Case File Number DET180082-A01 **February 19, 2020**

Location:	**685 85th Avenue – See map on reverse**
Assessor's Parcel Numbers:	**042-4318-008**
Proposal:	Appeal of a determination from the Zoning Manager that states a rock and concrete crushing activity at the site is: 1) classified as Heavy/High Impact Manufacturing Industrial Activities in the Planning Code, and 2) not a legal nonconforming activity. (Continuation of item from the 9/18/19 Planning Commission meeting.)
Applicant:	William Crotinger /Sean R Marciniak, Miller Starr Regalia
Appellant:	William Crotinger /Sean R Marciniak, Miller Starr Regalia
Case File Number:	**DET180082-A01**
Planning Permits Required:	None
General Plan:	Commercial Industrial Mix and General Industrial
Zoning:	Commercial Industrial Mix - 2 (CIX-2) Zone and Industrial and General Industrial Zone
Environmental Determination:	Categorically Exempt under California Environmental Quality Act (CEQA) Guidelines Section 15306, Information collection
Historic Status:	Non-Historic Property
City Council District:	7
Status:	The zoning determination letter was mailed on July 25, 2017 and again on February 02, 2018; Project appealed on November 3, 2018.
Staff Recommendation:	Deny the Appeal and uphold the Zoning Manager's determination.
Finality of Decision:	Final (cannot be appealed to the City Council pursuant to Section 17.132.030 of the Planning Code)
For Further Information:	Contact case Planner **Moe Hackett** at **(510) 238-3973** or **mhackett@oaklandca.gov**

SUMMARY

This item is an appeal of a zoning determination that a rock and cement crushing, sorting, and processing facility was illegally expanded into a warehouse on a neighboring parcel. Staff had recommended denial of the appeal at the September 18, 2019 Planning Commission meeting (see Attachment A for the Staff Report). Staff had considered the activity Heavy/High Impact Manufacturing Industrial Activities, and not permitted in the Commercial Industrial Mix - 2 (CIX-2) Zone.

#5

BACKGROUND

On July 16, 2013, the Bureau of Planning Issued a Zoning Clearance (ZC131567), on the basis that an existing rock and concrete crushing and processing operation at 8291, 8300, and 8304 Baldwin Street (Site 1) was a legal, nonconforming activity. This determination was based on evidence showing the operation was "grandfathered in" because it started when the site was within the M-40 Heavy Industrial Zone, which permits the activity. In 2008, the Zoning at the site changed from M-40 to Commercial Industrial Mix (CIX) – 2, which does not permit the activity (see Zoning Analysis, below).

Between June 9, 2014 and May 11, 2015, two holes were created on the side of a warehouse on an adjacent parcel at 685 85th Avenue (Site 2) to accommodate a machine for conveying rocks and concrete from Site 1 for sorting, processing, and storage. Staff based this time period on aerial images of the site contained on Google Earth. The holes in the warehouse were created without the benefit of permits, and the issue is currently being investigated by the Building Bureau's Code Enforcement Division. Site 2 was also rezoned to CIX-2 in 2008.

A Zoning Manager's determination letter was requested on July 13, 2018 by William Crotinger and Sean Marciniak of Miller Starr Regalia, the attorneys for the operator of the concrete processing and rock crushing operation (see Attachment A). This request was in response to a Notice of Violation issued by the City regarding the rock and concrete processing in the structure on Site 2.

Staff determined that the Zoning Manager considers the operation to be a Heavy/High Impact Industrial Activity under Chapter 17.10 of the Planning Code (see Attachment A for the October 29, 2018 determination letter). The determination further stated that expansion of the operation would require a Major Conditional Use Permit (a recent review of the letter determined that the activity is not permitted within the CIX-2 Zone at 685 85th Avenue; therefore, the expansion would require a Major Variance to expand). The determination letter stated that the expansion into the warehouse at Site 2 was performed without the benefit of permits and must be legalized or the activity vacated.

The applicant appealed the determination on November 13, 2018 (see Attachment A for the Appeal). The appeal went to the Planning Commission on September 18, 2019. At the meeting, the Planning Commission requested that staff provide a discussion of the determination that takes into account the impacts of the activity being indoors instead of outdoors.

On February 13, 2020, the owner of 685 85th Avenue submitted material related to project (see Attachment B). Due to time constraints, staff has only briefly read the submission. However, none of the material appears to relate to the appropriate classification of the activities taking place within the building and is, therefore, not relevant to this report. Staff will more thoroughly review the material and present an analysis at the February 19, 2020 meeting.

CLASSIFCATION ANALYSIS

In response the Planning Commission's request, staff is providing an analysis of different use classifications under the Planning Code where the indoor operation can appropriately fit based on substantial evidence in the record pertaining to the description of the operation and its purported impacts. The following lists four possible classifications for the indoor rock crushing operation for the Planning Commission to consider: Heavy/High Impact Manufacturing Industrial, Extensive Impact Civic, Recycling and Waste-Related Industrial, and General Manufacturing Industrial.

<u>Heavy/High Impact Manufacturing Industrial</u>

Description. Section 17.10.580 of the Planning Code describes Heavy/High Impact Manufacturing

Industrial Activities as the following:

> Heavy/High Impact Manufacturing Industrial Activities include high impact or hazardous manufacturing processes. This classification also includes certain activities accessory to the above, as specified in Section 17.10.040. Examples of activities in this classification include, but are not limited to, the following:
>
> A. Any manufacturing use with large-scale facilities for outdoor oil and gas storage;
> B. Any biotechnology research, development or production activities involving materials defined by the National Institute of Health as Risk Group 4 or Restricted Agents (commonly known as "biosafety level 4");
> C. Battery manufacturing and storage;
> D. Lime and gypsum products manufacturing;
> E. Non-ferrous metals production, processing, smelting and refining;
> F. Painting, coating and adhesive manufacturing;
> G. Synthetic dye and pigment manufacturing;
> H. Urethane and other open-cell foam product manufacturing;
> I. Petroleum and coal products manufacturing and refining;
> J. Primary metal smelting;
> K. Vinegar, yeast and other pungent, odor-causing items production;
> L. Leather tanning;
> M. Cement and asphalt manufacturing;
> N. Explosives manufacturing;
> O. Fertilizer and other agricultural chemical manufacturing.

Analysis. As mentioned, staff had previously determined that the crushing, processing, or sorting of concrete and rocks was categorized within the Heavy/High Impact Manufacturing Industrial land use classification. Staff determined that the classification was appropriate because it most closely describes the proposed activity, namely due to the similarity of materials being processed and the loud noises produced by cement and rock crushing, sorting, and processing. This determination was consistent with how the activity had been classified in the past. Further, no other classification mentions the processing of cement.

Since the September 18, 2019, Planning Commission meeting, the appellant provided staff technical analyses indicating that the activity within the warehouse does not create noise or air quality impacts to the surrounding neighborhood greater than outlined in the Performance Standards Chapter of the Planning Code (Chapter 17.120) or the Bay Area Air Quality Management District (BAAQMD) Significance Thresholds for particulate matter and greenhouse gas emissions, respectively. The following two reports were submitted, which are contained in Attachments C and D: "Air Quality, Greenhouse Gas and Dispersion Modeling Report" (Air Quality Analysis) and "Noise Impact Analysis Report Silverado/Argent Materials Recycling Project" (Noise Analysis), respectively.

The Air Quality Analysis indicates that the operation is approximately 90 percent below BAAQMD thresholds for particulate matter and greenhouse gas emissions. The report indicates that emissions are relatively low because the project's warehouse operations are electrified and do not use diesel fuel and that a minimal amount of dust produced from rock crushing escapes the warehouse. The Noise Analysis indicates that the operation within the warehouse does not exceed either the commercial or the industrial noise maximums in the Performance Standards of the Planning Code.

An activity is only appropriately categorized as Heavy/High Impacts if it includes high impact or hazardous manufacturing processes. The analyses indicate that the activity does not have a high impact on the neighborhood and the rock crushing does not involve hazardous materials or processes. Therefore, the operation should not be categorized as a Heavy/High Impact Manufacturing Industrial Activity.

Regulation. This activity classification is not permitted in the CIX-2 Zone and, therefore, would not be permitted to expand into the warehouse.

Extensive Impact Civic Activities

Description. Section 17.10.240 of the Planning Code describes Extensive Impact Civic Activities as the following:

> Extensive Impact Civic Activities include the activities typically performed by, or the maintenance and operation of, the following institutions and installations:
>
> A. Airports, heliports, and helistops;
> B. Cemeteries, mausoleums, columbariums, and crematories;
> C. Colleges, junior colleges, and universities, but excluding business schools or other similar types of trade schools operated as profit-making enterprises;
> D. Detention and correction institutions;
> E. Docks and wharves operated by a public agency;
> F. Electric transmission lines;
> G. Garbage dumps and transfer stations;
> H. Curbside recycling collection centers;
> I. Golf courses and driving ranges;
> J. Major mail-processing centers;
> K. Military installations;
> L. Public and public utility corporation or truck yards;
> M. Radio and television transmission stations;
> N. Railroad and bus terminals;
> O. Railroad rights-of-way and yards and bus storage areas;
> P. Reservoirs and water tanks;
> Q. Sewage disposal tanks;
> R. Stadiums, sports arenas, auditoriums, and bandstands;
> S. Truck terminals operated by a public agency;
> T. Zoological gardens and wildlife preserves;
> U. Campgrounds;
> V. Stormwater detention ponds and facilities;
> W. Facilities supervised by or under contract with the State Department of Corrections, including alternative sentencing and community work release programs.

Analysis. This classification is offered for consideration because it lists transfer stations in its list of possible facilities and the County of Alameda considers the rock crushing operation a transfer station for permitting purposes. However, staff does not consider it an appropriate classification for the following reasons.

OMC Section 8.28.010 describes a transfer station as "a facility with all appropriate permits utilized to receive collected materials, to temporarily store the collected materials, and to transfer the collected materials to a processing or disposal facility as appropriate." Staff does not believe that this is an appropriate description of the operation because it does not mention treating or transforming materials. Transfer stations are generally only holding areas where larger trucks pick up materials for transfer to processing facilities.

Further, the Planning Code considers the classification a Civic Activity, which includes "the performance of utility, educational, recreational, cultural, medical, protective, governmental, and other activities which are strongly vested with public or social importance." In general, the City has only categorized government operations (including functions contracted out by the government) or nonprofit facilities to be Civic Activities, not traditional for-profit operations. The subject rock crushing operation is a for-profit venture.

Regulation. This activity would require the granting of a Conditional Use Permit to expand into the warehouse because it is conditionally permitted in the CIX-2 Zone.

<u>Recycling and Waste-Related Industrial Activities</u>

Description. Section 17.10.586 of the Planning Code describes this activity as the following:

> Recycling and Waste-Related Industrial Activities include recycling collection, intermediate processing, and other activities related to the storage and processing of used and waste materials. This classification also includes certain activities accessory to the above, as specified in Section 17.10.040.
>
> A. Satellite Recycling Collection Centers. An activity accepting recyclable non-hazardous materials directly from the public by donation, redemption, or purchase at facilities less than five hundred (500) square feet in area that generally do not use power-driven processing equipment.
> Satellite collection centers may include mobile recycling units, bulk reverse vending machines, kiosk type units, and/or unattended containers placed for the donation of recyclable materials. These facilities are generally located in, or associated with supermarkets and shopping centers. Most, though not all, satellite collection centers are set up pursuant to requirements of the California Beverage Container Recycling and Litter Reduction Act of 1986, which requires establishment of such centers in all "Convenience Zones" (CZ) in California, defined as the area within one-half (½) mile of all supermarkets, to collect beverage containers made from materials such as aluminum, glass, plastic, and bimetal for recycling.
>
> B. Primary Recycling Collection Centers. An activity accepting recyclable non-hazardous materials by donation, redemption, or purchase at facilities occupying an area of more than five hundred (500) square feet that are not operated incidental to a host use and that may have a permanent building. Primary collection centers typically use power-driven equipment to sort and condense material for shipment to an intermediate processor or other user. Primary Recycling Collection Centers may have a combination of outdoor processing and storage.

Analysis. Staff does not consider this an appropriate classification because these facilities are intended to address materials that are received in relatively small amounts by donation. These activities are generally related to a paper, glass, and plastics and do not involve large amounts of construction debris such as the subject operation.

Regulation. This activity would require the granting of a Conditional Use Permit to expand into the warehouse because it is conditionally permitted in the CIX-2 Zone.

<u>General Manufacturing Industrial Activities</u>

Description. Section 17.10.580 of the Planning Code describes Heavy/High Impact Manufacturing Industrial Activities as the following:

> General Manufacturing Industrial Activities include the manufacturing, compounding, processing, assembling, packaging or treatment of products from extracted, raw, recycled or secondary materials; they may have some or all activities conducted outdoors. This classification excludes all activities under Intermediate Recycling Processing Facilities. The Zoning Administrator or his/her designee may place

an activity that otherwise fits this description, but does not produce noise, vibration, air pollution, fire hazard, or noxious emission that will violate standard in Chapter 17.120, or another federal, State or local standards into the Light Manufacturing Industrial Activities classification. This classification also includes certain activities accessory to the above, as specified in Section 17.10.040. Examples of activities in this classification include, but are not limited to, the following:

A. Chemical manufacturing (except for the chemical products listed under Heavy/High/Impact Manufacturing);
B. Glass manufacturing;
C. Metal foundries;
D. Wood product manufacturing;
E. Heavy equipment and manufacturing;
F. Paper finishing;
G. Pipe production facilities;
H. Textile mills;
I. Tire retreading and recapping;
J. Wood product manufacturing.

Analysis. Staff has determined that General Manufacturing Industrial Activities is the most accurate classification for an indoor rock and concrete crushing operation. As discussed previously, the proposal does not generate the impacts that would classify it as Heavy/High Impact. Further, the operation includes the processing of secondary materials and heavy equipment as described in the classification.

Regulation. Under the Planning Code, this activity would be allowed, by right, to expand into the warehouse because it is permitted in the CIX-2 Zone. However, expansion into the warehouse would be required to obtain all necessary building permits.

CONCLUSION

After reviewing technical analyses provided by the appellant, staff recommends re-classifying the rock crushing operation from a Heavy/High Impact Industrial Activity to a General Manufacturing Industrial Activity. This reclassification is appropriate because of the analyses demonstrate that, because the expansion of the operation the adjacent lot is indoors

RECOMMENDATIONS:

1. Uphold appeal and re-classify the rock crushing operation as a General Manufacturing Industrial Activity.

Prepared by:

MOE HACKETT
Planner II

Reviewed by:

ROBERT MERKAMP
Zoning Manager

Approved for forwarding to the
City Planning Commission:

for

EDWARD MANASSE
Deputy Director
Bureau of Planning

ATTACHMENTS:

A. September 18, 2019 Planning Commission October 29, 2018 Determination Letter
B. Materials submitted February 13, 2020 by the owner of 685 85th Avenue
C. Air Quality, Greenhouse Gas and Dispersion Modeling Report Argent Materials Oakland California (dated January 14, 2020)
D. Noise Impact Analysis Report Silverado/Argent Materials Recycling Project City of Oakland, Alameda County, California (dated January 3, 2020)

LEGAL NOTICE:

ANY PARTY SEEKING TO CHALLENGE THIS DECISION IN COURT MUST DO SO WITHIN NINETY (90) DAYS OF THE ANNOUNCEMENT OF A FINAL DECISION, PURSUANT TO THE CALIFORNIA CODE OF CIVIL PROCEDURE SECTION 1094.6, UNLESS A SHORTER PERIOD APPLIES.

Oakland City Planning Commission STAFF REPORT

Case File Number DET170053-A01 **September 18, 2019**

Location:	**685 85th Avenue – See map on reverse**
Assessor's Parcel Numbers:	**042-4318-008**
Proposal:	Appeal of a determination from the Zoning Manager that found a rock and concrete crushing activity at the site is: 1) classified as Heavy/High Impact Manufacturing Industrial Activities in the Planning Code, and 2) not a legal nonconforming activity.
Applicant:	William Crotinger /Sean R Marciniak, Miller Starr Regalia
Appellant:	William Crotinger /Sean R Marciniak, Miller Starr Regalia
Case File Number:	**DET180082-A01**
Planning Permits Required:	None
General Plan:	Commercial Industrial Mix and General Industrial
Zoning:	Commercial Industrial Mix - 2 (CIX-2) Zone and Industrial and General Industrial Zone
Environmental Determination:	Categorically Exempt under California Environmental Quality Act (CEQA) Guidelines Section 15306, Information collection
Historic Status:	Non-Historic Property
City Council District:	7
Status:	The zoning determination letter was mailed on July 25, 2017 and again on February 02, 2018; Project appealed on November 3, 2018.
Staff Recommendation:	Deny the Appeal and uphold the Zoning Manager's determination.
Finality of Decision:	Final (cannot be appealed to the City Council pursuant to Section 17.132.030 of the Planning Code)
For Further Information:	Contact case Planner **Moe Hackett** at **(510) 238-3973** or **mhackett@oaklandca.gov**

SUMMARY

This item is an appeal of a zoning determination that a rock and cement crushing, sorting, and processing facility was illegally expanded into a warehouse on a neighboring parcel. Staff recommends denial of the appeal because the activity is not permitted in the Commercial Industrial Mix - 2 (CIX-2) Zone and the Appellant has not demonstrated, based on substantial evidence in the record, that there was an error or abuse of discretion made by the zoning manager in the determination.

6

Attachment A

BACKGROUND

On July 16, 2013, the Bureau of Planning Issued a Zoning Clearance (ZC131567), on the basis that an existing rock and concrete crushing and processing operation at 8291, 8300, and 8304 Baldwin Street (Site 1) was a legal, nonconforming activity. This determination was based on evidence showing the business was "grandfathered" because it started when the site was within the M-40 Heavy Industrial Zone, which permits the activity. In 2008, the Zoning at the site changed from M-40 to Commercial Industrial Mix– 2 (CIX-2), which does not permit the activity (see Zoning Analysis, below).

At some point between June 9, 2014 and May 11, 2015, two holes were created on the side of a warehouse on an adjacent parcel at 685 85th Avenue (Site 2) to accommodate a machine for conveying rocks and concrete from Site 1 for sorting, storage, and further crushing. Staff determined this time-period on aerial images of the site located on Google Earth. The holes in the warehouse were created without the benefit of permits, and the issue is currently being investigated by code enforcement within the Building Bureau. Site 2 was also rezoned to CIX-2 in 2008. A site visit by staff from both the Bureaus of Planning and Building on August 30, 2019 confirmed that sorting, storage, and rock and concrete crushing were being performed within the building on Site 2.

A Zoning Manager's determination letter was requested on July 13, 2018 by William Crotinger and Sean Marciniak of Miller Starr Regalia, the attorneys for the operator of the rock and concrete crushing and processing operation (see Attachment A). This request was in response to a Notice of Violation issued by the City regarding the rock and concrete processing and crushing in the structure on Site 2.

Staff determined that the Zoning Manager considers the operation to be a Heavy/High Impact Industrial Activity under Chapter 17.10 of the Planning Code (see Attachment B for the October 29, 2018 determination letter). The determination further stated that expansion of the operation would require a Major Conditional Use Permit (a recent review of the letter determined that the activity is not permitted within the CIX-2 Zone at 685 85th Avenue; therefore, the expansion would require a Major Variance to expand. This issue is further discussed in the Zoning Analysis Section of this report). The determination letter stated that the expansion into the warehouse at Site 2 was performed without the benefit of permits and must be legalized or the activity vacated.

The applicant appealed the determination on November 13, 2018 (see Attachment C for the Appeal). The appeal is the subject of this report. Per Section 17.132.020 of the City of Oakland Planning Code, to uphold the appeal, the Planning Commission must determine that an error or abuse of discretion was made by the Zoning Manager or the Zoning Manager's decision is not supported by evidence in the record. The arguments raised by the Appellant are summarized below in the "Basis for the Appeal" portion of this report, along with City staff's response to each argument.

PROPERTY AND NEIGHBORHOOD DESCRIPTION

There are two sites in question: three parcels with the legal, nonconforming rock and concrete crushing operation at 8291, 8300, and 8304 Baldwin Street (Site 1) and the parcel that received the expansion at 685 85th Avenue (Site 2). Site 1 is 167,792 square-feet of open area that contains no structures, except for two small office areas. It contains large piles of concrete, truck routes, and machines for the crushing, sorting, and movement of rocks and concrete. Site 2 has an area of 204,276 square feet. This parcel is almost completely covered by a single large industrial building, which also contains machines that sort, crush, and move rocks and concrete. The industrial building also contains piles of sorted rocks and concrete. The context of the surrounding area is industrial, consisting of mostly large utilitarian buildings and open lots of varying sizes. The nearest residential areas are over 1,900 feet away.

ZONING ANALYSIS

Site 1 is entirely in the CIX-2 Industrial Zone. Site 2 is also within the CIX-2 Industrial Zone, except for the front approximately 180 feet of the property, which is in the General Industrial (IG) Zone. This zoning analysis will only consider the regulations of the CIX-2 Zone because the activity was expanded to the area of the parcel with that designation.

The CIX-2 Zone is intended to create, preserve, and enhance industrial areas that are appropriate for a wide variety of commercial and industrial establishments. It allows for a large custom, light, and general manufacturing with certain limitations relating to distance from residentially zoned areas.

Staff determined that the crushing and processing of concrete and rocks at the site is categorized within the Heavy/High Impact Manufacturing Industrial land use classification. Section 17.10.580 of the Planning Code describes this classification as the following:

> Heavy/High Impact Manufacturing Industrial Activities include high impact or hazardous manufacturing processes. This classification also includes certain activities accessory to the above, as specified in Section 17.10.040. Examples of activities in this classification include, but are not limited to, the following:
>
> A. Any manufacturing use with large-scale facilities for outdoor oil and gas storage;
> B. Any biotechnology research, development or production activities involving materials defined by the National Institute of Health as Risk Group 4 or Restricted Agents (commonly known as "biosafety level 4");
> C. Battery manufacturing and storage;
> D. Lime and gypsum products manufacturing;
> E. Non-ferrous metals production, processing, smelting and refining;
> F. Painting, coating and adhesive manufacturing;
> G. Synthetic dye and pigment manufacturing;
> H. Urethane and other open-cell foam product manufacturing;
> I. Petroleum and coal products manufacturing and refining;
> J. Primary metal smelting;
> K. Vinegar, yeast and other pungent, odor-causing items production;
> L. Leather tanning;
> M. <u>Cement and asphalt manufacturing (emphasis added)</u>;
> N. Explosives manufacturing;
> O. Fertilizer and other agricultural chemical manufacturing.

