L.R. and Wheeler N.J.M. (2008) Rebuttal and supplemental expert report: Analysis of air quality impacts. Final report prepared on behalf of Plaintiff United States and Plaintiff-Intervenors State of New York, State of New Jersey, State of Connecticut, Hoosier Environmental Council, and Ohio Environmental Council Sonoma Technology, Inc., Petaluma, CA, STI-908042-3465-FR, October.

Reid S.B., Chinkin L.R., McCarthy M.C., Raffuse S.M., and Brown S.G. (2008) A comparison of ambient measurements to emissions representations for modeling to support the Central California Ozone Study (CCOS). Final report prepared for the California Air Resources Board, Sacramento, CA, by Sonoma Technology, Inc., Petaluma, CA, STI-905044.13-3144-FR, October.

Chinkin L.R. and Wheeler N.J.M. (2008) Expert report of Lyle R. Chinkin and Neil J. M. Wheeler: Analysis of air quality impacts. Final report prepared on behalf of Plaintiff United States and Plaintiff-Intervenors State of New York, State of New Jersey, State of Connecticut, Hoosier Environmental Council, and Ohio Environmental Council by Sonoma Technology, Inc., Petaluma, CA, STI-908042-3432-FR, August.

Appendix C: Previous Expert Testimony

I, Lyle R. Chinkin, have testified as an expert witness at a trial or deposition in the past four years. The cases in which I have been deposed and testified are as follows:

- United States of America, et al. v. Westvaco Corporation, Civil Action No. MJG 00-CV-2602
- United States of America, et al. v. CITGO Petroleum Corporation, Civil Action No. 2:08-CV-00893
- United States of America v. DTE Energy Company and Detroit Edison Company, Civil Action No. 2:10-cv-13101-BAF-RSW

Appendix D: Statement of Compensation

Sonoma Technology, Inc. (STI) has been compensated at \$425 per hour for Lyle R. Chinkin's services to Quinn Emanuel. For any deposition or trial testimony Quinn Emanuel will compensate STI at a rate of 150% of Mr. Chinkin's rates in effect at the time the testimony is provided.