Staff determined this classification, which includes cement and asphalt manufacturing (underlined above), because it most closely describes the proposed activity and due to the loud noises and dust produced by cement and rock crushing, sorting, and processing. The activity on Site 2 is particularly hazardous because of the concentration of exhaust from the machines and the dust created by the rock crushing and sorting within a building. This determination is consistent with how the activity at other locations has been classified in the past. No other classification mentions the processing of cement.

This activity is not permitted in the CIX-2 Zone and, therefore, requires a Variance to operate. Section 17.148.020 states that Variances involving activities are considered Major and, thus, require a decision by the Planning Commission. Examples of activities permitted in the CIX-2 Zone include General Warehousing Storage and Distribution and Custom, Light, and General Manufacturing Industrial Activities.

Note that the determination letter incorrectly stated that the expansion required a Major Conditional Use Permit to expand into Site 2. Recent review of the issue determined that the activity is not allowed in the CIX-2 Zone and, therefore, requires a Major Variance to operate.

ENVIRONMENTAL DETERMINATION

The California Environmental Quality Act (CEQA) Guidelines statutorily and categorically exempts specific types of projects from Environmental Review. The zoning determination is Categorically Exempt under California Environmental Quality Act (CEQA) Guidelines Section 15306, Information Collection.

BASIS FOR APPEAL

The appellant filed a timely Appeal of the Zoning Manager's determination on November 13, 2018. The following describes the issues raised in the appeal and staff's response. The issues are in **bold** staff response are in *italic*.

1) **The zoning determination letter incorrectly frames our client's request. The City's letter indicates it was prepared "in response to [our] request for a zoning determination to expand ... the current activity to include facilities located at 685 85th Avenue (adjacent building)." We did not request that the City determine whether our client's "expansion" into the warehouse was lawful because, simply, our client never expanded into the warehouse. Silverado and the concrete recycling company operated on the premises before it, always used the entirety of the warehouse as an integral part of their recycling activities. It seems the City misunderstood the facts and the nature of our request.**

   Staff Response

   In the process of developing the determination, a site visit was made August 30, 2019, that confirmed the expansion of the activities on Site 1 onto Site 2. Staff would have been remiss not to note this in the determination and order termination of the violation. The scope of the determination letter is staff's decision to make, even if it is beyond that requested by the applicant.

   Staff determination that the rock and concrete crushing activities expanded into the warehouse after the 2008 rezoning of the property is based on the scope of the 2013 Zoning Clearance, which did not include Site 2, and aerial imagery from Google Earth that clearly showed two openings created in the building between June 9, 2014 and May 11, 2015 to accommodate the conveyance of rocks and concrete from Site 1. Attachment D shows these images and describes how staff determined when the activity was expanded into Site 2. Note that these openings were created without the benefit of a building permit and the violation is currently under code compliance investigation with the Bureau of Building as well.

   A site visit from Planning staff last winter confirmed the holes in the wall and the conveyers entering the warehouse. On a second site visit with staff from the Bureau of Building on August 30, 2019, staff witnessed rocks and concrete conveyed into the warehouse and sorted depending on size (see Attachment E for photographs of a hole in the wall, conveyer belts entering the warehouse, and the operation of machines crushing and processing rock and concrete within the warehouse). The larger rocks and concrete were further crushed within the warehouse. Staff also witnessed the hazardous indoor air quality condition produced as a result of the indoor rock crushing activities.

   The appellant states that Site 2 had been used as storage for the recycling prior to the 2008 rezoning. However, since Site 2 is on a separate parcel, the activity must be classified separately from the activity on Site 1 (see 17.10.040 of the Planning Code). Therefore, prior to the expansion, the operation on Site 2 was classified as General Warehousing, Storage, and

Distribution Industrial Activities (see Section 17.10.583 of the Planning Code), which is permitted in the CIX-2 Zone and prior zoning.

However, the conveyance of the rocks across a property line and into the warehouse changed the activity on Site 2 to Heavy/High Impact Manufacturing Industrial Activity after the 2008 rezoning of the property to CIX-2. As discussed in the Zoning Analysis section, above, this activity is not permitted in the CIX-2 Zone. Like the operation on Site 1, the processing, sorting, and crushing of rocks is considered Heavy/High Impact Manufacturing Activities because of the creation of noise and dust impacts and this classification most closely describes the operation.

In sum, the Heavy/High Impact Manufacturing Industrial Activity began on Site 2 after the 2008 rezoning to CIX-2, this activity is not permitted in the CIX-2 Zone, and is, therefore neither legal nor conforming. Staff has not found any Zoning Clearance or land use entitlement allowing this activity on Site 2.

2) **The current warehouse uses are not materially different than what occurred under prior zoning. One of the requests in our letter was to determine that Silverado's warehouse operations were legal, non-conforming uses because this activity preceded the City's rezoning of the property in 2008, replacing an industrial (M-40) district with a mixed commercial /industrial (CIX-2) zone district. With this change, certain heavy industrial uses were no longer permitted on the property. As detailed in our request for a zoning determination letter, the warehouse has always been used in conjunction with concrete recycling that occurred in the outdoor yard at 8291-8304 Baldwin Street, both before and after the City's zoning change in 2008.**

Staff Response

See response #1. According to the appeal, warehousing occurred for the rock and concrete operation prior to the rezoning. As described above, rock sorting, processing, and crushing started after the rezoning and are considered Heavy/High Impact Manufacturing Industrial Activities, which is not permitted in the CIX Zone.

3) **The zoning determination letter did not acknowledge the extensive evidence provided by Silverado of the warehouse's historical use. The City's zoning determination letter does not seem to acknowledge or account for the great deal of evidence that Silverado submitted to show the warehouse was used for recycling activities prior to the City's rezoning action in 2008. The evidence includes old lease material, declarations by employees of the previous recycling operator, sign under penalty of perjury; and Alameda County records, all of which show the warehouse has been used, for more than a decade, to store recycling equipment and materials, and for the repair of heavy recycling equipment. We consulted Bay Area planners, who have indicated such evidence is routinely accepted as proof of a legal, non-conforming use, and have attached a letter by a former City of Oakland planner that confirms this practice.**

Staff Response

As mentioned in response #1, since Site 2 is on a separate parcel, the activity on that site must be classified separately from the activity on Site 1 (see 17.10.040 of the Planning Code). Therefore, before the rock crushing, sorting, processing activities began, the operation on Site 2 was classified as General Warehousing, Storage, and Distribution Industrial Activities, which was permitted in the CIX-2 Zone and prior zoning. The expansion of the Heavy/High Impact Manufacturing Industrial Activities to Site 2, however, occurred after the 2008 rezoning. This activity is not permitted in the CIX-2 Zone, and is, therefore, neither conforming nor legal.

4) **Both The zoning determination letter did not address, all, our client's claim that Silverado's indoor operations are permitted by right. Staff's position has been that past Zoning Clearances only address Silverado's outdoor activities, which staff determined were Heavy Industrial Uses, whereas we presented substantial evidence that Silverado's indoor uses are Light Industrial or General Industrial Uses, which are permitted by right in CIX-2 districts. This issue was not addressed in the City's zoning determination letter.**

Staff Response

Staff agrees that the General Warehousing Industrial Activities, when not in conjunction with the Heavy/High Impact Manufacturing Industrial Activities, is permitted in the CIX-2 Zone. However, the crushing, sorting and processing of rock and concrete in the indoor warehouse are classified as Heavy/High Impact Manufacturing Industrial Activities, which are not permitted in the subject zone. Rock and concrete crushing, sorting and processing are classified as Heavy/High Impact Manufacturing Industrial Activities because of its noise and dust impacts and the classification most closely describes the activity. Further, the activity on Site 2 is hazardous due to the concentration of exhaust from the machines and the dust created by the rock crushing and sorting within a building. Staff witnessed this hazardous condition when they visited the site on August 30, 2019. In 2013, the Zoning Manager determined that Heavy/High Impact Manufacturing Activities was the appropriate classification for the operation. This determination was not contested by the applicant.

CONCLUSION

The Appellant has not demonstrated, based on substantial evidence in the record, that there was an error or abuse of discretion made by the Zoning Manager in the determination. Staff made the appropriate interpretation of Use Classification in the Planning Code, and the established history of the operation and actual, present-day site condition (based on Staff's site visit) demonstrate illegal and nonconforming activities at Site 2.

RECOMMENDATIONS: For approvals: 1. Deny the Appeal, thereby upholding the Zoning Manager's determination of unpermitted activities at 685 85th Avenue.

Prepared by:

MOE HACKETT
Planner II

Reviewed by:

ROBERT MERKAMP
Zoning Manager

Approved for forwarding to the
City Planning Commission:

EDWARD MANASSE
Deputy Director
Bureau of Planning

ATTACHMENTS:

A. July 13, 2018 Request for Determination
B. October 29, 2018 Determination Letter
C. November 13, 2018 Appeal of Determination Letter
D. Google Earth aerial imagery demonstrating expansion into Site 2
E. Photographs of conveyer belt entering the warehouse and the rock crushing machine operating within the warehouse.

LEGAL NOTICE:

ANY PARTY SEEKING TO CHALLENGE THIS DECISION IN COURT MUST DO SO WITHIN NINETY (90) DAYS OF THE ANNOUNCEMENT OF A FINAL DECISION, PURSUANT TO THE CALIFORNIA CODE OF CIVIL PROCEDURE SECTION 1094.6, UNLESS A SHORTER PERIOD APPLIES.

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Planning & Zoning Division

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City of Oakland
Planning & Zoning Division

July 13, 2018

Robert Merkamp
Zoning Manager
City of Oakland
Planning and Building Department
250 Frank H. Ogawa Plaza, Ste. 2340
Oakland, CA 94612-2031
Email: RMerkamp@oaklandnet.com

Re: Request for Zoning Determination Letter in relation to 685 85th Avenue; Code Enforcement Case No. 1704270

Dear Mr. Merkamp:

Miller Starr Regalia represents Silverado Contractors, Inc. and Argent Materials, Inc. (collectively, "Silverado") in their recycling operations at 685 85th Avenue and 8291-8304 Baldwin Street in the City of Oakland.[1] In February 2018, the City issued a Notice of Violation ("NOV") concerning these properties, alleging in part that on-site operations were inconsistent with present zoning. Miller Starr Regalia appealed the NOV, on Silverado's behalf, on March 9, 2018.

On July 3, 2018, Administrative Manager Sandra Smith sent us a letter, setting forth the City's process for adjudicating a zoning appeal. In that letter, she indicated the next step to appeal the City's alleged zoning violation would be for Silverado to request a zoning determination letter from you. This letter constitutes such a request.

I. Request that City determine Silverado's outdoor and indoor activities are legal, nonconforming uses.

We hereby request that the City determine that Silverado's recycling operations are lawful. Insofar as these recycling operations occur at 8291, 8300, and 8304 Baldwin Street and 685 85th Street (collectively, "the Properties"), these are legal, nonconforming uses. These operations were permitted by right prior to June 17, 2008, when the City changed the Properties' zoning from an industrial

[1] The assessor parcel numbers for 8291, 8300 and 8304 Baldwin Street are, respectively, 042-4318-044, 042-4318-043, 042-04317-042. The assessor parcel number for 685 85th Avenue is 042-4318-008.

(M-40) district to a CIX-2 (Commercial Industrial Mix – 2) district, and have been conducted continuously since at least 1998.

In support of these determinations, we hereby incorporate by reference the contents of our March 9, 2018 Appeal Letter and each of its 14 exhibits. In addition, we have included in this correspondence additional evidence to support our conclusions that Silverado's operations on each of the Properties are legal, nonconforming uses. These conclusions are explained and evidenced below.

II. Silverado's use of the three outdoor parcels and the warehouse are all legal, nonconforming uses.

A. *Brief summary of Silverado's uses.*

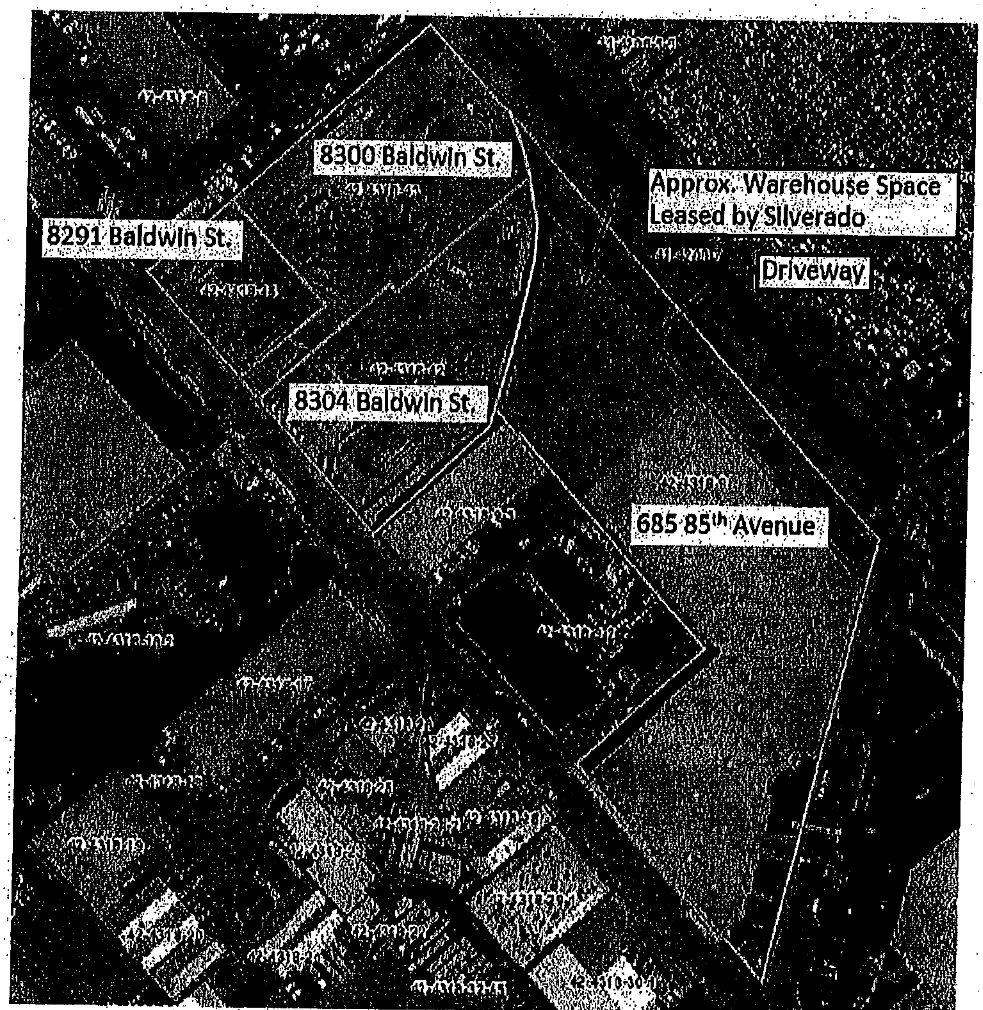
Silverado accepts the delivery of concrete and asphalt from trucks which ingress onto the Properties from 85th Avenue. In the site's yard, materials are unloaded from vehicles, stockpiled, and broken into softball-sized rocks by a mechanical crusher. Depending on market demand, these softball-sized rocks are either sold directly to Silverado's customers, or sent to Silverado's warehouse space for secondary processing and sorting. This warehouse space accommodates the secondary processing and sorting equipment, which takes up less than 16,000 square feet of the 40,000-square-foot indoor area.

After being processed and sorted into smaller aggregates, the materials are stored and made available for pickup by customers in the remaining 24,000 square feet of warehouse space, as well as in outdoor storage areas. Both the indoor and outdoor spaces are also used for the storage and repair of heavy equipment.

Ultimately, the yard and warehouse, and each of the four legal lots they occupy, are operated as an integrated whole, and together allow Silverado to recycle about 425,000 tons of aggregate annually. In past years, Silverado has taken down and recycled enormous projects such as the Bay Bridge and Candlestick Park, and diverted recycled building materials back into local construction projects. Silverado's customers consist largely of utilities, cement suppliers, and contractors (including general engineering, underground, demolition, and paving contractors), and its recycled products are used in a variety of applications, including as components of infrastructure projects (e.g., road and utility beds) and as ingredients in other products (e.g., concrete).

Silverado's recycling center is located in an industrial area of the City near Interstate 880, set amid railroad tracks, a junkyard (used to source recycled car and truck parts), and other industrial uses. The nearest residential homes are located thousands of feet away, and Silverado's immediate neighbors are the Golden Gate Truck Center, the East Bay SPCA, and various cannabis-related businesses.

For convenience, we have included an annotated map of all the Properties:



Over the past several years, Silverado's operations have become increasingly important for the Bay Area construction economy as a source of aggregate. Historically, this material was available from a number of quarry and aggregate mining activities, scattered throughout the Bay Area — some in rivers and other wetland areas. One by one, almost of all these quarry have closed, primarily for environmental reasons, but the construction need for materials has increased significantly. Silverado's operation provides a source of vitally important aggregate close to urban construction needs, without the accompanying environmental damage of quarry in rural areas.

B. ***Silverado's predecessor conducted the same type of recycling operations, on all three outdoor parcels and within the warehouse.***

Each of the outdoor and indoor spaces that Silverado uses for recycling operations was used by a predecessor that conducted similar, integrated recycling operations, and did so before the City's rezoned the area in 2008. Here are the relevant facts:

- Silverado is not the first recycling business to use the Properties to process asphalt and concrete. Since at least the late 1990s, two sister companies — Aman Environmental Construction, Inc. and the Cleveland Wrecking Company ("Aman") — had performed and supported the same recycling operations, turning asphalt and concrete into reusable products. (*See* Appeal Letter, Exhibit 2, ¶ 7.)

- Aman occupied, and used in an integrated manner, the entirety of 8291, 8300, and 8304 Baldwin Street and a portion of 685 85th Avenue, including the 40,000-square-foot warehouse space. There is a great deal of evidence to support this conclusion, including:

  - **A copy of Aman's lease with the owner of the Properties**, which shows Steve Aman and his companies had the right to use all of the outdoor portions of the Properties since 1998, and rights to use the warehouse space starting in November 27, 2006. (*See* **Attachment 1**, [*see* Recital A, which covers the outdoor space, and Paragraph 1, which gave Aman rights to use 40,000 square feet of building space at 689-691 85th Avenue[2]].)

  - **Eyewitness statements of people who worked for and with Aman, signed under penalty of perjury.** These documents include the statements of workers employed by Aman and a third-party trucking company, who utilized the Properties on a frequent basis. (*See* **Attachment 2a-2c**.) These individuals, which include an operations superintendent, a site foreman, and a truck driver who regularly delivered equipment to the site, report that the outdoor areas were used to crush rock, whereas the warehouse was used for storage (e.g., the storage of recyclable materials, equipment and hazardous materials) and as a shop to repair heavy equipment (e.g., through welding and other processes) — all of which were integral to Aman's recycling operations. The recollection of these individuals is consistent with the recollection of William J. Torres, the former president of an affiliate to Aman, who provided a declaration in

[2] The 689-691 85th Avenue is a street address used to describe the same warehouse that the 685 85th Avenue address describes. We are unaware as to how the street addresses were assigned, but can confirm it is all the same property.

support of our March 9, 2018 Appeal Letter. (Appeal Letter, Exhibit 2, Torres Decl., ¶¶ 2-7.)

- **Government documents, showing usage of the warehouse by Aman.** Various government forms and other documents show the warehouse was in use by Aman prior to the City's rezoning action in June 2008, including:
  - A June 14, 2007 hazardous materials reporting form that Aman submitted to the Alameda County Department of Environmental Health, which confirms that diesel, oil, hydraulic fluid, propane, spray paint, and waste oil were kept in the warehouse. (*See* **Attachment 3**.)
  - A June 8, 2007 Hazardous Materials Inspection Report, which shows the warehouse was used to store diesel, propylene, and used oil. (*See* **Attachment 4** [reference to "shop bldg" in northeast corner of property].) The warehouse is referred to as a "shop" in this document, which is consistent with recollections by Aman employees that the warehouse was used, in part, as a shop to repair heavy machinery. (*See* **Attachment 2a**, ¶ 9; *see also* **Attachment 2b**, ¶ 10.)
- **Historical satellite imagery.** Satellite photos confirm that land within all corners of the yard at the Baldwin Properties has been occupied with recycling activities since at least 1998. (*See* Appeal Letter, Exhibit 3 [historical satellite photos of Properties compiled from Google Earth; Exhibit 4) [satellite photos of site maintained by City].) More specifically:
  - Comparing a satellite photo taken on May 31, 2007 (a year before the City's rezoning of the site) and a satellite photo taken within the past two years, one can see that the Properties have been used in substantially the same way by Aman and Silverado. (*See* **Attachment 5**.) For instance, the location of recyclable material piles and internal circulation routes occupy virtually the same footprints. (*See id.*)
  - When one overlays lot lines on satellite imagery, which is possible using Alameda County's online Parcel Viewer application,[3] one can see that the onsite operations are not severable by legal lot lines. (*See* **Attachment 6**.) For instance, in numerous places, machinery and internal circulation routes straddle multiple lot lines, demonstrating

[3] *See* http://gis.acgov.org/Html5Viewer/index.html?viewer=parcel_viewer.

that operations were never confined to APN 42-4318-43, the legal designation for 8300 Baldwin Street. (*See id.*)

We recognize that some City documents indicate that legal, nonconforming uses occurred at "8300 Baldwin," without mention of the three other, associated Properties. However, it appears that "8300 Baldwin" was used as shorthand for multiple properties, as was the case in the hazardous material reports sent by Aman to the County. Even the City's own documents suggest there was a conflation of the Properties. For instance, while the City's most recent zoning determination indicates that prior Zoning Clearances were issued only for 8300 Baldwin Street, and not for the remaining parcels that comprise the Properties (*see* Appeal Letter, Exhibit 6), the staff worksheet that supports these Zoning Clearances suggests they cover the business' entire operations on all parcels. (*See* Appeal Letter, Exhibit 9 [5/16/12 staff worksheet indicates legal, nonconforming determination applies to "business," not a particular property].) City inspection notes, meanwhile, confirm that the 2013 Zoning Clearance at least "covers 3 open parcels centered [on] 8300 Baldwin and rear driveway thru 685 85th Avenue behind warehouse ..." (*See* Appeal Letter, Exhibit 11 [1/5/18 Inspector Notes, as referenced in 1/19/18 email from Audree V. Jones-Taylor to City].)

Regardless of what past Zoning Clearances state, the evidence presented here is substantial, and would support any determination by the City that Silverado's activities on the site are legal nonconforming uses.

Specifically, rock crushing and other recycling activities conducted on each of the outdoor spaces were also conducted by Aman prior to the City's zoning change in June 2008. Meanwhile, Silverado uses the same exact warehouse space in support of recycling activities that Aman used prior to June 2008. The only difference is that Silverado uses 16,000 square feet of the warehouse for secondary processing and sorting activities, whereas Aman used this space for storage (e.g., the storage of recyclable materials, equipment, and hazardous materials) and the repair of heavy equipment. The remaining 24,000 square feet of warehouse space has been used by both Silverado and Aman for the storage of equipment and materials and the repair of heavy equipment.

While the nature of these recycling activities are somewhat different, the Oakland Planning Code only prohibits changes that either increase the footprint of or relocate a nonconforming use (OPC, § 17.114.080(A); *see* more extensive discussion in our March 9, 2018 Appeal Letter.)

First, Silverado's use of the 16,000-square-foot portion of the warehouse for processing and sorting of materials does not constitute an increase in size. Silverado currently uses the same exact indoor space that Aman used prior to the City's rezoning of the site in 2008, and the footprint of operations has never changed.

Second, Silverado never relocated its operations to an area that was not previously used for recycling, but instead reconfigured its existing, industrial space. In determining the meaning of words used in the City's Municipal and Planning Codes, section 1.04.020 of the Municipal Code provides that "[a]ll words and phrases shall be construed according to the common and approved usage of the language." Accordingly, Merriam-Webster's dictionary defines "relocate" to mean "establish or lay out in a *new* place." The term "reconfigure," meanwhile, means "to change the way (something) is arranged or prepared for a particular purpose." The difference, then, is that "relocating" a use contemplates moving an activity into a space that was previously unoccupied, or was occupied with a completely different land use, whereas "reconfiguring" a land use merely contemplates the rearrangement of similar activities within space that is already occupied. Silverado has *reconfigured* its operations within the same footprint Aman used, and has not *relocated* any uses to a space that Aman did not previously use in its recycling operations.

While zoning laws can be precise, it is not the practice of cities and counties to supervise a property owner's exact configuration of activities on a square-foot by square-foot basis. So long as these activities are in the same land use category, agencies general shy away from the micromanagement of operations.[4] For instance, in a restaurant, the City's zoning code is unconcerned about the configuration of tables and chairs and cooking space so long as the property is zoned for restaurant use. (*See, e.g.*, OPC, § 17.73.020 [restaurants permitted in CIX-2 zones, without discussion of restaurants' internal components]; *see also* OPC, §§ 17.10.272, 17.10.274 [City's definitions of restaurants do not address specific locations of kitchens, seating, and other component activities, but are concerned with establishing larger categories of use].) Similarly, in a big box retail store, the City's zoning does not control in which aisles a product is stored or sold, so long as the site has commercial zoning. (*See, e.g.*, OPC, § 17.73.020 [certain retail stores, including General Wholesale Sales, permitted in CIX-2 zones, without discussion of location of component operations]; *see also, e.g.*, OPC, §§ 17.10.340, 17.10.345, 17.10.430 [City's definitions of retail stores do not address specific locations of sales areas, ancillary office uses, and other operational activities].) In each of the above examples, reconfiguring a site by moving seating or sales displays does not change or alter the land use.

[4] It is more the function of the building code, and its enforcement, to ensure that specific activities are conducted in specific locations, but only to the extent necessary to make sure these activities are conducted in a safe manner. In this instant enforcement action, there is no allegation that Silverado's indoor land use activities violate the building code. The building code violation alleged by the City concerns the structural integrity of two openings to the warehouse but, as discussed in the City's July 3, 2018 letter, this violation is to be addressed once the zoning issues are resolved. Please note, a structural engineering firm, FBA Inc., has determined these "openings do not structurally compromise either the vertical load carrying ability or the lateral stability of the warehouse structures." (March 9, 2018 Appeal Letter, Exhibit 8.)

Here, Silverado's situation is analogous. Where, specifically, Silverado stores materials or conducts processing activities on the site, and whether it shifts operations around, does not alter the site's use. After all, the footprint of the large debris pile in the center of the site changes on a daily basis, based on how much recyclable material is imported and recycled on that specific day. Furthermore, until a few years ago, Aman and Silverado used portable crushing and processing equipment, meaning the configuration of the site changed frequently. Recycling is a dynamic operation, and necessarily must be permitted to change — and we believe the City's code reflects this.

In accordance with the above, we are requesting the City determine all of Silverado's activities are legal and nonconforming.

C. ***In the alternative, Silverado's warehouse uses are permitted by right in CIX-2 Zones.***

If the City determines that Silverado's processing and sorting activities in the 16,000-square-foot portion of the warehouse at 685 85th Avenue constitute a relocation of uses, as opposed to a reconfiguration of its operations, we request that the City determine these warehouse activities are permitted by right under current zoning.

Prior to June 2008, when the City rezoned the area, Silverado's operations would have qualified as an Intermediate Recycling Processing Facility, which was defined as an "activity serving as a collection point for receiving, processing, storage, and distribution of large quantities of recyclable materials delivered from recycling collection centers or other sources." (Former OPC, § 17.10.586.) This term contemplated that recycling activities would be "processed entirely indoors." (Appeal Letter, Exhibit 12, p. 6 [December 2, 2008 Staff Report to the Community and Economic Development Agency].) On March 17, 2009, the City Council deleted this industrial subclassification through its adoption of Ordinance No. 12923, with the understanding that the City would "revert to the previous practice of considering such businesses as manufacturing (light, general or heavy/high impact, depending on the nature of the operations)." (*See id.*) The proper approach, then, is to consider the scope of Silverado's operations and, based on the specific facts, determine whether it qualifies as a light, general, or heavy industrial use.

The secondary processing and sorting of the "softball-sized" rocks in the warehouse, as well as their storage, properly qualify as either a General Manufacturing Industrial Activity or a Light Manufacturing Industrial Activity, both of which are permitted by right in CIX-2 and IG Zones. (OPC, Table 17.73.020.)

Turning to the facts, Silverado's processing and sorting operations within the warehouse consist of the processing and sorting of small, recycled stones into smaller stones, gravel, and sand. These are not "high impact" or "heavy" manufacturing activities, given that (1) these activities fit within less than 16,000 square feet of indoor space (whereas the remaining ~24,000 square feet of warehouse space is devoted to access and the storage of product, as well as the repair of equipment), and thus do not involve "large-scale facilities;" and (2) these activities do not produce noise, vibration, air pollution, a fire hazard, or noxious emissions that would violate the standards set forth in Chapter 17.120, or any other federal, state or local standards, and thus have minimal impact. (*See* OPC, § 17.10.580; *see also* March 9, 2018 Appeal Letter [detailed analysis showing Silverado's warehouse operations do not produce noise, vibration, air pollution, fire hazards, or noxious emissions that would violate the standards in Chapter 17.120, or any other federal, state, or local standards].) Therefore, the City has the discretion to determine that Silverado's operations qualify as "Light Manufacturing Industrial Activities" or as "General Manufacturing Industrial Activities" under sections 17.10.560 and 17.10.570 of the Oakland Planning Code.

Both General and Light Manufacturing Industrial Activities are permitted by right in CIX-2 and IG Zones. Accordingly, if Silverado's warehouse operations do not qualify as a legal, nonconforming use, we request the City determine they are lawful and permitted under current zoning requirements.

III. Conclusion.

Silverado constitutes an Oakland success story in its recycling and diversion of debris that would otherwise go into precious landfills. Our client's operations also allow for the sourcing of construction material without the need to permit additional quarrying sites in the region, which are generally harmful to the environment. The recycling of aggregate generates approximately 50 percent fewer greenhouse gas emissions when compared to the mining of raw materials to produce the same product. (*See* **Attachment 7**.) Environmental benefits also accrue from having a local source of aggregate, because less truck trips are needed to produce and deliver materials. The nearest quarries are scattered widely across the Bay Area, and generally are located between 30 to 40 miles away from the Properties. If Silverado's product were not available to local construction companies, truck deliveries from regional quarries would significantly increase vehicle miles traveled ("VMT"), and the diesel particulate matter and greenhouse gas emissions associated with these trucking routes would also increase. The estimated VMT-related greenhouse gas emission savings from operation of Silverado's site is equal to the emissions generated by about 18,000 passenger vehicles, or by about 16,000 single-family homes (which is the equivalent of 10 percent of Oakland's entire housing stock). (*See id.*) Meanwhile, Silverado's decision to move processing operations indoors confers a more localized environmental benefit, as dust from these operations is captured indoors, and does not disperse into the community. Lastly, Silverado's processing and sorting equipment is electrically powered, further reducing emissions, and our client hopes, in the long-term, to install solar panels on the warehouse roof.

Turning to the legalities, as discussed above, we believe the City can lawfully and appropriately determine Silverado's uses, both outdoors and indoors, are legal, nonconforming activities. Substantial evidence shows that Silverado's outdoor operations on the Properties are a continuation of recycling operations that have occurred on each and every one of the outdoor Properties since at least 1998. With respect to Silverado's warehouse operations, these activities, too, are lawful. Our client's predecessor in interest, Aman, used the warehouse for the storage of equipment and materials, and for the repair of heavy equipment, since at least 2007. Since taking possession of the warehouse, Silverado also has used the space, and a majority of it, for storage, and has occupied the remaining space with processing and sorting activities. The footprint of recycling operations on the Properties, including the warehouse, has not changed in any meaningful way and, to the extent Silverado has refined its operations, this change constitutes a reconfiguration, and not an expansion or relocation, of industrial activities. The indoor activities occurring in the warehouse therefore qualify as legal, nonconforming uses.

Even if Silverado's warehouse operations did not qualify as a legal, nonconforming use, they would remain lawful. These indoor activities constitute recycling operations that should be classified as either light or general uses after an evaluation of the specific facts involved. The facts here show that Silverado's processing and sorting of materials comply with each of the City's environmental standards in Chapter 17.120, and thus could be categorized as either a General or Light Manufacturing Industrial Activity. Both of these uses are permitted by right in the governing CIX-2 and IG Zones, without the need for additional permits.

Thank you for your attention to these important matters, and please let us know if you have any questions.

Very truly yours,

Miller Star Regalia

Sean Marciniak

SRM:kll

Attachments 1 – 7

cc: Sandra Smith, Administrative Manager, City of Oakland, ssmith@oaklandnet.com
Brian Mulry, Deputy City Attorney, City of Oakland, bmulry@oaklandcityattorney.org
Luz Buitrago, Deputy City Attorney, City of Oakland, LBuitrago@oaklandcityattorney.org
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Bryan Wenter, Esq., Miller Starr Regalia

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This paragraph references Aman's right to use the three outdoor parcels (8291, 8300, and 8304 Baldwin Street), even though the street address listed is 8300 Baldwin Street. (*See* Exhibit A.) The 8300 Baldwin Street parcel is only about 80,000 square feet, whereas the leased area is about 140,000 square feet.

COPY

SECOND AMENDMENT TO COMMERCIAL LEASE AGREEMENT

This Second Amendment to Commercial Lease Agreement (the "Amendment") is entered into as of November 21, 2006 (the "Effective Date") by and between URS Corporation, a Nevada corporation dba URS Corporation Americas, as successor-in-interest to Aman Environmental Construction, Inc. ("Lessee"), and the Kenneth W. Morris 1986 Separate Property Trust under the Revocable Trust Agreement Dated April 10, 1986, as amended ("Lessor").

RECITALS

A. Lessor and Lessee entered into that certain Commercial Lease dated May 26, 1998 (executed on May 27, 1998) (the "Commercial Lease") with respect to the property commonly known as 8300 Baldwin Street, Oakland, California, which property includes approximately 140,000 square feet of land and three (3) buildings (the "Original Premises"). The Original Premises is more particularly shown on **Exhibit A** attached hereto and made a part hereof by this reference.

B. Pursuant to the terms of that certain Addendum Number One to Commercial Lease Agreement executed on July 9, 2002 ("First Addendum"), the parties agreed, among other things, to extend the term of the Commercial Lease until May 31, 2007.

C. Pursuant to the terms of that certain Amendment to Commercial Lease Agreement, executed on October 24, 2004 (the "Amendment" and, together with the Commercial Lease and the First Addendum, collectively, the "Lease"), Lessee agreed to expand the Original Premises by leasing an additional 20,000 square feet of space.

D. Lessor and Lessee desire to further amend the Lease as hereinafter set forth.

TERMS

NOW, THEREFORE, in consideration of the foregoing Recitals, the mutual covenants herein contained, and good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereby agree as follows:

1. Premises. Lessee and Lessor agree that, as of the Effective Date, (a) the Original Premises is hereby expanded to include approximately 40,000 square feet of the building commonly referred to as 689 – 691 85th Avenue, Oakland, California as more particularly shown on **Exhibit B** attached hereto and made a part hereof by this reference (the "Expansion Premises"), and (b) Lessor shall deliver unfettered possession of the Expansion Premises to Lessee. The Expansion Premises and the Original Premises are collectively referred to as the "Premises."

This paragraph references the warehouse space Silverado uses at 685 85th Avenue; we received a copy of this lease through discovery in litigation against Silverado's landlord but, unfortunately, we were not provided with a copy of Exhibit B.

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ATTACHMENT 1

2. Lease Term. Notwithstanding anything to the contrary contained in the Lease, the term of the Lease is extended until May 31, 2012. In addition, Lessee is hereby granted the option (the "Option") to extend the term of the Lease for one (1) additional period of five (5) years. If Lessee elects to exercise the Option, Lessee shall notify Lessor in writing at least twelve (12) months prior to the expiration of the term of the Lease. The rent during the term of the Option is set forth below in Section 3. If Lessee does not exercise the Option, Lessee will pay Lessor a fee of Three Hundred Fifty Thousand Dollars ($350,000) (the "Option Cancellation Fee") upon the expiration of the Lease term. Notwithstanding the immediately preceding sentence, Lessee shall not be obligated to pay Lessor the Option Cancellation Fee if the Lease is terminated prior to May 31, 2012 due to casualty, condemnation or a default under the Lease by Lessor.

3. Rent. Notwithstanding anything to the contrary contained in the Lease, from and after the Effective Date, the rent payable for the Premises shall be as follows:

(a)	Effective Date through November 31, 2006	$30,350.00 per month
(b)	December 1, 2006 through May 31, 2007	$44,350.00 per month
(c)	June 1, 2007 through May 31, 2012	$47,600.00 per month

and, if the Option is exercised:

(d)	June 1, 2012 through May 31, 2017	$55,707.00 per month

4. Improvements.

(a) Lessee is responsible for constructing a demising wall consisting of 4" by 4" studs with ½" plywood facing in order to separate the Expansion Premises from the balance of the 103,300 square foot building within which such Expansion Premises are located. Lessee will construct such demising wall from floor to ceiling, in accordance with all applicable laws, at Lessee's sole cost and expense. The wall will be constructed prior to the date that Lessee occupies the Expansion Premises. In addition to construction of the wall as provided in this Section 4, Lessee shall have the right to make any other leasehold improvements it deems necessary or advisable, all such improvements to be the sole responsibility of the Lessee and at Lessee's sole cost and expense. Lessor is not responsible for funding the leasehold improvements. Lessee will provide plans for any leasehold improvements to Lessor for review and approval, such approval not to be unreasonably withheld, conditioned or delayed. If Lessor fails to approve or disapprove any such improvement plans within ten (10) days after Lessee's delivery thereof, then Lessor shall be deemed to have approved such plans.

(b) If Lessee decides to install a roll up door in the rear of the Expansion Premises, the roll up door will be aligned (i.e. the size of the door will be 15' by 30') to the front roll up door on 85th Avenue. Lessor will require Lessee to utilize the same door company which installed the front roll up door so that the same quality and manufacturer of the door will be

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utilized; provided, if such installation company is unavailable or no longer in operation, Lessee shall use an installation company reasonably acceptable to Lessor and Lessee.

(c) Lessee shall install, at Lessee's sole cost and expense, black fabric screening material and a slatted gate entrance in the locations shown on **Exhibit B** attached hereto.

5. Other Expenses/Maintenance. Lessee shall be responsible for any increase in real property or personal property taxes due to its construction of leasehold improvements in the Expansion Premises. In the event the building containing the Expansion Premises is not a separate tax parcel, Lessor and Lessee shall reasonably allocate any tax increases caused by the construction of such leasehold improvements. Lessee shall be responsible for the cost of all utilities expenses reasonably allocable to the Expansion Premises and will be responsible for any damage it causes to the alarm and fire sprinkler system located within the Expansion Premises. Lessee will, at Lessee's expense, install a separate electrical meter and, if Lessee determines in its sole discretion that it will need to utilize water in the Expansion Premises, a separate water line, to the Expansion Premises and will be responsible for the billings from the utility companies in connection with such actions. From January 1 to December 31 of each calendar year, Lessee shall be responsible for cleaning, at least once per month, the gutters of the entire warehouse building (approximately 143,300 square feet).

6. Easement. Lessee is hereby granted a fifteen (15) foot wide right of way easement from the easterly fence line for vehicular and pedestrian ingress and egress over and truck staging in the east side of the building containing the Expansion Premises, such area shown on **Exhibit B** attached hereto (the "Easement Area"). Lessee shall have the exclusive right to use the side doors of the Expansion Premises. Lessee is also allowed to install a scale in the Easement Area near the Original Premises. Lessee shall be responsible for all costs and expenses required to install the scale and remove the scale upon termination of the Lease. Lessee shall be entitled to use the Easement Area for the purposes set forth in this Section 6 twenty-four hours per day, three hundred sixty-five days per year. The provisions of this Section 6 shall remain in full force and effect until the expiration of the Lease term (as such term may be extended) and Lessee shall have the right, at its sole option, to record in the official records of the County of Alameda First American Title Insurance Company's standard form of easement agreement to effectuate the provisions hereof (or such other form of easement agreement reasonably acceptable to Lessee). Lessor shall use its best efforts to assist Lessee in the recordation of such easement agreement. Lessee to supply and install K-Rails in the Easement Area in a location reasonably selected by Lessor.

7. Demolition.

(a) Lessee shall have the right to demolish and remove the 10,000 square foot metal building (the "Demolition Property") located on the land that comprises the Original Premises and shown on **Exhibit A**, at Lessee's sole cost and expense. In connection with any such demolition, Lessee will note the location where sewer, water and electrical services connect to the Demolition Property and Lessee shall cap these services in accordance with city and county regulations. Lessee shall ensure that all hazardous materials generated from the Demolition

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Property by Lessee shall be properly removed from the Demolition Property and disposed of to the extent required by, and in accordance with, all California and Federal hazardous material laws and regulations. Notwithstanding the immediately preceding sentence, Lessee agrees to remove any lead-based paint found on the Demolition Property, even though such materials were not generated by, or placed upon, the Demolition Property by Lessee; provided, in no event shall Lessee be liable for any hazardous materials, including any lead-based paint, placed upon the Demolition Property by any party other than Lessee. Lessee is solely responsible for removal of hazardous materials from the Demolition Property placed therein by Lessee and will indemnify the Lessor, at Lessee's sole cost and expense, for any damage to Lessor caused by Lessee's failure to remove such hazardous materials in accordance with the terms of this Section 7. Lessee shall not be liable for or otherwise obligated to Lessor under any provision of the Lease with respect to (i) any claim, remediation obligation, investigation obligation, liability, cause of action, attorneys' fees, consultants' cost, expense or damage resulting from any hazardous material present in, on or about the Demolition Property or any other part of the Premises or the Expansion Premises to the extent not caused nor otherwise permitted, directly or indirectly, by Lessee; or (ii) the removal, investigation, monitoring or remediation of any hazardous material present in, on or about the Demolition Property, or any other part of the Premises or the Expansion Premises caused by any source, including third parties other than Lessee, as a result of or in connection with the acts or omissions of persons other than Lessee; provided, however, Lessee shall be fully liable for and otherwise obligated to Lessor under the provisions of this Lease for all liabilities, costs, damages, penalties, claims, judgments, expenses (including without limitation, attorneys' and experts' fees and costs) and losses to the extent (A) Lessee contributes to the presence of such hazardous materials, or (B) Lessee allows or permits persons over which Lessee has control and/or for which Lessee is legally responsible for, to cause such hazardous materials to be present in, on, under, through or about any portion of the Demolition Property or any other part of the Premises or the Expansion Premises. Except as otherwise expressly set forth in this Section 7(a), Lessor agrees to, and shall, protect, indemnify, defend (with counsel reasonably acceptable to Lessee) and hold Lessee and Lessee's directors, officers, employees, successors and assigns harmless from and against any and all claims, judgments, damages, penalties, fines, liabilities, losses, suits, administrative proceedings and costs (including, but not limited to, attorneys' and consultant fees and court costs), arising at any time during or after the term of this Lease, to the extent arising from (1) any hazardous materials present in, on or about the Demolition Property or any other part of the Premises or the Expansion Premises to the extent not caused nor otherwise permitted by Lessee and (2) the removal, investigation, monitoring or remediation of any hazardous materials present in, on or about the Demolition Property or any other part of the Premises or the Expansion Premises to the extent not caused nor otherwise permitted by Lessee.

(b) Lessor may elect, upon written notice delivered to Lessee at least twelve (12) months prior to the end of the Lease term, to require Lessee to remove, at Lessee's sole cost and expense, the concrete foundation and slab on the Demolition Property; provided, however, Lessee's obligations with respect to removal of any hazardous materials discovered in connection therewith shall be subject to terms of Section 7(a). If any hazardous materials are discovered during removal of the foundation or slab on the Demolition Property, then Lessee shall have the right to immediately cease all such removal work and all of Lessee's obligations

Slab chome of Large slab for new Building ? SA KM pursuant to this Section 7(b) shall be null and void. If Lessor fails to provide timely written notice to Lessee of such election, then Lessee's obligations pursuant to this Section 7(b) shall be null and void.

(c) Lessee agrees to regrade, in accordance with applicable law, those areas of the Premises shown on **Exhibit B** so that surface waters will not migrate from the Premises into the building adjacent to the Premises. Lessee shall be responsible for re-directing any accumulation of surface waters that migrate from the Premises into the building adjacent to the Premises.

8. Right of First Refusal. Section 24 of the Lease is hereby deleted in its entirety and the following is inserted in lieu thereof:

> "24. Right of First Refusal. In the event that Lessor (a) elects to sell the Premises and the legal parcel upon which the Premises is located (the "Offer Property"), or (b) receives a bona fide offer from a third party for the purchase and sale of the Offer Property, Lessor shall provide to Lessee prompt written notice thereof (the "Offer Notice"). The Offer Notice shall include either the material terms customarily found in letters of intent for the purchase and sale of property similar to the Offer Property (including, without limitation, purchase price, deposit amount, due diligence period, customary representations and warranties, prorations of costs pursuant to county custom and a closing date), or in the event Lessor receives a bona fide offer pursuant to Section 24(b) above, Lessor shall attach to such Offer Notice a true and correct copy of the third party offer received by Lessor. Lessee shall have thirty (30) days following receipt of the Offer Notice to elect to purchase the Offer Property upon the same terms and conditions contained in the Offer Notice. If Lessee timely exercises its right of first refusal herein, Lessor and Lessee shall, within thirty (30) days after Lessee's election to purchase the Offer Property, enter into an agreement of purchase and sale for the Offer Property on the then AIR Commercial Real Estate Association form of purchase agreement for non-residential property (the "Purchase Agreement"). The Purchase Agreement shall contain all of the terms and provisions contained in the Offer Notice."

9. Railroad Spur. The provisions of Section 39 of the Lease are hereby deleted in their entirety.

10. Effect. As of the Effective Date, the provisions of this Amendment are expressly incorporated into the provisions of the Lease and the provisions of this Amendment shall be effective. Except as expressly modified by this Amendment, the Lease shall remain unchanged and in full force and effect.

11. Priority of Amendment. To the extent the provisions of the Lease are inconsistent with the provisions of this Amendment, the provisions of this Amendment shall supersede and control.

12. No Modification or Waiver. Except as otherwise set forth in this Amendment, nothing in this Amendment shall be deemed to waive or modify any of the provisions of the Lease.

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13. Successors. The provisions of this Amendment shall bind and inure to the benefit of the heirs, representatives, successors and assigns of the parties hereto.

14. Counterparts. This Amendment may be executed in several counterparts, each of which will be deemed an original but all of which together will constitute one and the same document.

Executed in the city of Oakland, State of California, on the 27 day of November, 2006.

"LESSOR"

Kenneth W. Morris 1986 Separate Property Trust under the Revocable Trust Agreement Dated April 10, 1986

By: [signature]
Name: Kenneth W. Morris
Its: Trustee

"LESSEE"

URS Corporation, a Nevada corporation dba URS Corporation Americas

By: [signature]
Name: Steve M. Aman
Its: V.P.

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"EXHIBIT A"

The "Original Premises" cover the three outdoor parcels: 8291, 8300, 8304 Baldwin Street.

Shop Building to be demolished

Original Premises

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I, Michael Zamora, declare:

1. As to the facts in this declaration, I know them to be true of my own knowledge or have obtained knowledge of them from employees with whom I work and from my review of relevant business records. If called upon to testify as to the matters set forth in this declaration, I could and would competently testify thereto. As to those matters stated in this declaration on information and belief, I believe them to be true.

2. From approximately 2000 to 2016, I worked at the Cleveland Wrecking Company as its General Superintendent Operation Manager.

3. The Cleveland Wrecking Company operated a demolition business at 8291, 8300, and 8304 Baldwin Street in Oakland, California from the time I started working with the company to about 2012, and operated within a 40,000-square-foot warehouse space, located at 685 85th Avenue, from 2007 to about 2012.

4. I worked at 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue in Oakland, California at least every other day during the time I was employed by the Cleveland Wrecking Company and the time these properties were being used by the Cleveland Wrecking Company, as it was my job to oversee all of the Cleveland Wrecking Company's activities occurring on the site.

5. The Cleveland Wrecking Company shared use of 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue with its sister company, Aman Environmental Construction, Inc. As such, I am familiar with the activities of Aman Environmental Construction, Inc. as well, which operated a rock, asphalt, and cement crushing and recycling business at this location. The actual leaseholder of the property might have been an affiliate company, or a successor-in-interest, of Aman Environmental Construction, Inc., but I am not aware of, and was not privy to, the details about the legal ownership of the foregoing properties.

6. I have reviewed parcel maps for 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue in Oakland, California, and am familiar with them. These addresses correspond, respectively, with property described by Assessor Parcel Numbers 042-4318-044, 042-4318-043, 042-04317-042, and 042-4318-008.

ATTACHMENT 2a

7. From approximately 2007 to the time their operations ceased in about 2012, Aman Environmental Construction, Inc. utilized approximately 40,000 square feet of the warehouse located on 685 85th Avenue to conduct and facilitate the crushing and recycling operations occurring at 8291, 8300, and 8304 Baldwin Street.

8. I distinctly remember the warehouse space being used, as early as 2007, to store tools, equipment, oil, and other materials and substances related to crushing and recycling operations conducted by Aman Environmental Construction, Inc.

9. I also remember the warehouse space being used, as early as 2007, as a shop to repair equipment related to the crushing and recycling activities of Aman Environmental Construction, Inc. For instance, I recall employees welding broken components of rock crushers during this time.

10. I also remember the warehouse being used, as early as 2007, to store recyclable material that had been salvaged from demolition sites, which was used to support recycling operations undertaken by Aman Environmental Construction, Inc.

11. The other portion of the warehouse at 685 85th Avenue, which was not under the control of the Cleveland Wrecking Company and Aman Environmental Construction, Inc., had been used by another company to store vehicles, and I believe this other space supported a freight company's operations. This portion of the warehouse, which was situated closer to 85th Avenue, was separated from the operations of the Cleveland Wrecking Company and Aman Environmental Construction, Inc. by a large, floor-to-ceiling wall. I have reviewed information about the current configuration of the warehouse, and this wall is the same wall that presently divides the warehouse into separate tenant spaces.

12. The 40,000-square-foot warehouse space was first occupied by the Cleveland Wrecking Company and Aman Environmental Construction, Inc. a short time after Aman Environmental Construction, Inc., or another of its sister companies, entered into a lease for this indoor space, which I believe happened in late 2006.

13. From at least 2000 to the time they ceased doing business at the site, the Cleveland Wrecking Company and Aman Environmental Construction, Inc. utilized the entirety of 8291, 8300, 8304 Baldwin Street for demolition support activities and the crushing and recycling of rock, asphalt, and cement, as well as accessory uses, which included accessory office space, a weigh station, and other ancillary uses, which includes all space within the fenced perimeter of the site.

14. From at least 2007 to the time they ceased doing business at their Oakland site, the Cleveland Wrecking Company and Aman Environmental Construction, Inc. used an alley adjacent to the warehouse on 685 85th Avenue for driveway purposes, which connected 8291, 8300, 8304 Baldwin Street to 85th Avenue.

15. I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct of my own personal knowledge, except as to those matters stated on information and belief, and, as to those matters, I am informed and believe that they are true, and that this declaration was executed on July 10, 2018, in Oakland, California.

Michael Zamora

I, Oscar Reyes, declare:

1. As to the facts in this declaration, I know them to be true of my own knowledge. If called upon to testify as to the matters set forth in this declaration, I could and would competently testify thereto. As to those matters stated in this declaration on information and belief, I believe them to be true.

2. From approximately 1998 to 2011, I worked for the Cleveland Wrecking Company as a foreman, overseeing demolition activities at various sites throughout the San Francisco Bay Area.

3. From approximately 1998 to at least 2011, the Cleveland Wrecking Company conducted a demolition business from outdoor space located at 8291, 8300 and 8304 Baldwin Street and, from 2007 to at least 2011, conducted a demolition business from indoor space located at 685 85th Avenue in Oakland, California.

4. From approximately 1998 to at least 2011, the Cleveland Wrecking Company shared space at 8291, 8300 and 8304 Baldwin Street with Aman Environmental Construction, Inc., which operated a rock, asphalt, and cement crushing and recycling business on the properties. From approximately 2007 to at least 2011, the Cleveland Wrecking Company shared a large, indoor warehouse space with Aman Environmental Construction, Inc. at 685 85th Street, where operations related to its crushing and recycling business were also conducted. The Cleveland Wrecking Company and Aman Environmental Construction, Inc. were sister companies.

5. I have reviewed parcel maps for 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue in Oakland, California, and am familiar with them. These addresses correspond, respectively, with property described by Assessor Parcel Numbers 042-4318-044, 042-4318-043, 042-04317-042, and 042-4318-008.

6. From approximately 1998 to 2011, I was present at 8291, 8300 and 8304 Baldwin Street a few dozen times per year. From approximately 2007 to 2011, I was present at 685 85th Avenue a few dozen times per year. Two to three times per month, I would visit the properties to pick up equipment for the Cleveland Wrecking Company's off-site demolition activities and,

ATTACHMENT 2b

when demolition activities were slow, I would repair equipment at 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue.

7. I am familiar with the scope of operations performed by the Cleveland Wrecking Company and Aman Environmental Construction, Inc. at 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue from approximately 1998 to 2011.

8. From 2007, both the Cleveland Wrecking Company and Aman Environmental Construction, Inc. utilized approximately 40,000 square feet of the warehouse on 685 85th Avenue to store and repair equipment, to store tools, and to store salvageable materials from demolition sites which I believe were later recycled by Aman Environmental Construction, Inc.

9. The warehouse at 685 85th Avenue is extremely large, and the portion occupied by Cleveland Wrecking Company and Aman Environmental Construction, Inc. was walled off from another tenant's space from 2007 to at least 2011. I understand this wall remains in place at the present time.

10. These warehouse activities I observed, as identified in Paragraph 8, were integrated with the rock/asphalt/cement crushing, demolition, and recycling operations occurring at 8291, 8300, and 8304 Baldwin Street, and I distinctly remember personally repairing tools and equipment, including rock crushing equipment, in the warehouse from 2007 until 2011.

11. From approximately 1998 to 2011, Aman Environmental Construction, Inc. and the Cleveland Wrecking Company utilized the entirety of 8291, 8300, 8304 Baldwin Street for demolition activities and the crushing and recycling of rock, asphalt, and cement, as well as accessory uses, which included accessory office space, a weigh station, and other ancillary uses. I distinctly remember the entire outdoor area, from Baldwin Street to the northerly railroad tracks, being used for crushing, screening, and stockpiling recyclable material.

12. From at least 2007, and perhaps earlier, the Cleveland Wrecking Company and Aman Environmental Construction, Inc. used an alley adjacent to the warehouse on 685 85th Avenue for driveway purposes, which connected 8291, 8300, 8304 Baldwin Street to 85th Avenue, and to store equipment at various times.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct of my own personal knowledge, except as to those matters stated on information and belief, and, as to those matters, I am informed and believe that they are true, and that this declaration was executed on July 11, 2018, in Millbrae, California.

Oscar Reyes

I, Jeffrey John Rashke, declare:

1. As to the facts in this declaration, I know them to be true of my own knowledge. If called upon to testify as to the matters set forth in this declaration, I could and would competently testify thereto. As to those matters stated in this declaration on information and belief, I believe them to be true.

2. From approximately 2001 to the present, I have worked for Mike O'Brien Specialized Hauling as a truck driver.

3. From approximately 2001 to 2012 or 2013, I hauled equipment for the Cleveland Wrecking Company, which conducted a demolition business at 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue in Oakland, California during various times. I believe that the Cleveland Wrecking Company was a sister company to Aman Environmental Construction, Inc., which operated a rock, asphalt, and cement crushing and recycling business on the same properties.

4. I have reviewed parcel maps for 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue in Oakland, California, and am familiar with them. These addresses correspond, respectively, with property described by Assessor Parcel Numbers 042-4318-044, 042-4318-043, 042-04317-042, and 042-4318-008.

5. I am familiar with the scope of operations performed by the Cleveland Wrecking Company and Aman Environmental Construction, Inc. at 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue as these activities occurred from approximately 2001 to the time the companies ceased doing business on these properties.

6. From approximately 2001 to the time the Cleveland Wrecking Company and Aman Environmental Construction, Inc. ceased doing business at 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue, I was present on these properties once or twice a month, at which times I hauled crushers, excavators, and other portable equipment between these four Oakland properties and various locations in the San Francisco Bay Area where the Cleveland Wrecking Company conducted demolition activities.

ATTACHMENT 2c

7. From approximately 2007 to the time the Cleveland Wrecking Company and Aman Environmental Construction, Inc. ceased doing business at 8291, 8300 and 8304 Baldwin Street and 685 85th Avenue, both companies utilized approximately 40,000 square feet of the warehouse on 685 85th Avenue to store equipment, such as excavators, rock screening equipment, and Bobcat equipment, as well as salvageable materials from demolition sites which I believe were later recycled by Aman Environmental Construction, Inc. I understand that this equipment and the recyclable materials were connected with the crushing, demolition, and recycling activities occurring at 8291, 8300, and 8304 Baldwin Street.

8. From approximately 2001 to the time it ceased activities, Aman Environmental Construction, Inc. utilized the entirety of 8291, 8300, 8304 Baldwin Street for the crushing and recycling of rock, asphalt, and cement, as well as accessory uses, which included accessory office space, a weigh station, and other ancillary uses. I distinctly remember the entire outdoor area being used for crushing, screening, and stockpiling aggregate and recyclable materials.

9. From at least 2007 to the time they ceased activities, the Cleveland Wrecking Company and Aman Environmental Construction, Inc. used an alley adjacent to the warehouse on 685 85th Avenue for driveway purposes, which connected 8291, 8300, 8304 Baldwin Street to 85th Avenue, which is how I accessed the site in hauling equipment for the Cleveland Wrecking Company.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct of my own personal knowledge, except as to those matters stated on information and belief, and, as to those matters, I am informed and believe that they are true, and that this declaration was executed on July 12, 2018, in East Palo Alto, California.

[signature]

Jeffrey John Rashke

21

UNIFIED PROGRAM CONSOLIDATED FORM
FACILITY INFORMATION
BUSINESS ACTIVITIES

I. FACILITY IDENTIFICATION

FACILITY ID # *(Agency Use Only)* 1.		EPA ID # (Hazardous Waste Only) 2. CAL 000 280029
BUSINESS NAME (Same as Facility Name) 3. AMAN ENVIRONMENTAL CONSTRUCTION INC.		

II. ACTIVITIES DECLARATION

NOTE: If you check YES to any part of this list, please submit the Business Owner/Operator Identification page (OES Form 2730).

Does your facility...		If Yes, please complete these pages of the UPCF...
A. HAZARDOUS MATERIALS Have on site (for any purpose) hazardous materials at or above 55 gallons for liquids, 500 pounds for solids, or 200 cubic feet for compressed gases (include liquids in ASTs and USTs); or the applicable Federal threshold quantity for an extremely hazardous substance specified in 40 CFR Part 355, Appendix A or B; or handle radiological materials in quantities for which an emergency plan is required pursuant to 10 CFR Parts 30, 40 or 70?	☒ YES ☐ NO 4.	HAZARDOUS MATERIALS INVENTORY – CHEMICAL DESCRIPTION (OES 2731)
B. UNDERGROUND STORAGE TANKS (USTs) 1. Own or operate underground storage tanks?	☐ YES ☒ NO 5.	UST FACILITY (Formerly SWRCB Form A) UST TANK (one page per tank) (Formerly Form B)
2. Intend to upgrade existing or install new USTs?	☐ YES ☒ NO 6.	UST FACILITY UST TANK (one per tank) UST INSTALLATION – CERTIFICATE OF COMPLIANCE (one page per tank) (Formerly Form C)
3. Need to report closing a UST?	☐ YES ☒ NO 7.	UST TANK (closure portion – one page per tank)
C. ABOVE GROUND PETROLEUM STORAGE TANKS (ASTs) Own or operate ASTs above these thresholds: —any tank capacity is greater than 660 gallons, or —the total capacity for the facility is greater than 1,320 gallons?	☐ YES ☒ NO 8.	NO FORM REQUIRED TO CUPAs
D. HAZARDOUS WASTE 1. Generate hazardous waste?	☒ YES ☐ NO 9.	EPA ID NUMBER – provide at the top of this page
2. Recycle more than 100 kg/month of excluded or exempted recyclable materials (per HSC §25143.2)?	☐ YES ☐ NO 10.	RECYCLABLE MATERIALS REPORT (one per recycler)
3. Treat hazardous waste on site?	☐ YES ☒ NO 11.	ONSITE HAZARDOUS WASTE TREATMENT – FACILITY (Formerly DTSC Forms 1772) ONSITE HAZARDOUS WASTE TREATMENT – UNIT (one page per unit) (Formerly DTSC Forms 1772 A, B, C, D, and L)
4. Treatment subject to financial assurance requirements (for Permit by Rule and Conditional Authorization)?	☐ YES ☒ NO 12.	CERTIFICATION OF FINANCIAL ASSURANCE (Formerly DTSC Form 1232)
5. Consolidate hazardous waste generated at a remote site?	☐ YES ☒ NO 13.	REMOTE WASTE / CONSOLIDATION SITE ANNUAL NOTIFICATION (Formerly DTSC Form 1196)
6. Need to report the closure/removal of a tank that was classified as hazardous waste and cleaned onsite?	☐ YES ☒ NO 14.	HAZARDOUS WASTE TANK CLOSURE CERTIFICATION (Formerly DTSC Form 1249)

E. LOCAL REQUIREMENTS 15.

(You may also be required to provide additional information by your CUPA or local agency.)

ATTACHMENT 3

The 8300 Baldwin Street address was used as "shorthand" for Aman's entire business operations, including the warehouse. See the next page.

UNIFIED PROGRAM CONSOLIDATED FORM
FACILITY INFORMATION
BUSINESS OWNER/OPERATOR IDENTIFICATION

I. IDENTIFICATION

FACILITY ID # (Agency Use Only) 1.	BEGINNING DATE 100. 1/1/07 — ENDING DATE 101. 12/31/07
BUSINESS NAME (Same as FACILITY NAME) 3. AMAN ENVIRONMENTAL/CONSTRUCTION INC	BUSINESS PHONE 102. (570) 553-0110
BUSINESS SITE ADDRESS 103. 8300 BALDWIN STREET	
CITY 104. OAKLAND — CA	ZIP CODE 105. 94621
DUN & BRADSTREET 106.	SIC CODE (4 digit #) 107.
COUNTY 108. ALAMEDA	
BUSINESS OPERATOR NAME 109. BILL TORRES	BUSINESS OPERATOR PHONE 110. (510) 568-2626 ext.

II. BUSINESS OWNER

OWNER NAME 111. KENNETH W. MORRIS	OWNER PHONE 112. (415) 398-1512 ext.
OWNER MAILING ADDRESS 113. 8300 BALDWIN STREET	
CITY 114. OAKLAND — STATE 115. CA	ZIP CODE 116. 94621

III. ENVIRONMENTAL CONTACT

CONTACT NAME 117. BILL TORRES	CONTACT PHONE 118. (510) 568-2626 ext.
CONTACT MAILING ADDRESS 119. 8300 BALDWIN STREET	
CITY 120. OAKLAND — STATE 121. CA	ZIP CODE 122. 94621

IV. EMERGENCY CONTACTS

-PRIMARY-	-SECONDARY-
NAME 123. BILL TORRES	NAME 128. GREG DESSER
TITLE 124. REGIONAL MANAGER	TITLE 129. SALES MANAGER
BUSINESS PHONE 125. (510) ext. 568-2626	BUSINESS PHONE 130. (510) ext. 553-0110
24-HOUR PHONE* 126. (510) ext. 772-2911	24-HOUR PHONE* 131. (510) ext. 385-6004
PAGER # 127. N/A	PAGER # 132. N/A

ADDITIONAL LOCALLY COLLECTED INFORMATION: 133.

Billing Address: 8300 BALDWIN STREET - OAKLAND CA 94621

Property Owner: KENNETH MORRIS Phone No.: (415) 398-1512

Certification: Based on my inquiry of those individuals responsible for obtaining the information, I certify under penalty of law that I have personally examined and am familiar with the information submitted and believe the information is true, accurate, and complete.

SIGNATURE OF OWNER/OPERATOR OR DESIGNATED REPRESENTATIVE [signature]	DATE 134. 6/14/07 — NAME OF DOCUMENT PREPARER 135. BILL TORRES
NAME OF SIGNER (print) 136. BILL TORRES	TITLE OF SIGNER 137. REGIONAL MANAGER

* See Instructions on next page.

There was not a warehouse on the 8300 Baldwin Street parcel in June 2007, and this reference is to the warehouse on 685 85th Avenue.

These materials are consistent with what Aman workers observed being in the warehouse before June 2018.

Non-Waste Hazardous Materials Inventory Statement

For use by Unidocs Member Agencies or where approved by your Local Jurisdiction

Date: 6/14/07

Business Name: (Same as Facility Name) AMAN ENVIRONMENTAL CONSTRUCTION INC.

Chemical Location (Building/Storage Area): WAREHOUSE

EPCRA Confidential Location? ☐ Yes ☒ No

Trade Secret Information? ☐ Yes ☒ No

Facility ID # (Agency Use Only):

Type of Report on This Page: ☒ Add; ☐ Delete; ☐ Revise

Page 1 of 1 (One page per building or area)

1. Haz. Class	2. Map and Grid or Location Code	3. Common Name	CAS No. (EHS)	4. Hazardous Components (For mixtures only): Chemical Name	% Wt.	EHS	CAS No.	5. Type and Physical State	6. Quantities: Max. Daily	Average Daily	Largest Cont.	Days On Site	Storage Container*	7. Units	8. Storage Codes: Storage Pressure	Storage Temp.	9. Hazard Categories
2		DIESEL	68476346 ☐ EHS			☐		liquid		300		365	R	gallons	ambient	ambient	chronic health
1		MOTOR OIL	☐ EHS	HYDROTREATED RESIDUAL OIL; ZINC DIALKYL; Mixture	10-20	☐	64742-[illegible]; 64742-57-0; 68649-42-3	mixture; liquid		1,500		365	D	gallons		ambient	acute health
1		Hydraulic FLUID	68649-42-3 ☐ EHS			☐		liquid		1000		365	D	gallons		ambient	
1		OXYGEN	7782-44-7 ☐ EHS			☐		pure; gas			100	365	L	pounds	ambient	ambient	pressure release
4		Propane	105991-15-1 ☒ EHS			☐		gas				365	L	pounds	ambient	ambient	fire; pressure release
1		Spray PAINT	68476-85-7 ☐ EHS			☐		gas		10lbs		365	F	pounds	ambient	ambient	acute health

* Code	Storage Type	Code	Storage Type	Code	Storage Type	Code	Storage Type	Code	Storage Type	Code	Storage Type
A	Aboveground Tank	D	Steel Drum	G	Carboy	J	Bag	M	Glass Bottle or Jug	P	Tank Wagon
B	Belowground Tank	E	Plastic/Non-metallic Drum	H	Silo	K	Box	N	Plastic Bottle or Jug	Q	Rail Car
C	Tank Inside Building	F	Can	I	Fiber Drum	L	Cylinder	O	Tote Bin	R	Other

If EPCRA, sign below:

Hazardous Waste Inventory Statement

For use by Unidocs Member Agencies or where approved by your Local Jurisdiction

Date: 6/14/07

Business Name: (Same as Facility Name or DBA) AMAN ENVIRONMENTAL CONST INC

Chemical Location: (Building/Storage Area)

EPCRA Confidential Location? ☐ Yes; ☒ No

Trade Secret Information? ☐ Yes; ☒ No

Facility ID # (Agency Use Only)

Type of Report on This Page: ☒ Add; ☐ Delete; ☐ Revise

Page 1 of 1 (One page per building or area)

1. Haz. Class	2. Map and Grid or Location Code	3. Waste Stream Name	4. Hazardous Components: Chemical Name	% Wt.	EHS	CAS No.	5. Type and Physical State	6. Quantities: Max. Daily	Average Daily	Largest Cont.	7. Annual Waste Amount	8. Units	9. Storage Codes: Storage Pressure	Storage Temp.	10. Hazard Categories
1		WASTE OIL Management Method: ☒ Shipped Off-site ☐ Recycled On-site ☐ Treated On-site			☐ ☐ ☐ ☐ ☐		☒ waste ☐ solid ☒ liquid ☐ gas	Curies: (If radioactive)	200 Days On Site: 365	Storage Container:*	State Waste Code:	☒ gallons ☐ pounds ☐ cu. feet ☐ tons	☒ ambient ☐ > amb. ☐ < amb.	☒ ambient ☐ > amb. ☐ < amb. ☐ cryogenic	☐ fire ☐ reactive ☐ pressure release ☐ acute health ☐ chronic health ☐ radioactive
		Management Method: ☐ Shipped Off-site ☐ Recycled On-site ☐ Treated On-site			☐ ☐ ☐ ☐ ☐		☒ waste ☐ solid ☐ liquid ☐ gas	Curies: (If radioactive)	Days On Site:	Storage Container:*	State Waste Code:	☐ gallons ☐ pounds ☐ cu. feet ☐ tons	☐ ambient ☐ > amb. ☐ < amb.	☐ ambient ☐ > amb. ☐ < amb. ☐ cryogenic	☐ fire ☐ reactive ☐ pressure release ☐ acute health ☐ chronic health ☐ radioactive
		Management Method: ☐ Shipped Off-site ☐ Recycled On-site ☐ Treated On-site			☐ ☐ ☐ ☐ ☐		☒ waste ☐ solid ☐ liquid ☐ gas	Curies: (If radioactive)	Days On Site:	Storage Container:*	State Waste Code:	☐ gallons ☐ pounds ☐ cu. feet ☐ tons	☐ ambient ☐ > amb. ☐ < amb.	☐ ambient ☐ > amb. ☐ < amb. ☐ cryogenic	☐ fire ☐ reactive ☐ pressure release ☐ acute health ☐ chronic health ☐ radioactive
		Management Method: ☐ Shipped Off-site ☐ Recycled On-site ☐ Treated On-site			☐ ☐ ☐ ☐ ☐		☒ waste ☐ solid ☐ liquid ☐ gas	Curies: (If radioactive)	Days On Site:	Storage Container:*	State Waste Code:	☐ gallons ☐ pounds ☐ cu. feet ☐ tons	☐ ambient ☐ > amb. ☐ < amb.	☐ ambient ☐ > amb. ☐ < amb. ☐ cryogenic	☐ fire ☐ reactive ☐ pressure release ☐ acute health ☐ chronic hea ☐ radioactive
		Management Method: ☐ Shipped Off-site ☐ Recycled On-site ☐ Treated On-site			☐ ☐ ☐ ☐ ☐		☒ waste ☐ solid ☐ liquid ☐ gas	Curies: (If radioactive)	Days On Site:	Storage Container:*	State Waste Code:	☐ gallons ☐ pounds ☐ cu. feet ☐ tons	☐ ambient ☐ > amb. ☐ < amb.	☐ ambient ☐ > amb. ☐ < amb. ☐ cryogenic	☐ fire ☐ reactive ☐ pressure release ☐ acute health ☐ chronic health ☐ radioactive
		Management Method: ☐ Shipped Off-site ☐ Recycled On-site ☐ Treated On-site			☐ ☐ ☐ ☐ ☐		☒ waste ☐ solid ☐ liquid ☐ gas	Curies: (If radioactive)	Days On Site:	Storage Container:*	State Waste Code:	☐ gallons ☐ pounds ☐ cu. feet ☐ tons	☐ ambient ☐ > amb. ☐ < amb.	☐ ambient ☐ > amb. ☐ < amb. ☐ cryogenic	☐ fire ☐ reactive ☐ pressure release ☐ acute health ☐ chronic health ☐ radioactive

* Storage Type codes:

Code	Storage Type	Code	Storage Type	Code	Storage Type	Code	Storage Type	Code	Storage Type	Code	Storage Type
A	Aboveground Tank	D	Steel Drum	G	Carboy	J	Bag	M	Glass Bottle or Jug	P	Tank Wagon
B	Belowground Tank	E	Plastic/Nonmetallic Drum	H	Silo*	K	Box	N	Plastic Bottle or Jug	Q	Rail Car
C	Tank Inside Building	F	Can	I	Fiber Drum	L	Cylinder	O	Tote Bin	R	Other

If EPCRA, sign below:

OAKLAND FIRE EPARTMENT/FIRE PREV ITION BUREAU
HAZARDOUS MATERIALS UNIT

250 FRANK OGAWA PLAZA, SUITE 3341, OAKLAND, CA 94612-2032 • (510) 238-3927

HAZARDOUS MATERIALS INSPECTION REPORT

20-2812

Site Number	Facility Name	Facility Address	Zip Code
	~~[illegible]~~ Aman Environmental	8300 Baldwin	21

Inspection Report

☑ **PERMISSION TO INSPECT GRANTED** CAL000190320

Bill Jones, 568-2626
HW Storage, HWG, NOI
Site Map ok
No HMBP

(1) SUBMIT HMBP, keep copy, www.unidocs.org FORM UN020
(2) Manifests Not onsite — Keep 3 yrs onsite
(3) Clean out 2nd contain on Gas Agt
Shop Bldg
(NE corner) 13x55g + 165g oil & oil filters in 2nd contain
Empty 500 G AGT Diesel in 2nd contain
w/ 8/[illegible] Propalyne cleaned up
1N container — 175 Agt used oil w/ 2nd contain
(4) + label on door, No accum date
3x100 new oil on 2nd contain
(5) Get 2nd contain pallet for spills
(6) Get NFPA 704 Diamond For Bldg
Comply w/i 30 days — Send Compliance Form when done

Aman workers remember the warehouse at 685 85th Avenue was used as a shop to repair heaving machinery, and this description is consistent with those recollections.

Facility Contact/Print Name:	Inspected By:		
	[signature] 238-3927	☐ Insp. Griffin	238-7759
Facility Contact/Signature:		☑ Insp. Kupers	238-7054
[signature]		☐ Insp. Matthews	238-2396
		☐ Insp. Gomez	238-7253
	Date: 6/8/07		

538-156 (05/05)

ATTACHMENT 4

May 31, 2017 Satellite Photo, Google Earth:

Current (2017/2018) Satellite Photo, Google Earth:

ATTACHMENT 5

Parcel Viewer
Alameda County Assessor's Office

Tools

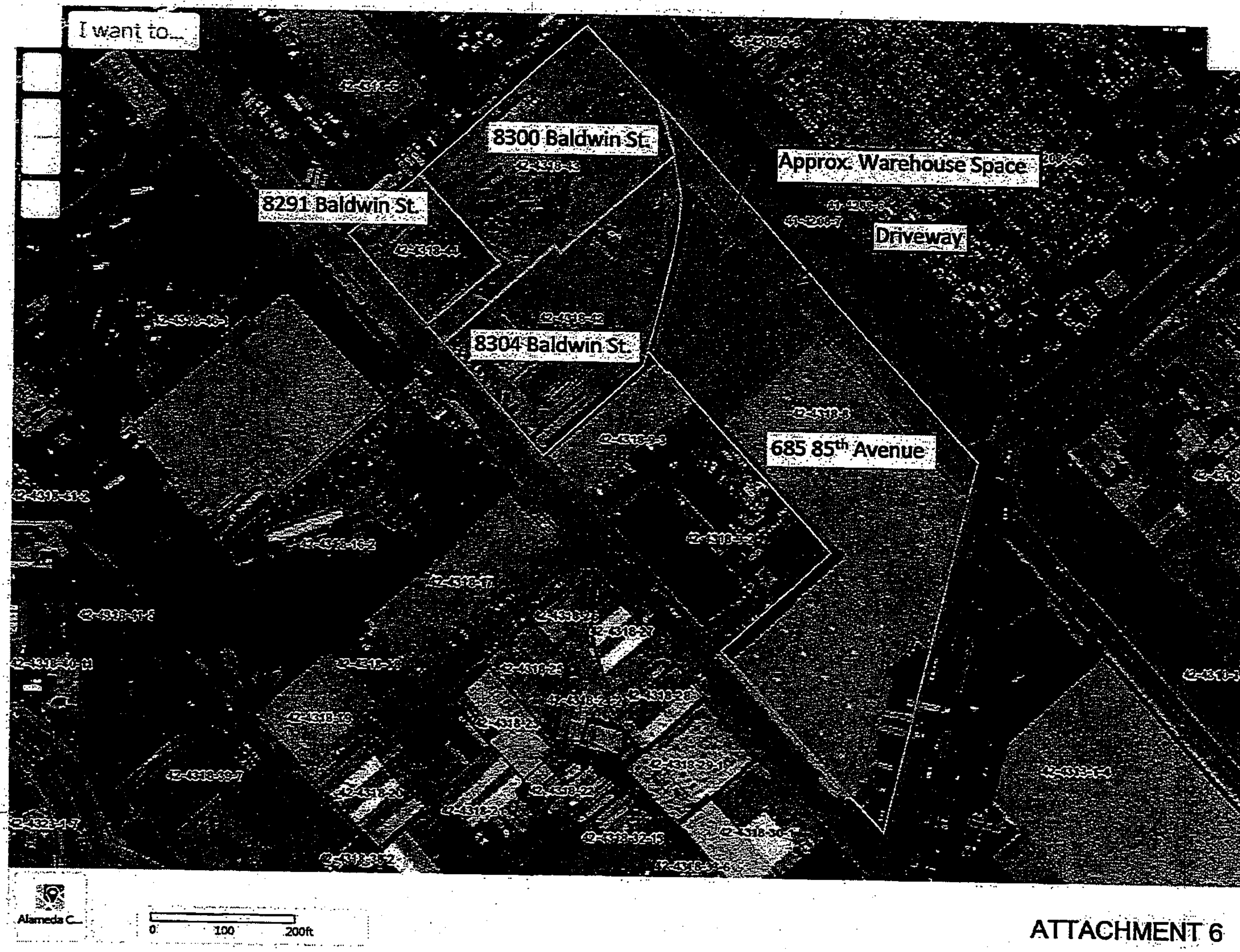
Find Parcel | Print | Distance | Area | Edit D... | Quick-Start Guide | Help

Search Tools | Printing | Measure | Help

Parcel Search (1)

APN: 42-4318-43
8300 BALDWIN ST OAKLAND 94621 -
Open in Google Maps

Parcel Information | Tax Information



Displaying 1 - 1 (Total: 1)
Page 1 of 1

ATTACHMENT 6

ARGENT MATERIALS

8300 Baldwin Street Oakland, CA 94621 Telephone (510) 638-7188 / Fax (510) 638-7189

June 8, 2018

Dear Interested Parties:

To better quantify the environmental benefits associated with our recycling operation, Argent Materials recently asked Environmental Science Associates (ESA), a reputable environmental consulting firm, to study and analyze our operations.

Their findings are discussed in the attached report. The following is an executive summary:

- **ESA found that Argent contributes to a significant reduction in vehicle miles traveled and associated greenhouse gas (GHG) emissions of trucks transporting concrete aggregate for disposal.** Operation of Argent's recycling facility in Oakland will save up to 53,000 metric tons of CO_2 when compared to the GHG emissions that would result from generating or recycling aggregate product at other locations in the Bay Area. As a frame of reference, 53,000 metric tons of CO_2 is the equivalent of emissions generated by about 18,710 passenger vehicles, or by about 16,054 single family homes—about 10 percent of Oakland's entire housing stock.

- **ESA found that Argent contributes to a significant reduction in GHG emissions from recycling materials as compared to *mining* for new aggregate.** Argent's focus on recycling means that, per ton of aggregate produced, it will generate significantly fewer GHG emissions when compared to its competitors that mine for aggregate. Based on a study by the U.S. Environmental Protection Agency, the recycling of aggregate products generates approximately 50% fewer greenhouse emissions than mining to generate those same aggregate products from raw materials. This percentage is represented as an averaged across aggregate containing materials including asphalt concrete, asphalt shingles, and concrete. (Think: buying recycled paper rather than cutting down trees to produce new paper.)

We are pleased by these findings and are always working to find ways to be an even better steward of natural resources and our environment. Please don't hesitate to contact us with any questions about the attached report.

Sincerely,

Bill Crotinger
General Manager

ATTACHMENT 7

GREENHOUSE GAS EMISSIONS STUDY FOR THE TRANSPORT OF AGGREGATE MATERIALS

Comparative Analysis of Argent Materials and Existing Suppliers in the Local Area

Prepared for
Argent Materials
8300 Baldwin Street, Oakland, CA 94621

June 2018

[redacted]

ESA

GREENHOUSE GAS EMISSIONS STUDY FOR THE TRANSPORT OF AGGREGATE MATERIALS

Comparative Analysis of Argent Materials and Existing Suppliers in the Local Area

Prepared for
Argent Materials
8300 Baldwin Street, Oakland, CA

June 2018

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Los Angeles, CA 90017
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Irvine
Los Angeles
Oakland
Orlando
Pasadena
Petaluma
Portland
Sacramento
San Diego
San Francisco
Santa Monica
Seattle
Tampa
Woodland Hills

D180535.00

ESA

OUR COMMITMENT TO SUSTAINABILITY | ESA helps a variety of public and private sector clients plan and prepare for climate change and emerging regulations that limit GHG emissions. ESA is a registered assessor with the California Climate Action Registry, a Climate Leader, and founding reporter for the Climate Registry. ESA is also a corporate member of the U.S. Green Building Council and the Business Council on Climate Change (BC3). Internally, ESA has adopted a Sustainability Vision and Policy Statement and a plan to reduce waste and energy within our operations. This document was produced using recycled paper.

TABLE OF CONTENTS

Appendices

Page

List of Figures

List of Tables

EXECUTIVE SUMMARY
Greenhouse Gas Emissions

The purpose of this Greenhouse Gas Emissions Study is to provide a quantitative evaluation of the greenhouse gases (GHGs) emissions from the transport of aggregate materials from Argent Materials aggregate recycling facility located in the Oakland, California in comparison to the transport of aggregate materials to the same receiver destinations from existing aggregate suppliers in Alameda, Contra Costa and San Mateo County.

Argent Materials provides approximately 425,000 tons of recycled aggregates to its end-user receiver clients annually, the great majority of which are local. Through the year 2050, operation of Argent Material's recycling facility in Oakland will save up to 53,000 metric tons of CO_2 when compared to the GHG emissions that would result from generating or recycling aggregate product at other locations in the Bay Area. As a frame of reference, 53,000 metric tons of CO_2 is the equivalent of emissions generated by about 18,710 passenger vehicles, and by about 16,054 single family homes (about 10 percent of Oakland's 165,000 housing units[1]). By using this local source of recycled materials, local developers and building companies will be able to avoid purchasing up to approximately $4.5 million in GHG emissions offset, allowing for a reduction in the cost of homes and other projects.

Emissions of GHGs are quantitatively estimated using heavy-duty haul truck emission factors from the latest version of the California Air Resources Board (CARB) on-road vehicle emissions factor model, EMFAC2017. The input parameters in the EMFAC2017 model accounts for the specific vehicle truck type used to transport aggregate material, the range of vehicle model years used within each calendar year, forecasted emissions during future calendar years, vehicle speeds on local roadways and regional freeways for the region, and the effect of adopted CARB regulations affecting heavy-duty trucks. Existing supplier facilities and locations were determined from facilities mapped in the California Geological Survey (CGS), *Aggregate Sustainability in California*, Map Sheet 52 (CGS 2012) and detailed in the California Department of Conservation Division of Mines and Geology, *Update of Mineral Land Classification: Aggregate Materials in the South San-Francisco Bay Production- Consumption Region* (DMG 1996). These local suppliers include Ebi Aggregates, the CEMEX Clayton Quarry, the CEMEX Eliot Facility, and Vulcan Materials Company Pleasanton Sand and Gravel, which mostly rely on the mining, as opposed to the recycling, of aggregate.

Transport distances from the Argent Materials and from existing suppliers in Alameda, Contra Costa and San Mateo County to end-user receiver destinations in Alameda, Contra Costa and San

[1] Bay Area Association of Governments, *San Francisco Bay Area Housing Data 2009 Survey*, p. 2, available at https://abag.ca.gov/pdfs/2009_Housing_Data.pdf.

Francisco counties are estimated based on a population-weighted average transport distance to incorporated cities within each county. In addition, the distances to end-user receivers were weighted based on client aggregate demand data provided by Argent Materials where 90% of aggregate sold is delivered to clients within 15 miles, and the remaining 10% of material is delivered to clients further than 15 miles. This Study assumes that all aggregate supplied from Argent Materials would be delivered to end-user receiver destinations in Alameda, Contra Costa and San Francisco counties based on annual client information given by Argent Materials.

As summarized in **Table 1,** *Summary of Argent Materials and Existing Aggregate Suppliers in Alameda, Contra Costa and San Mateo Comparisons,* the transport of 425,000 tons of aggregate material annually from Argent Materials instead of Ebi Aggregates would result in a savings of approximately 33,311 metric tons (MT) of carbon dioxide (CO_2) from year 2018 to 2050 (i.e., 33-year period). This reduction would be equivalent to the following:

- 33,311 metric tons of CO_2 saved is equivalent to removing GHG emissions from nearly 11,682 average passenger vehicles traveling on roadways and freeways in Northern California over 33 years (or approximately 354 average passenger vehicles per year).
- 33,311 metric tons of CO_2 saved is equivalent to removing GHG emissions from approximately 10,024 average single-family homes in California over 33 years (or 303 average single-family homes per year).

As summarized in **Table 1**, the transport of 425,000 tons of aggregate material annually from Argent Materials instead of Vulcan Materials Company Pleasanton Sand & Gravel or CEMEX Eliot Facility would result in a savings of approximately 51,358 MT of CO_2) from year 2018 to 2050 (i.e., 33-year period). This reduction would be equivalent to the following:

- 51,358 metric tons of CO_2 saved is equivalent to removing GHG emissions from nearly 18,011 average passenger vehicles traveling on roadways and freeways in Northern California over 33 years (or approximately 545 average passenger vehicles per year).
- 51,358 metric tons of CO_2 saved is equivalent to removing GHG emissions from approximately 15,455 average single-family homes in California over 33 years (or approximately 468 average single-family homes per year).

As summarized in **Table 1**, the transport of the 425,000 tons of aggregate material annually from Argent Materials instead of CEMEX Clayton Quarry would result in savings of approximately 53,350 MT of CO_2 from year 2018 to 2050 (i.e., 33-year period). This reduction would be equivalent to the following:

- 53,350 metric tons of CO_2 saved is equivalent to removing GHG emissions from nearly 18,710 average passenger vehicles traveling on roadways and freeways in Northern California over 33 years (or approximately 566 average passenger vehicles per year).
- 53,350 metric tons of CO_2 saved is equivalent to removing GHG emissions from approximately 16,054 average single-family homes in California over 33 years (or approximately 486 average single-family homes per year).

Furthermore, while this GHG report focuses on the GHG emissions savings as a result of transport of aggregate products to end user receivers, additional GHG emissions savings are expected as the Argent Materials facility recycles aggregates by taking construction debris and processing it into its final aggregate product as compared to the other local suppliers that either do a combination of recycling and mining (Ebi Aggregates) or mining (CEMEX Clayton Quarry, CEMEX Eliot, Vulcan Materials Company Pleasanton Sand & Gravel) to generate aggregate materials. Based on a study by the U.S. Environmental Protection Agency (USEPA), the recycling of certain aggregates products generates approximately 50% less GHG emissions than mining to generate those same aggregate products from raw materials (percentage averaged across aggregate containing materials including asphalt concrete, asphalt shingles and concrete) (USEPA 2016). Therefore, facilities such as Argent Materials, which provides recycled aggregates from construction debris, generate additional GHG savings not quantified in this report as compared to facilities that provide aggregates from virgin mined sources.

Cost Savings from Avoided GHG Emissions

As summarized in **Table 1**, for the transport of 425,000 tons of aggregate material annually from Argent Materials instead of Ebi Aggregates, cost savings from purchasing an equivalent amount of GHG emissions offsets could be as follows:

- Assuming an average cost under current conditions of $15.10 per metric ton, 33,311 metric tons of CO_2 saved is equivalent to approximately $502,996 saved.
- Assuming an average cost under projected future 2030 conditions of $25 to $85 per metric ton, 33,311 metric tons of CO_2 saved is equivalent to the range of $832,775 to $2,831,435 saved.

As summarized in **Table 1**, for the transport of 425,000 tons of aggregate material annually from Argent Materials instead of Vulcan Materials Company Pleasanton Sand & Gravel or CEMEX Eliot Facility, cost savings from purchasing an equivalent amount of GHG emissions offsets could be as follows:

- Assuming an average cost under current conditions of $15.10 per metric ton, 51,358 metric tons of CO_2 saved is equivalent to approximately $775,516 saved.
- Assuming an average cost under projected future 2030 conditions of $25 to $85 per metric ton, 51,538 metric tons of CO_2 saved is equivalent to the range of $1,283,967 to $4,365,489 saved.

As summarized in **Table 1**, for the transport of 425,000 tons of aggregate material annually from Argent Materials instead of CEMEX Clayton Quarry, cost savings from purchasing an equivalent amount of GHG emissions offsets could be as follows:

- Assuming an average cost under current conditions of $15.10 per metric ton, 53,350 metric tons of CO_2 saved is equivalent to approximately $805,594 saved.
- Assuming an average cost under projected future 2030 conditions of $25 to $85 per metric ton, 53,350 metric tons of CO_2 saved is equivalent to the range of $1,333,765 to $4,534,802 saved.

TABLE 1
SUMMARY OF ARGENT MATERIALS AND EXISTING AGGREGATE SUPPLIERS IN ALAMEDA, CONTRA COSTA AND SAN MATEO COMPARISONS

Aggregate Source	Weighted Average Distance to End-User Receiver Locations (miles)	Transport GHG Emissions (metric tons CO_2)	Net Difference Compared to Argent Materials (metric tons CO_2)		Number of Passenger Vehicle Equivalent GHG Emissions Savings		Number of Single-Family Homes Equivalent GHG Emissions Savings		Cost Savings from Purchasing Equivalent Amount of GHG Offsets	
			Over 33-year period	Average Annual	Over 33-year period	Average Annual	Over 33-year period	Average Annual	At 2018 Price ($15.10 per metric ton in 2018)	Range at 2030 Price ($25 to $85 per metric ton in 2030)
Transport of 425,000 tons annually, over 33 years										
Argent Materials	9.2	25,088	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ebi Aggregates	21.5	58,399	+33,311 (+133%)	1,009	11,682	354	10,024	303	$502,996	$832,775 to $2,831,435
CEMEX Eliot Facility	28.2	76,447	+51,358 (+205%)	1,556	18,011	545	15,455	468	$775,516	$1,283,967 to $4,365,489
Vulcan Materials Company Pleasanton Sand & Gravel	28.2	76,447	+51,358 (+205%)	1,556	18,011	545	15,455	468	$775,516	$1,283,967 to $4,365,489
CEMEX Clayton Quarry	28.9	78,439	+53,350 (+213%)	1,616	18,710	566	16,054	486	$805,594	$1,333,765 to $4,534,802

SOURCE: ESA 2018.

Minimizing Greenhouse Gas 'Leakage'

The State of California defines GHG emissions leakage as a reduction in emissions of GHGs within the State that is offset by an increase in emissions of GHGs outside the State. Leakage occurs when emission control measures result in cost increases which:

- Can be avoided by relocating outside the state, and
- Exceed economic advantages of remaining in the state.

As demonstrated in this report, Argent Materials is a local source of aggregate for the Alameda, Contra Costa, and San Francisco County regions. By utilizing the resources at Argent Materials, regional demand for aggregate would be met while significantly decreasing GHG emissions compared to transporting aggregate from sources outside the region. Sourcing from Argent Materials would therefore be consistent with the State's policy of designing measures to minimize GHG emissions leakage by reducing the emissions of GHGs associated with the transport of aggregate to satisfy demand in Alameda, Contra Costa and San Francisco County.

1.0 Introduction

1.1 Purpose

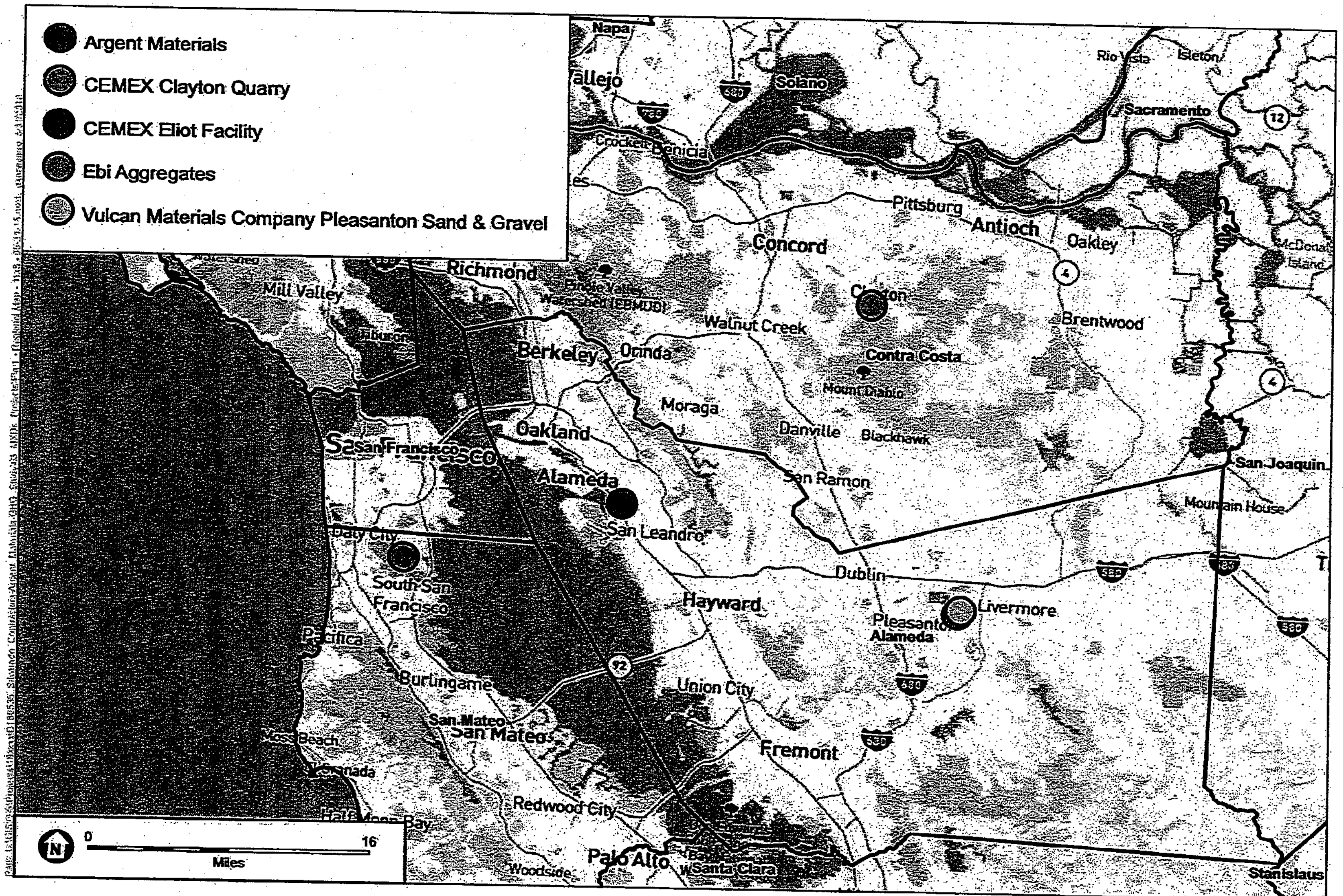
The purpose of this Greenhouse Gas Emissions Study is to provide a quantitative evaluation of the greenhouse gases (GHGs) emissions from the transport of aggregate materials from the Argent Materials aggregate recycling facility located in the Alameda county to end-user receiver destinations in Alameda, Contra Costa and San Francisco counties, in comparison to the transport of aggregate materials to the same receiver destinations from existing suppliers in Alameda, Contra Costa and San Mateo County. The locations of the two existing suppliers in Alameda county are within a third of a mile of each other. Therefore, since the location of these two supplier locations was practically identical, the distance from end-user receiver destinations to these two facilities were treated as being equal. The locations of Argent Materials and existing aggregate suppliers in Alameda, Contra Costa and San Mateo County are shown in **Figure 1**, *Regional Map of Argent Materials and suppliers in Alameda, Contra Costa and San Mateo County*.

The focus of this Study is the net difference in transportation-related GHG emissions from on-road haul trucks supplying aggregate materials from Argent Materials in comparison to existing suppliers in Alameda, Contra Costa and San Mateo County. Emissions of GHGs are quantitatively estimated using heavy-duty haul truck emission factors from the latest version of the California Air Resources Board (CARB) on-road vehicle emissions factor model, EMFAC2017.

1.2 Regional Aggregate Demand

Argent Materials provides approximately 425,000 tons of recycled aggregates to its end-user receiver clients annually. The basis for the comparative analysis in this Study is the transport of 425,000 tons of concrete aggregates annually, until the year 2050. The distances to end-user receivers were weighted based client aggregate demand data provided by Argent Materials where 90% of aggregate sold is delivered to clients within 15 miles, and the remaining 10% of material is delivered to clients further than 15 miles.

As detailed in the California Geological Survey (CGS) report, *Aggregate Sustainability in California*, state geologists divided California into 31 production-consumption (P-C) regions in which Portland cement concrete (PCC)-grade aggregate production is matched to the area in which most of it is consumed. As shown in Map Sheet 52 of the document, Alameda, Contra Costa and San Francisco County are located in the South San Francisco P-C region (CGS 2012).



SOURCE: OpenStreetMap, 2018

GHG Analysis for Argent Materials and Existing Suppliers

ESA

Figure 1
Regional Map of Argent Materials Facility and Existing Aggregate Suppliers in Alameda, Contra Costa and San Mateo County

As detailed in Map Sheet 52, the South San Francisco County P-C region has an aggregate supply of approximately 1,381 million tons and permitted reserves of approximately 404 million tons (CGS 2012). According to CGS staff responsible for the preparation of the *Aggregate Sustainability in California* study and the accompanying Map Sheet 52, the aggregate predictions in the study and Map Sheet 52 are based on historical aggregate use and projected into the future taking into account projected growth in housing starts, gross national product, population, and several other economic factors. The aggregate projections are not based on actual import and export data for each region, as such data is not generally tracked or widely available to the CGS.

1.3 Aggregate Sources Compared in this Study

1.3.1 Argent Materials

The Argent Materials facility is located at 8300 Baldwin Street in Oakland California generally east of Baldwin Street, east of the Nimitz Freeway (Interstate Route 880). The facility recycles approximately 1,500 tons of concrete a day, where the concrete is received categorized and processed before it is stored in the facility's 40,000 square-foot warehouse, where it is further refined into its final product. Argent Materials provides approximately 425,000 tons of recycled aggregates annually to its end-user receiver clients each year across Alameda, Contra Costa and San Francisco counties, which includes government agencies such as the California Department of Transportation (Caltrans), Bay Area Rapid Transit (BART), and the East Bay Municipal Utilities District, as well as nearly 2,000 construction firms.

1.3.2 Existing Aggregate Suppliers

1.3.2.1 Ebi Aggregates

Evans Brothers Inc. is a demolition services company that provides demolition, earth work, environmental remediation, site development and concrete crushing services for clients in both the public and private sector. Evans Brothers Inc. also owns and operates Ebi Aggregates located at 1 Quarry Road, Brisbane, California in San Mateo county. Ebi Aggregates both accepts demolition debris in order to make recycled aggregate products, as well as mines the unnamed quarry in Brisbane, southwest of the facility for aggregate materials.

For the purposes of this Study, the comparative analysis assumes the transport of 425,000 tons of aggregates annually, from 2018 to 2050 (i.e, 33-year period) from this facility to end-user receivers in Alameda, Contra Costa and San Francisco counties.

1.3.2.2 CEMEX Clayton Quarry

CEMEX is a global building materials company that produces, distributes and sells cement, ready-mix concrete, aggregates and related building products to more than 50 countries. CEMEX's United States network includes 11 cements plants, 269 ready-mix concrete plants, and 50 aggregate quarries. CEMEX's own and operates the CEMEX Clayton Quarry facility located at 515 Mitchell Canyon Road, Clayton, California in Contra Costa county. The CEMEX Clayton Quarry facility produces aggregates through mining the 124-acre Clayton Quarry that is capable of producing approximately a half-million tons of aggregate materials per year.

For the purposes of this Study, the comparative analysis assumes the transport of 425,000 tons of aggregates annually, from 2018 to 2050 (i.e, 32-year period) from this facility to end-user receivers in Alameda, Contra Costa and San Francisco counties.

1.3.2.3 CEMEX Eliot Facility

As described above, CEMEX is a global building materials company that produces, distributes and sells cement, ready-mix concrete, aggregates and related building products to more than 50 countries. CEMEX's United States network includes 11 cements plants, 269 ready-mix concrete plants, and 50 aggregate quarries. CEMEX's own and operates the CEMEX Eliot Facility located at 1544 Stanley Blvd, Pleasanton, California in Alameda county. The CEMEX Eliot Facility produces aggregates by mining the Eliot Mine located in unincorporated Alameda County, where Vulcan Materials Company Pleasanton Sand & Gravel, another existing supplier facility described below, also mines for aggregates.

For the purposes of this Study, the comparative analysis assumes the transport of 425,000 tons of aggregates annually, from 2018 to 2050 (i.e, 33-year period) from this facility to end-user receivers in Alameda, Contra Costa and San Francisco counties. As the CEMEX Eliot Facility and Vulcan Materials Company Pleasanton Sand & Gravel both mine Eliot Mine and are located in close proximity to one another (within 0.3 miles), the GHG analysis used the same distance to end-user receivers for both the CEMEX Eliot Facility and Vulcan Materials Company Pleasanton Sand & Gravel aggregate suppliers, however each facility is considered a separate and distinct existing aggregate supplier.

1.3.2.4 Vulcan Materials Company Pleasanton Sand & Gravel

Vulcan Materials Company is a construction materials company and is the nation's largest producer of construction aggregates with 337 sites that produce construction aggregates. Vulcan Materials Company owns and operates the Vulcan Materials Company Pleasanton Sand & Gravel facility located at 50 El Charro Road, Pleasanton, California in Alameda county, and produces aggregates by mining the Eliot Mine located in unincorporated Alameda County, where CEMEX Eliot Facility, another existing supplier facility described above, also mines for aggregates.

For the purposes of this Study, the comparative analysis assumes the transport of 425,000 tons of aggregates annually, from 2018 to 2050 (i.e, 33-year period) from this facility to end-user receivers in Alameda, Contra Costa and San Francisco counties. As the CEMEX Eliot Facility and Vulcan Materials Company Pleasanton Sand & Gravel both mine Eliot Mine and are located in close proximity to one another (within 0.3 miles), the GHG analysis used the same distance to end-user receivers for both the CEMEX Eliot Facility and Vulcan Materials Company Pleasanton Sand & Gravel aggregate suppliers, however each facility is considered a separate and distinct existing aggregate supplier.

2.0 Greenhouse Gases and Climate Change

This section provides a brief summary of GHGs, climate change, and regulations affecting heavy-duty trucks.

2.1 Regulated Greenhouse Gases

Compounds that are regulated as GHGs and that are relevant to transportation sources of GHGs are listed below.

- **Carbon Dioxide (CO_2):** CO_2 is the most abundant GHG in the atmosphere and is primarily generated from fossil fuel combustion from stationary and mobile sources.
- **Methane (CH_4):** CH_4 is emitted from biogenic sources (i.e., resulting from the activity of living organisms), incomplete combustion in forest fires, landfills, manure management, and leaks in natural gas pipelines.
- **Nitrous Oxide (N_2O):** N_2O produced by human-related sources including agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuel, adipic acid production, and nitric acid production.

The overwhelming majority of GHG emission from aggregate hauling would be in the form of CO_2 emissions. Emissions of CH_4 and N_2O would be extremely minimal and would not substantially contribute to overall GHG emissions, even when considering the higher GWP values of these pollutants. Therefore, this analysis focuses on CO_2 emissions. Other regulated GHGs include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6); however, these are not generally associated with transportation sources.

2.2 State of California Greenhouse Gas Emissions

In accordance with Health and Safety Code (HSC) Division 2.5 – California Global Warming Solutions Act of 2006, CARB is tasked with compiling the official GHG emissions inventories for the State of California. Based on the 2015 GHG inventory data (i.e., the latest year for which data are available from CARB), California emitted 440.4 million metric tons (MMT) of CO_2e including emissions resulting from imported electrical power, which represents a 1.5 $MMTCO_2e$ decrease from 2014 (CARB 2017a). The transportation sector is the largest contributor to statewide GHG emissions at 37 percent in 2015.

2.3 Effects of Greenhouse Gas Emissions

The IPCC, in its Fifth Assessment Report (AR5), Summary for Policy Makers, stated that, "it is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together" (IPCC 2013). A report from the National Academy of Sciences concluded that 97 to 98 percent of the climate researchers most actively publishing in the field support the tenets of the IPCC in that climate change is very likely caused by human (i.e., anthropogenic) activity (Anderegg 2010).

According to CARB, the potential impacts in California due to global climate change may include: loss in snow pack; sea level rise; more extreme heat days per year; worsening air quality and more high ozone days; more large forest fires; more drought years; increased erosion of California's coastlines and sea water intrusion into the Sacramento and San Joaquin Deltas and associated levee systems; and increased pest infestation (CalEPA 2006).

2.4 Regulations Affecting Heavy-Duty Trucks

The United States Environmental Protection Agency (USEPA) has adopted a Cause or Contribute Finding in which the USEPA Administrator found that GHG emissions from motor vehicle and motor vehicle engines are contributing to air pollution, which is endangering public health and welfare. In 2006, the California State Legislature adopted Assembly Bill 32 (AB 32), codified in HSC Division 25.5 – California Global Warming Solutions Act of 2006, focusing on reducing GHG emissions in California to 1990 levels by 2020. In 2016, the California State Legislature adopted Senate Bill 32 (SB 32) and its companion bill AB 197. SB 32 and AB 197 amends HSC Division 25.5 and establishes a new climate pollution reduction target of 40 percent below 1990 levels by 2030 and includes provisions to ensure the benefits of state climate policies reach into disadvantaged communities, such as Littlerock. Shifting aggregate production from Littlerock would be a step toward compliance with this standard.

The State of California has adopted a Low Carbon Fuel Standard (LCFS) for transportation fuels that establishes a reduction in the carbon intensity of transportation fuels by 10 percent by 2020. CARB has proposed increasing the stringency of the LCFS by reducing the carbon intensity of transportation fuels by 18 percent by 2030.

GHG emissions and fuel efficiency standards for medium- and heavy-duty trucks have been jointly developed by the USEPA and the National Highway Traffic Safety Administration (NHTSA). For vocational vehicles, which consist of a variety of work vehicles including dump trucks, the Phase 1 Heavy-Duty Vehicle Greenhouse Gas Regulation started with model year 2014 and the standard requires up to a 10 percent reduction in CO_2 emissions by model year 2017 over the 2010 baseline. The Phase 2 standards start in model year 2021 and require the phase-in of a 12 to 24 percent reduction in CO_2 emission reduction from vocational vehicles by model year 2027 over the 2017 baseline (USEPA 2016). CARB has stated that California is aligning with the federal Phase 2 standards in structure, timing, and stringency, but with some minor California differences (CARB 2017b).

3.0 Greenhouse Gas Emissions Methodology

This section describes the methodology used to quantitatively estimate the GHG emissions from the transport of aggregate materials from the Argent Materials facility located in Alameda county to end-user receiver destinations in Alameda, Contra Costa and San Francisco counties in comparison to the transport of aggregate materials to the same receiver destinations from existing suppliers in Alameda, Contra Costa and San Mateo counties. Emissions modeling tools, calculation assumptions, and the methodology used to estimate transport distances are described below.

3.1 On-Road Emissions Factor Model, EMFAC2017

As part of CARB's mission to promote and protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants, CARB has developed an EMission FACtors (EMFAC) model to calculate statewide and regional emissions inventories by multiplying emissions rates with vehicle activity data from all motor vehicles, including passenger cars to heavy-duty trucks, operating on highways, freeways, and local roads in California (CARB 2017). The EMFAC2017 (v1.0.1) model is the latest version that provides emission factors for motor vehicles operating on roads in California. According to the model documentation, EMFAC2017 includes the latest data on California's car and truck fleets and travel activity, updates to truck emission factors based on the latest test data, and the latest forecasting methods for developing vehicle age distributions and estimating vehicle miles traveled. EMFAC2017 also includes the emissions benefits from CARB's recent rulemakings, including on-road diesel fleet rules, Advanced Clean Car Standards, and the Phase I Heavy-Duty Vehicle Greenhouse Gas Regulation (refer to Section 2.4.4).

An emissions inventory can be calculated, at the most basic level, as the product of an emission rate, expressed in grams of a pollutant emitted per some unit of source activity, and a measure of that source's activity (CARB 2017). Emission rates for on-road vehicles traveling on highways and roadways are typically expressed as mass of pollutant emitted per mile driven. For the purposes of this Study, the EMFAC2017 model was used to obtain GHG emissions factors in units of grams per mile driven. The model can provide emissions factors based on a customized set of parameters including geographical region, calendar years, vehicle category, vehicle model years, and vehicle traveling speeds. Emission factors were generated based on the following set of parameters:

- **Region:** The Metropolitan Transportation Commission (MTC) jurisdictional area was selected since the area includes Alameda, Contra Costa, San Mateo and San Francisco counties; therefore, the emission factors from EMFAC2017 would be representative of vehicles traveling within these counties. MTC also has jurisdiction over Marin, Napa, Santa Clara, Solano and Sonoma counties.

- **Calendar Year:** Emission factors were generated for calendar years 2018 through 2050 in order to evaluate GHG emissions for current and future years. As noted above, EMFAC2017 includes emissions benefits from on-road diesel fleet rules, Advanced Clean Car Standards, and the Phase I Heavy-Duty Vehicle Greenhouse Gas Regulation. Therefore, future year GHG emission rates, in terms of grams per mile driven, would be expected to generally decline in future years.

- **Vehicle Category:** EMFAC2017 can output weighted average emission factors for a combined vehicle fleet mix using model data regarding the percentage of each vehicle type and usage parameters within the specified model region or specific emission factors for individual vehicle types within the specified model region. Vehicle categories are separated into non-truck and truck types. Within each type, vehicles are further categorized as follows:

  - Non-trucks: passenger cars, light-duty trucks, medium-duty trucks, mobile homes, motorcycles, school buses, urban buses, other buses, and motor coaches.

  - Trucks: light-heavy-duty trucks, medium-heavy-duty trucks, and heavy-heavy-duty trucks.

  EMFAC2017 has subcategories for each of the above categories, in particular for truck vehicle types. The subcategories for trucks are based on the different uses, such as agricultural truck or utility fleet truck, and gross vehicle weight rating (GVWR). For the transport of aggregate materials, the GHG emission factors used in this analysis were obtained for medium-heavy duty, instate truck (EMFAC vehicle code T6) heavy-heavy-duty, single unit trucks (EMFAC vehicle code T7). The T6 vehicle category applies to trucks with less than 26,000 pounds GVWR, while the T7 vehicle category applies to trucks with greater than 33,000 pounds GVWR. The average of the emission factors from these two vehicle categories was taken to represent the typical fleet of trucks that ranges from 12-ton to 25-ton capacity trucks used to transport sand and gravel aggregate materials.

- **Vehicle Model Year:** EMFAC2017 can output weighted average emission factors for aggregated vehicle model years using model data regarding the percentage of each vehicle model year operating within each calendar year or specific emission factors for individual model years. For the purpose of this Study, GHG emission factors were obtained for aggregated vehicle model years, which would represent the expected distribution of vehicle model years operating within each calendar year for the region.

- **Vehicle Speed:** Vehicle emissions can vary greatly by speed. Emission rates are typically higher at low speeds and lower at middle to higher speeds. Emission rates tend to increase as vehicles travel at high speeds in excess of 60 miles per hour due to efficiency losses (e.g., exponential increase in air resistance, operating outside of an engine's ideal design specification). EMFAC2017 considers vehicle speed values in "speed bins" of 5 mile per hour increments and can output composite emission factors for aggregated vehicle speeds using model data regarding the percentage that each vehicle operates at different speeds or specific emission factors for individual speeds. For the purpose of this Study, GHG emission factors were obtained for the aggregated vehicle speeds, which would represent the expected distribution of vehicle speeds over local roadways and regional freeways for the region. The use of aggregated vehicle speeds is not the same as using an "average" speed value. Aggregated vehicle speeds is the composite of the EMFAC2017 speed bins whereas an average speed value would model the emissions as if vehicles were traveling only at the average speed value. As the model was run in a region-specific context based on the SCAG jurisdictional area, the emission factors generally take into account the effects of regional congestion on average speeds and the corresponding effect on exhaust emissions.

- **Fuel:** Vehicle emissions also vary by fuel type. EMFAC2017 can output weighted average emission factors for aggregated vehicle fuels using model data regarding the percentage of vehicles utilizing different fuels or specific emission factors for vehicles using a specific fuel. For the purpose of this Study, GHG emission factors were obtained for aggregated fuel types, which would represent the expected distribution of vehicle fuels for the region. For the case of heavy-heavy-duty, single unit trucks, nearly all of these vehicles would be diesel-fueled.

The above parameters result in GHG emission factors that account for the specific vehicle truck types used to transport aggregate material, the range of vehicle model years used within each calendar year, forecasted emissions during future calendar years, vehicle speeds on local roadways and regional freeways for the region, and the effect of adopted CARB regulations affecting heavy-duty trucks.

3.2 Aggregate Transportation Distances

This Study evaluates the net difference in transportation-related GHG emissions from on-road haul trucks supplying aggregate materials from the Argent Materials facility in comparison to four existing suppliers in Alameda, Contra Costa and San Mateo counties. Thus, the origination point for the analysis was set at the Argent Materials address and at the aggregate source addresses in Alameda, Contra Costa and San Mateo counties (refer to **Figure 1** and section 1.4).

There is no single end-user receiver destination for aggregate material as demand often results from development and infrastructure projects that could occur anywhere. For the purposes of this Study, a weighted average transport distance was estimated for the transport of aggregate materials to Alameda, Contra Costa and San Francisco counties. The weighted average distances are estimated as follows:

- The distances in miles to 13 incorporated cities within Alameda, Contra Costa and San Francisco counties including: Alameda, Albany, Berkeley, El Cerrito, Emeryville, Fremont, Hayward, Oakland, Piedmont, Richmond, San Francisco, San Leandro, Union

City were measured from Argent Materials and existing suppliers in Alameda, Contra Costa and San Mateo counties. The distances were mapped using the default route to each city provided in Google maps and includes travel over local roadways and regional freeways.

- The populations of each city in the analysis within Alameda, Contra Costa and San Francisco counties were obtained from the California Department of Finance (CDF 2018). It is assumed that aggregate demand is proportional to the relative population of each city. Cities with larger populations were assumed to have proportionately higher aggregate demand and proportionately higher aggregate truck trips.
- The weighted average transport distance is calculated based on the population-weighted average distance to the cities included in the analysis within Alameda, Contra Costa and San Francisco counties. In addition, the distances to end-user receivers were weighted based client aggregate demand data provided by Argent Materials where 90% of aggregate sold is delivered to clients within 15 miles, and the remaining 10% of material is delivered to clients further than 15 miles.
- Unincorporated county areas were not specifically included in the average distance calculations due to the generally non-uniform geographical extent of unincorporated areas and the difficulty in identifying population estimates for specific unincorporated areas. It is presumed that excluding unincorporated county areas would have a minimal effect on the weighted average transport distances.

3.3 Other Emission Calculation Assumptions

The following assumptions were also included in the GHG emissions calculations:

- The average truck capacity is assumed to be between 12 and 25 tons based on general mining industry standard practices and a review of mining industry documentation (CNRA 2013).
- Annual GHG emissions were estimated based on consistent aggregate demand over the analyzed time period. For example, the 425,000 tons annual demand was assumed to remain constant over the 33-year analysis period.

4.0
Greenhouse Gas Emissions Results

4.1 Argent Materials and Ebi Aggregates Comparison

This Study evaluates the net difference in transportation-related GHG emissions from on-road haul trucks supplying aggregate materials from the Argent Materials facility in comparison to four existing suppliers in Alameda, Contra Costa and San Mateo counties. The basis for the comparative analysis in this Study is the transport of 425,000 tons of concrete aggregates annually, from year 2018 until the year 2050 (approximately 33 years). Calculation details are provided in **Appendix A**.

Table 2, *Argent Materials and Existing Aggregate Suppliers in Alameda, Contra Costa and San Mateo Counties Comparison GHG Emissions*, shows the calculated GHG emissions from the transport of aggregate material from Argent Materials to end-user receiver destinations in Alameda, Contra Costa and San Francisco County. For comparison purposes, the calculated GHG emissions are also provided for the transport of the same tonnage of aggregate material from Ebi Aggregates located in San Mateo county. As shown in **Table 2**, the transport of aggregate material Argent Materials would result in fewer GHG emissions compared to Ebi Aggregates. This is due to the proximity of Argent Materials to end-user receiver destinations in Alameda, Contra Costa and San Francisco County. The transport of aggregate material from Ebi Aggregates results in approximately 131 percent greater GHG emissions than the transport of the same amount of material from Argent Materials.

4.2 Argent Materials and CEMEX Eliot Facility and Vulcan Materials Company Pleasanton Sand & Gravel Comparison

This Study evaluates the net difference in transportation-related GHG emissions from on-road haul trucks supplying aggregate materials from the Argent Materials facility in comparison to four existing suppliers in Alameda, Contra Costa and San Mateo counties. The basis for the comparative analysis in this Study is the transport of 425,000 tons of concrete aggregates annually, from year 2018 until the year 2050.

Table 2 shows the calculated GHG emissions from the transport of aggregate material from Argent Materials to end-user receiver destinations in Alameda, Contra Costa and San Francisco County. For comparison purposes, the calculated GHG emissions are also provided for the transport of the same tonnage of aggregate material from the CEMEX Eliot Facility and Vulcan Materials Company Pleasanton Sand & Gravel both located in Alameda county where the same distances to the end-user receivers to these two facilities were modelled. As shown in **Table 2**, the transport of aggregate material Argent Materials would result in fewer GHG emissions compared to CEMEX Eliot Facility and Vulcan Materials Company Pleasanton Sand & Gravel. This is due to the proximity of Argent Materials to end-user receiver destinations in Alameda, Contra Costa and San Francisco County. The transport of aggregate material from CEMEX Eliot and Vulcan Materials Company Pleasanton Sand & Gravel results in approximately 205 percent greater GHG emissions than the transport of the same amount of material from Argent Materials.

TABLE 2

ARGENT MATERIALS AND EXISTING AGGREGATE SUPPLIERS IN ALAMEDA, CONTRA COSTA AND SAN MATEO COUNTIES COMPARISON GHG EMISSIONS

Aggregate Source	Weighted Average Distance to End-User Receiver Locations (miles)	Transport GHG Emissions (metric tons CO_2)	Net Difference Compared to Argent Materials (metric tons CO_2)		Number of Passenger Vehicle Equivalent GHG Emissions Savings		Number of Single-Family Homes Equivalent GHG Emissions Savings		Cost Savings from Purchasing Equivalent Amount of GHG Offsets	
			Over 33-year period	Average Annual	Over 33-year period	Average Annual	Over 33-year period	Average Annual	At 2018 Price ($15.10 per metric ton in 2018)	Range at 2030 Price ($25 to $85 per metric ton in 2030)
Transport of 425,000 tons annually, over 33 years										
Argent Materials	9.2	25,088	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ebi Aggregates	21.6	58,399	+33,311 (+133%)	1,009	11,682	354	10,024	303	$502,996	$832,775 to $2,831,435
CEMEX Eliot Facility	28.2	76,447	+51,358 (+205%)	1,556	18,011	545	15,455	468	$775,516	$1,283,967 to $4,365,489
Vulcan Materials Company Pleasanton Sand & Gravel	28.2	76,447	+51,358 (+205%)	1,556	18,011	545	15,455	468	$775,516	$1,283,967 to $4,365,489
CEMEX Clayton Quarry	28.9	78,439	+53,350 (+213%)	1,616	18,710	566	16,054	486	$805,594	$1,333,765 to $4,534,802

SOURCE: ESA 2018.

4.3 Argent Materials and CEMEX Clayton Quarry Comparison

This Study evaluates the net difference in transportation-related GHG emissions from on-road haul trucks supplying aggregate materials from the Argent Materials facility in comparison to four existing suppliers in Alameda, Contra Costa and San Mateo counties. The basis for the comparative analysis in this Study is the transport of 425,000 tons of concrete aggregates annually, from year 2018 until the year 2050.

Table 2 shows the calculated GHG emissions from the transport of aggregate material from Argent Materials to end-user receiver destinations in Alameda, Contra Costa and San Francisco County. For comparison purposes, the calculated GHG emissions are also provided for the transport of the same tonnage of aggregate material from CEMEX Clayton Quarry located in Contra Costa county. As shown in **Table 2**, the transport of aggregate material Argent Materials would result in fewer GHG emissions compared to CEMEX Clayton Quarry. This is due to the proximity of Argent Materials to end-user receiver destinations in Alameda, Contra Costa and San Francisco County. The transport of aggregate material from CEMEX Clayton Quarry results in approximately 213 percent greater GHG emissions than the transport of the same amount of material from Argent Materials.

4.4 Total Greenhouse Gas Emission Savings

As shown in **Table 2**, the transport of 425,000 tons of aggregate material annually from Argent Materials instead of Ebi Aggregates would result in a savings of approximately 33,311 metric tons (MT) of carbon dioxide (CO_2) from year 2018 to 2050 (i.e., 33-year period). This reduction would be equivalent to the following:

- 33,311 metric tons of CO_2 saved is equivalent to removing GHG emissions from nearly 11,682 average passenger vehicles traveling on roadways and freeways in Northern California over 33 years (or approximately 354 average passenger vehicles per year).
- 33,311 metric tons of CO_2 saved is equivalent to removing GHG emissions from approximately 10,024 average single-family homes in California over 33 years (or 303 average single-family homes per year).

As shown in **Table 2**, the transport of 425,000 tons of aggregate material annually from Argent Materials instead of Vulcan Materials Company Pleasanton Sand & Gravel or CEMEX Eliot Facility would result in a savings of approximately 51,358 MT of CO_2) from year 2018 to 2050 (i.e., 33-year period). This reduction would be equivalent to the following:

- 51,358 metric tons of CO_2 saved is equivalent to removing GHG emissions from nearly 18,011 average passenger vehicles traveling on roadways and freeways in Northern California over 33 years (or approximately 545 average passenger vehicles per year).
- 51,358 metric tons of CO_2 saved is equivalent to removing GHG emissions from approximately 15,455 average single-family homes in California over 33 years (or approximately 468 average single-family homes per year).

As shown in **Table 2**, the transport of the 425,000 tons of aggregate material annually from Argent Materials instead of CEMEX Clayton Quarry would result in savings of approximately 53,350 MT of CO_2 from year 2018 to 2050 (i.e., 33-year period). This reduction would be equivalent to the following:

- 53,350 metric tons of CO_2 saved is equivalent to removing GHG emissions from nearly 18,710 average passenger vehicles traveling on roadways and freeways in Northern California over 33 years (or approximately 566 average passenger vehicles per year).

- 53,350 metric tons of CO_2 saved is equivalent to removing GHG emissions from approximately 16,054 average single-family homes in California over 33 years (or approximately 486 average single-family homes per year).

Furthermore, while this GHG report focuses on the GHG emissions savings as a result of transport of aggregate products to end user receivers, additional GHG emissions savings are expected from the production of aggregate. As mentioned above, the Argent Materials facility recycles aggregates by taking construction debris and processing it into its final aggregate product as compared to the other local suppliers that either do a combination of recycling and mining (Ebi Aggregates) or strictly mining (CEMEX Clayton Quarry, CEMEX Eliot, Vulcan Materials Company Pleasanton Sand & Gravel) to generate aggregate materials. For instance, based on a study by the USEPA, the recycling of certain aggregates products generates approximately 50% less GHG emissions than mining to generate those same aggregate products from raw materials (percentage averaged across aggregate containing materials including asphalt concrete, asphalt shingles and concrete) (USEPA 2016). This is because aggregate recycling facilities only require the additional GHG emissions of transporting the construction debris from their suppliers in order to obtain aggregate supplies, whereas mining facilities require many pieces of heavy-duty, off-road equipment to perform intensive activities such as excavating and quarrying in order to generate raw aggregate materials that would in turn produce greater quantities of GHG emissions. Therefore, facilities such as Argent Materials, which provides recycled aggregates from construction debris, generate additional GHG savings not quantified in this report as compared to facilities that provide aggregates from virgin mined sources.

4.5 Greenhouse Gas Cost Savings

The following discussion provides an estimated cost savings from transporting aggregate material from the Argent Materials facility located in the Alameda County to end-user receiver destinations in Alameda, Contra Costa and San Francisco counties in comparison to the transport of aggregate materials to the same receiver destinations from existing suppliers in Alameda, Contra Costa and San Mateo counties.

The cost of GHG emission allowances has been priced at $15.10 per metric ton as of March 29, 2018 according to the California Carbon Dashboard (http://calcarbondash.org/). In 2030, CARB predicts that the cost of GHGs per metric ton to be in the range of $25 to $85 under the State's Cap-and-Trade program (CARB 2017c).

As shown in **Table 2**, for the transport of 425,000 tons of aggregate material annually from Argent Materials instead of Ebi Aggregates, cost savings from purchasing an equivalent amount of GHG emissions offsets could be as follows:

- Assuming an average cost under current conditions of $15.10 per metric ton, 33,311 metric tons of CO_2 saved is equivalent to approximately $502,996 saved.
- Assuming an average cost under projected future 2030 conditions of $25 to $85 per metric ton, 33,311 metric tons of CO_2 saved is equivalent to the range of $832,775 to $2,831,435 saved.

As shown in **Table 2**, For the transport of 425,000 tons of aggregate material annually from Argent Materials instead of Vulcan Materials Company Pleasanton Sand & Gravel or CEMEX Eliot Facility, cost savings from purchasing an equivalent amount of GHG emissions offsets could be as follows:

- Assuming an average cost under current conditions of $15.10 per metric ton, 51,358 metric tons of CO_2 saved is equivalent to approximately $775,516 saved.
- Assuming an average cost under projected future 2030 conditions of $25 to $85 per metric ton, 51,538 metric tons of CO_2 saved is equivalent to the range of $1,283,967 to $4,365,489 saved.

As shown in **Table 2**, for the transport of 425,000 tons of aggregate material annually from Argent Materials instead of CEMEX Clayton Quarry, cost savings from purchasing an equivalent amount of GHG emissions offsets could be as follows:

- Assuming an average cost under current conditions of $15.10 per metric ton, 53,350 metric tons of CO_2 saved is equivalent to approximately $805,594 saved.
- Assuming an average cost under projected future 2030 conditions of $25 to $85 per metric ton, 53,350 metric tons of CO_2 saved is equivalent to the range of $1,333,765 to $4,534,802 saved.

4.6 Minimizing Greenhouse Gas 'Leakage'

Implementing GHG emissions control programs often requires an assessment for potential leakage-related issues. The State of California defines GHG emissions leakage as a reduction in emissions of GHGs within the State that is offset by an increase in emissions of GHGs outside the State. Under the State's Global Warming Solutions Act, CARB is required to design GHG emissions control measures to minimize leakage. Leakage occurs when emission control measures result in cost increases which:

- Can be avoided by relocating outside the state, and
- Exceed economic advantages of remaining in the state.

Locating aggregate mining near points of consumption results in cost savings while generating GHG emission reductions, and therefore meet neither of the above criteria. Emissions related to transport of aggregate cannot be avoided by relocating outside the state because they must be delivered to the point of consumption. For this reason, emission reductions achieved by minimizing haul distances are not subject to leakage.

In order to reduce GHG emissions and minimize leakage in the context of the aggregate mining and supply industry, policies should therefore encourage or require utilization of aggregate reserves located nearest to points of consumption. Such measures would result in a "win-win-win" for industry, government, and the environment. Conversely, regulatory actions to prohibit mining of known and/or permitted aggregate supplies located close to areas with high demand for aggregate would result in the generation of increased GHG emissions, which would then need to be offset in other ways under the State's Global Warming Solutions Act. Such alternative emission control measures are not likely to be more cost effective than utilizing nearby aggregate reserves, nor is it likely that such measures would be revenue neutral. Rather, such offsetting measures would likely increase costs, and therefore be subject to leakage. Such measures would result in a "lose-lose" for industry and government, while generating no net environmental benefit. This would be inconsistent with the State's policy to pursue emission control measures that minimize GHG emissions leakage.

As demonstrated in this report, Argent Materials is a local source of aggregate for the Alameda, Contra Costa and San Francisco County regions. By utilizing the resources at Argent Materials, regional demand for aggregate would be met while significantly decreasing GHG emissions compared to transporting aggregate from sources outside the region. Sourcing from Argent Materials would therefore be consistent with the State's policy of designing measures to minimize GHG emissions leakage by reducing the emissions of GHGs associated with the transport of aggregate to satisfy demand in Alameda, Contra Costa and San Francisco County.

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Appendix A
Greenhouse Gas Emissions Calculation Worksheets

ESA

A-1 Greenhouse Gas Calculations

Cities	Population	Proportion	Number of Trucks
San Leandro	87,598	0.0793	2807
Alameda	78,863	0.0714	2528
Oakland	428,827	0.3881	13744
Piedmont	11,318	0.0102	363
Hayward	162,030	0.1466	5193
Emeryville	11,994	0.0109	384
Berkeley	121,874	0.1103	3906
Albany	19,053	0.0172	611
Union City	72,591	0.0661	2339
El Cerrito	24,539	0.0020	70
San Francisco	883,963	0.0704	2494
Richmond	110,967	0.0088	313
Fremont	235,439	0.0188	664
		1	35417

Facility
Argent Materials
8300 Baldwin St
Oakland, CA 94621

City	Miles from facility	Proportion	Number of Trucks	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
San Leandro	3	0.2378	2807	21.7	21.4	21.3	21.0	20.9	20.8	20.6	20.5	20.4	20.3	20.2	20.1	20.1	20.0	19.9	19.8	19.7	19.6
Alameda	3.5	0.2783	2528	25.4	25.0	24.8	24.6	24.4	24.3	24.1	24.0	23.9	23.7	23.7	23.6	23.5	23.4	23.3	23.2	23.0	22.9
Oakland	7	2.7164	13744	248.0	243.9	241.9	239.9	238.5	237.2	235.5	234.3	233.1	231.4	230.8	230.1	229.4	228.5	227.3	226.1	224.9	223.6
Piedmont	9.7	0.0093	363	9.1	8.9	8.8	8.8	8.7	8.7	8.6	8.6	8.5	8.5	8.4	8.4	8.4	8.4	8.3	8.3	8.2	8.2
Hayward	9.7	1.4223	5193	129.6	127.7	126.7	125.6	124.9	124.2	123.3	122.7	122.1	121.1	120.9	120.3	120.1	119.6	119.0	118.4	117.7	117.1
Emeryville	9.7	0.1053	384	9.6	9.5	9.4	9.4	9.3	9.2	9.1	9.1	9.0	9.0	8.9	8.9	8.9	8.9	8.8	8.8	8.7	8.7
Berkeley	12.1	1.3345	3906	121.8	119.8	118.8	117.9	117.2	116.5	115.7	115.1	114.5	112.7	113.4	113.1	112.7	112.3	111.7	111.1	110.5	109.9
Albany	14.2	0.2448	611	22.4	22.0	21.8	21.6	21.5	21.4	21.2	21.1	21.0	20.9	20.8	20.7	20.7	20.6	20.5	20.4	20.3	20.2
Union City	14.4	0.9511	2339	86.3	85.4	84.7	84.0	83.5	83.1	82.5	82.1	81.6	81.0	80.8	80.6	80.3	80.0	79.6	79.2	78.7	78.3
El Cerrito	16.8	0.0334	70	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.7
San Francisco	18	1.2675	2494	115.7	113.4	112.9	111.9	111.3	110.7	109.9	109.3	108.8	108.0	107.7	107.4	107.1	106.6	106.1	105.5	104.9	104.3
Richmond	18.7	0.1652	313	15.1	14.8	14.7	14.6	14.5	14.4	14.3	14.3	14.2	14.1	14.0	14.0	14.0	13.9	13.8	13.8	13.7	13.6
Fremont	20.8	0.3801	664	35.6	35.0	34.7	34.5	34.3	34.2	33.8	33.7	33.5	33.2	33.2	33.0	32.9	32.8	32.6	32.5	32.3	32.1
	12.1538	9.2462	Totals	844.1	830.3	823.4	816.6	811.9	807.4	801.7	797.2	793.5	787.5	785.7	783.3	780.9	777.8	773.9	769.6	765.4	761.3

CM Aggregates
1 Quarry Rd
Brisbane, CA

City	Miles from facility	Proportion	Number of Trucks	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
San Leandro	28.3	2.2434	2807	204.8	201.4	199.8	198.1	197.0	195.9	194.5	193.5	192.5	191.4	190.6	190.0	189.5	188.7	187.7	186.7	185.7	184.7
Alameda	21.5	1.5344	2528	140.1	137.9	136.6	135.5	134.7	134.0	133.0	132.4	131.7	130.7	130.4	130.0	129.6	129.1	128.4	127.7	127.0	126.3
Oakland	18	6.9851	13744	637.7	627.2	622.1	616.9	613.3	610.0	605.6	602.6	598.5	594.8	591.6	591.8	589.9	587.6	584.5	581.4	578.2	575.0
Piedmont	19.2	0.1966	363	18.0	17.7	17.5	17.4	17.3	17.2	17.0	17.0	16.9	16.7	16.7	16.7	16.6	16.5	16.5	16.4	16.3	16.2
Hayward	29.1	4.2668	5193	389.5	383.2	380.0	376.8	374.2	372.6	369.9	368.1	366.2	363.4	362.6	361.5	360.4	358.9	357.1	355.2	353.2	351.2
Emeryville	16.1	0.3747	384	16.0	15.7	15.6	15.4	15.3	15.3	15.2	15.1	15.0	14.9	14.8	14.8	14.8	14.7	14.6	14.5	14.5	14.4
Berkeley	19.4	2.1396	3906	196.3	193.1	190.5	189.0	187.9	186.8	185.5	184.6	183.6	182.2	181.8	181.3	180.7	180.0	179.0	178.1	177.1	176.1
Albany	19.9	0.3431	611	31.3	30.8	30.6	30.3	30.1	30.0	29.7	29.6	29.4	29.2	29.2	29.1	29.0	28.9	28.7	28.6	28.4	28.2
Union City	31.8	2.1005	2339	191.8	188.6	187.1	185.5	184.4	183.4	182.1	181.2	180.3	178.9	178.5	177.5	177.4	176.7	175.8	174.8	173.9	172.9
El Cerrito	22.7	0.0451	70	4.1	4.0	4.0	4.0	4.0	3.9	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.7	3.7
San Francisco	8.2	0.5774	2494	52.7	51.9	51.4	51.0	50.7	50.4	50.1	49.8	49.6	49.2	49.1	48.9	48.6	48.6	48.2	48.1	47.8	47.5
Richmond	24.1	0.2130	315	19.4	19.1	19.0	18.8	18.7	18.6	18.5	18.4	18.3	18.1	18.1	18.0	18.0	17.9	17.8	17.7	17.6	17.5
Fremont	37.5	0.7033	664	64.2	63.2	62.6	62.1	61.8	61.4	61.0	60.7	60.4	59.9	59.8	59.6	59.4	59.2	58.9	58.5	58.2	57.9
	22.7538	21.5231	Totals	1965.0	1932.7	1916.8	1900.9	1889.8	1879.5	1866.1	1856.8	1847.3	1833.1	1829.0	1821.4	1817.8	1810.6	1801.1	1791.6	1781.7	1771.7

CEMEX Clayton Quarry
515 Mitchell Canyon Rd
Clayton, CA 94517

City	Miles from facility	Proportion	Number of Trucks	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
San Leandro	31.8	2.5208	2807	230.1	226.4	224.5	222.6	221.3	220.1	218.6	217.5	216.4	214.7	214.2	211.6	212.9	212.1	210.9	209.8	208.7	207.5
Alameda	28.5	2.0625	2528	183.3	185.2	183.7	182.2	181.1	180.1	178.8	177.9	177.0	175.7	175.3	174.7	174.2	173.5	172.6	171.7	170.7	169.8
Oakland	25	9.7015	13744	885.7	871.2	864.0	856.8	851.8	847.2	841.1	836.9	832.7	826.3	824.4	821.9	819.4	816.1	811.8	807.5	803.1	798.6
Piedmont	23.2	0.2376	363	21.7	21.3	21.2	21.0	20.9	20.7	20.6	20.5	20.4	20.2	20.2	20.1	20.1	20.0	19.9	19.8	19.7	19.6
Hayward	20.8	4.5808	5193	411.6	406.9	403.5	400.1	397.8	395.6	392.8	390.9	388.9	385.9	385.0	383.8	382.7	381.1	379.1	377.1	375.1	373.0
Emeryville	24.3	0.3637	384	24.3	23.7	23.5	23.3	23.2	23.0	22.9	22.8	22.6	22.5	22.4	22.3	22.3	22.2	22.1	22.0	21.8	21.7
Berkeley	24.7	2.7241	3906	248.7	244.6	242.6	240.6	239.2	237.9	236.2	235.0	233.8	232.0	231.5	230.8	230.1	229.2	228.0	226.8	225.5	224.2
Albany	25.7	0.4431	611	40.5	39.8	39.5	39.1	38.9	38.7	38.4	38.2	38.0	37.7	37.7	37.5	37.4	37.3	37.1	36.9	36.7	36.5
Union City	44.5	2.9393	2339	268.3	263.9	261.8	259.6	258.1	256.7	254.8	253.6	252.3	250.3	249.8	249.0	248.2	247.3	246.0	244.7	243.3	242.0
El Cerrito	31.7	0.0630	70	5.7	5.7	5.6	5.5	5.5	5.5	5.5	5.4	5.4	5.4	5.4	5.3	5.3	5.3	5.3	5.2	5.2	5.2
San Francisco	33.1	2.3308	2494	212.8	209.3	207.6	205.9	204.7	203.5	202.1	201.1	200.1	198.5	198.1	197.5	196.9	196.1	195.1	194.0	193.0	191.9
Richmond	31.6	0.2793	313	25.5	25.1	24.9	24.7	24.5	24.4	24.2	24.1	24.0	23.8	23.7	23.7	23.6	23.5	23.4	23.3	23.1	23.0
Fremont	43.3	0.8121	664	74.1	72.9	72.3	71.7	71.3	70.9	70.4	70.1	69.7	69.2	69.0	68.8	68.6	68.3	68.0	67.6	67.2	66.9
	30.6692	28.9087	Totals	2630.2	2595.9	2574.5	2553.2	2538.3	2524.5	2506.5	2493.9	2481.2	2462.1	2455.6	2448.0	2441.5	2421.9	2428.2	2406.3	2393.2	2379.7

Vulcan Materials
501 El Charro Rd.
Pleasanton, CA 94566

City	Miles from facility	Proportion	Number of Trucks	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
San Leandro	21.1	1.6726	2807	152.7	150.2	149.0	147.7	146.5	146.1	145.0	144.3	143.6	142.5	142.1	141.7	141.3	140.7	140.0	139.2	138.5	137.7
Alameda	27.2	1.9411	2528	172.2	174.3	172.9	171.6	170.4	169.5	168.3	167.5	166.6	165.3	165.0	164.4	163.9	163.3	162.4	161.6	160.7	159.8
Oakland	30	11.6418	13744	1062.8	1045.4	1036.8	1028.2	1022.2	1016.6	1009.4	1004.3	999.2	991.5	989.3	986.3	983.2	979.3	974.2	969.1	963.7	958.3
Piedmont	30.6	0.3134	363	28.6	28.1	27.9	27.7	27.5	27.4	27.2	27.0	26.8	26.7	26.6	26.6	26.5	26.4	26.2	26.1	25.9	25.8
Hayward	17.1	2.5073	5193	228.9	225.2	223.3	221.4	220.2	219.0	217.4	216.3	215.2	213.5	213.1	212.4	211.8	210.9	209.8	208.7	207.6	206.4
Emeryville	32.1	0.3484	384	31.8	31.3	31.0	30.8	30.6	30.4	30.2	30.1	29.9	29.7	29.6	29.5	29.4	29.3	29.2	29.0	28.8	28.7
Berkeley	34.1	3.7608	3906	343.3	337.7	334.9	332.1	330.2	328.4	326.1	324.4	322.8	320.3	319.6	318.6	317.6	316.4	314.7	313.0	311.3	309.6
Albany	37	0.6379	611	58.2	57.3	56.8	56.3	56.0	55.7	55.3	55.0	54.8	54.3	54.2	54.0	53.9	53.7	53.4	53.1	52.8	52.5
Union City	24	1.5852	2339	144.7	142.4	141.2	140.0	139.2	138.4	137.4	136.8	136.1	135.0	134.7	134.3	133.9	133.4	132.7	132.0	131.2	130.5
El Cerrito	39.4	0.0783	70	7.1	7.0	7.0	6.9	6.9	6.8	6.8	6.8	6.7	6.7	6.7	6.6	6.6	6.6	6.6	6.5	6.5	6.4
San Francisco	40.8	2.8731	2494	262.3	258.0	255.9	253.7	252.3	250.9	249.1	247.9	246.6	244.7	244.1	243.4	242.6	241.7	240.4	239.2	237.8	236.5
Richmond	40.8	0.3607	313	32.9	32.4	32.1	31.9	31.7	31.5	31.3	31.1	31.0	30.7	30.6	30.6	30.5	30.3	30.2	30.0	29.9	29.7
Fremont	24.2	0.4539	664	41.4	40.8	40.4	40.1	39.9	39.6	39.4	39.2	39.0	38.7	38.6	38.5	38.3	38.2	38.0	37.8	37.6	37.4
	30.64615385	28.1746	Totals	2572.2	2530.0	2509.1	2488.5	2473.9	2460.3	2442.8	2430.6	2418.2	2399.6	2394.2	2386.9	2379.5	2370.1	2357.7	2345.2	2332.4	2319.3

CEMEX Eliot
1544 Stanley Blvd
Pleasanton, CA 94566

City	Miles from facility	Proportion	Number of Trucks	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
San Leandro	21.1	1.6726	2807	152.7	150.2	149.0	147.7	146.5	146.1	145.0	144.3	143.6	142.5	142.1	141.7	141.3	140.7	140.0	139.2	138.5	137.7
Alameda	27.2	1.9411	2528	171.2	174.3	172.9	171.4	170.4	169.5	168.3	167.5	166.6	165.3	165.0	164.4	163.9	163.3	162.4	161.6	160.7	159.8
Oakland	30	11.6418	13744	1062.8	1045.4	1036.8	1028.2	1022.2	1016.6	1009.4	1004.3	999.2	991.5	989.3	986.3	983.2	979.3	974.2	969.1	963.7	958.3
Piedmont	30.6	0.3134	363	28.6	28.1	27.9	27.7	27.5	27.4	27.2	27.0	26.9	26.7	26.6	26.6	26.5	26.4	26.2	26.1	25.9	25.8
Hayward	17.1	2.5073	5193	228.9	225.2	223.3	221.4	220.2	219.0	217.4	216.3	215.2	213.5	213.1	212.4	211.8	210.9	209.8	208.7	207.6	206.4
Emeryville	32.1	0.3484	384	31.8	31.3	31.0	30.8	30.6	30.4	30.2	30.1	29.9	29.7	29.6	29.5	29.4	29.3	29.2	29.0	28.8	28.7
Berkeley	34.1	3.7608	3906	343.3	337.7	334.9	332.1	330.2	328.4	326.1	324.4	322.8	320.3	319.6	318.6	317.6	316.4	314.7	313.0	311.3	309.6
Albany	37	0.6379	611	58.2	57.3	56.8	56.3	56.0	55.7	55.3	55.0	54.8	54.3	54.2	54.0	53.9	53.7	53.4	53.1	52.8	52.5
Union City	24	1.5852	2339	144.7	142.4	141.2	140.0	139.2	138.4	137.4	136.8	136.1	135.0	134.7	134.3	133.9	133.4	132.7	132.0	131.2	130.5
El Cerrito	39.4	0.0783	70	7.1	7.0	7.0	6.9	6.9	6.8	6.8	6.8	6.7	6.7	6.7	6.6	6.6	6.6	6.6	6.5	6.5	6.4
San Francisco	40.8	2.8731	2494	262.3	258.0	255.9	253.7	252.3	250.9	249.1	247.9	246.6	244.7	244.1	243.4	242.6	241.7	240.4	239.2	237.8	236.5
Richmond	40.8	0.3607	313	32.9	32.4	32.1	31.9	31.7	31.5	31.3	31.1	31.0	30.7	30.6	30.6	30.5	30.3	30.2	30.0	29.9	29.7
Fremont	34.2	0.4539	664	41.4	40.8	40.4	40.1	39.9	39.6	39.4	39.2	39.0	38.7	38.6	38.5	38.3	38.2	38.0	37.8	37.6	37.4
	30.6462	28.1746	Totals	2572.2	2530.0	2509.1	2488.3	2473.9	2460.3	2442.8	2430.6	2418.2	2399.6	2394.2	2386.9	2379.5	2370.1	2357.7	2345.2	2332.4	2319.3

Cities	Population	Proportion	Number of Trucks
San Leandro	87,508	0.0793	2807
Alameda	78,863	0.0714	2528
Oakland	428,827	0.3881	13744
Piedmont	11,318	0.0102	363
Hayward	162,030	0.1466	5193
Emeryville	11,994	0.0109	384
Berkeley	121,874	0.1103	3906
Albany	19,053	0.0172	611
Union City	72,991	0.0661	2339
El Cerrito	24,939	0.0020	70
San Francisco	843,963	0.0704	3494
Richmond	110,967	0.0088	313
Fremont	235,439	0.0188	664
		1	35417

Facility
Argent Materials
8300 Baldwin St
Oakland, CA 94621

City	Miles from facility	Proportion	Number of Trucks	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Totals [metric tons]
San Leandro	3	0.2378	2807	19.5	19.3	19.2	19.1	18.8	18.8	18.6	18.5	18.3	18.2	18.0	17.8	17.7	17.6	17.4	
Alameda	3.5	0.2783	2528	22.8	22.6	22.5	22.3	22.2	22.0	21.8	21.6	21.5	21.3	21.1	20.9	20.8	20.6	20.4	
Oakland	7	2.7184	13744	222.3	220.9	219.4	217.9	216.3	214.7	213.0	211.3	209.6	207.8	206.1	204.3	202.6	200.8	199.1	
Piedmont	9.7	0.0893	363	8.1	8.1	8.0	8.0	7.9	7.8	7.8	7.7	7.7	7.6	7.5	7.5	7.4	7.3	7.3	
Hayward	9.7	1.4273	5193	116.4	115.6	114.9	114.1	113.2	112.4	111.5	110.6	109.7	108.8	107.3	107.0	106.1	105.1	104.2	
Emeryville	9.7	0.1053	384	8.6	8.6	8.5	8.4	8.4	8.3	8.3	8.2	8.1	8.2	8.0	7.9	7.9	7.8	7.7	
Berkeley	12.1	1.3345	3906	109.2	108.5	107.8	107.0	106.3	105.5	104.6	103.8	103.0	102.1	101.2	100.4	99.5	98.6	97.8	
Albany	14.2	0.2448	611	20.0	19.9	19.8	19.6	19.5	19.3	19.2	19.0	18.9	18.7	18.6	18.4	18.3	18.1	17.9	
Union City	14.4	0.9511	2339	77.8	77.3	76.8	76.3	75.7	75.2	74.6	74.0	73.4	72.8	72.2	71.5	70.9	70.3	69.7	
El Cerrito	16.8	0.0334	70	2.7	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	
San Francisco	18	1.2625	3494	103.7	103.1	102.4	101.7	100.9	100.2	99.4	98.6	97.8	97.0	96.2	95.3	94.5	93.7	92.9	
Richmond	18.7	0.1653	313	13.5	13.4	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.6	12.5	12.4	12.3	12.2	12.1	
Fremont	20.8	0.3901	664	31.9	31.7	31.5	31.3	31.1	30.8	30.5	30.3	30.1	29.8	29.6	29.3	29.1	28.8	28.6	
	12.1538	9.2462	Totals	756.6	751.8	746.9	741.7	736.2	730.7	724.9	719.1	713.3	707.4	701.4	695.5	689.3	683.5	677.6	25,088.08

[illegible] Aggregates
1 Quarry Rd.
Brisbane, CA

City	Miles from facility	Proportion	Number of Trucks	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Totals
San Leandro	28.3	2.2434	2807	183.6	182.4	181.2	179.9	178.6	177.3	175.9	174.5	173.1	171.6	170.2	168.7	167.3	165.8	164.4	
Alameda	21.5	1.5344	2528	125.6	124.8	123.9	123.1	122.2	121.3	120.3	119.3	118.4	117.4	116.4	115.4	114.4	113.4	112.4	
Oakland	18	6.9851	13744	571.6	568.0	564.2	560.3	556.2	552.0	547.6	543.3	538.9	534.4	529.9	525.4	520.8	516.4	511.9	
Piedmont	19.2	0.3966	363	16.1	16.0	15.9	15.8	15.7	15.5	15.4	15.3	15.2	15.0	14.9	14.8	14.7	14.5	14.4	
Hayward	29.1	4.2668	5193	349.2	346.9	344.7	342.3	339.7	337.2	334.5	331.8	329.2	326.4	323.7	320.9	318.2	315.4	312.7	
Emeryville	16.1	0.1747	384	14.3	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.1	13.0	12.9	12.8	
Berkeley	19.4	2.1396	3906	175.1	174.0	172.8	171.6	170.4	169.1	167.7	166.4	165.1	163.7	162.3	160.9	159.5	158.1	156.8	
Albany	19.8	0.3431	611	28.1	27.9	27.7	27.5	27.3	27.1	26.9	26.7	26.5	26.3	26.0	25.8	25.6	25.4	25.1	
Union City	31.8	2.1005	2339	171.9	170.8	169.7	168.5	167.3	166.0	164.7	163.4	162.0	160.7	159.3	158.0	156.6	155.3	153.9	
El Cerrito	22.7	0.0451	70	3.7	3.7	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.4	3.4	3.4	3.3	3.3	
San Francisco	8.2	0.5774	3494	47.3	47.0	46.6	46.3	46.0	45.6	45.3	44.9	44.5	44.2	43.8	43.4	43.1	42.7	42.3	
Richmond	24.1	0.2130	313	17.4	17.3	17.2	17.1	17.0	16.8	16.7	16.6	16.4	16.3	16.2	16.0	15.9	15.7	15.6	
Fremont	37.5	0.7033	664	57.6	57.2	56.8	56.4	56.0	55.6	55.1	54.7	54.3	53.8	53.4	52.9	52.4	52.0	51.5	
	22.7528	21.5221	Totals	1762.2	1750.1	1738.6	1726.4	1713.8	1700.8	1687.4	1673.5	1660.4	1646.6	1632.8	1618.9	1604.9	1591.1	1577.3	58,399.08

CEMEX Clayton Quarry
515 Mitchell Canyon Rd
Clayton, CA 94517

City	Miles from facility	Proportion	Number of Trucks	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Totals
San Leandro	31.8	2.5236	2807	206.3	205.0	203.6	202.2	200.7	199.2	197.6	196.1	194.5	192.9	191.2	189.6	188.0	186.3	184.7	
Alameda	28.9	2.0625	2528	168.8	167.7	166.6	165.4	164.2	163.0	161.7	160.4	159.1	157.8	156.5	155.1	153.8	152.5	151.2	
Oakland	25	9.7015	13744	793.9	788.9	783.7	778.2	772.5	766.6	760.6	754.5	748.4	742.2	736.0	729.7	723.4	717.2	711.0	
Piedmont	28.2	0.2376	363	19.4	19.3	19.2	19.1	18.9	18.8	18.6	18.5	18.3	18.2	18.0	17.9	17.7	17.6	17.4	
Hayward	30.9	4.5308	5193	370.7	368.4	366.0	363.4	360.8	358.0	355.2	352.4	349.5	346.6	343.7	340.8	337.9	334.9	332.0	
Emeryville	24.3	0.2637	384	21.6	21.4	21.3	21.2	21.0	20.8	20.7	20.5	20.3	20.2	20.0	19.8	19.7	19.5	19.3	
Berkeley	24.7	2.7241	3906	222.9	221.5	220.0	218.5	216.9	215.3	213.6	211.9	210.2	208.4	206.7	204.9	203.1	201.4	199.6	
Albany	25.7	0.4431	611	36.3	36.0	35.8	35.5	35.3	35.0	34.7	34.5	34.2	33.9	33.6	33.3	33.0	32.8	32.5	
Union City	44.5	2.9393	2339	240.5	239.0	237.4	235.8	234.0	232.3	230.4	228.6	226.8	224.9	223.0	221.1	219.2	217.3	215.4	
El Cerrito	31.7	0.0630	70	5.2	5.1	5.1	5.1	5.0	5.0	4.9	4.9	4.9	4.8	4.8	4.7	4.7	4.7	4.6	
San Francisco	32.1	2.2308	3494	190.7	189.5	188.3	187.0	185.6	184.2	182.7	181.9	179.8	178.3	176.8	175.3	173.8	172.3	170.8	
Richmond	31.6	0.2793	313	22.9	22.7	22.6	22.4	22.2	22.1	21.9	21.7	21.6	21.4	21.2	21.0	20.8	20.6	20.5	
Fremont	43.3	0.8121	664	66.5	66.0	65.6	65.1	64.7	64.2	63.7	63.2	62.7	62.2	61.6	61.1	60.6	60.0	59.5	
	30.6092	28.9087	Totals	2365.6	2350.6	2335.2	2318.9	2301.9	2284.5	2266.5	2248.3	2230.2	2211.7	2193.0	2174.4	2155.7	2137.0	2118.5	76,436.69

Vulcan Materials
501 El Charro Rd.
Pleasanton, CA 94566

City	Miles from facility	Proportion	Number of Trucks	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Totals
San Leandro	21.1	1.6726	2807	136.9	136.0	135.1	134.2	133.2	132.2	131.1	130.1	129.0	128.0	126.9	125.8	124.7	123.6	122.6	
Alameda	27.2	1.9411	2528	158.8	157.8	156.8	155.7	154.6	153.4	152.2	151.0	149.8	148.5	147.3	146.0	144.7	143.5	142.3	
Oakland	30	11.6428	13744	952.6	946.6	940.4	933.8	927.0	920.0	912.7	905.4	898.1	890.7	883.2	875.6	868.2	860.6	853.2	
Piedmont	30.6	0.3134	363	25.6	25.5	25.3	25.1	25.0	24.8	24.6	24.4	24.2	24.0	23.8	23.6	23.4	23.2	23.0	
Hayward	17.1	2.5073	5193	205.2	203.9	202.5	201.1	199.6	198.1	196.5	195.0	193.4	191.8	190.2	188.6	187.0	185.3	183.7	
Emeryville	32.1	0.3484	384	28.5	28.3	28.1	27.9	27.7	27.5	27.3	27.1	26.9	26.7	26.4	26.2	26.0	25.8	25.5	
Berkeley	34.1	3.7808	3906	307.7	305.8	303.8	301.7	299.5	297.2	294.9	292.5	290.1	287.7	285.3	282.9	280.4	278.0	275.6	
Albany	37	0.6379	611	52.2	51.9	51.5	51.2	50.8	50.4	50.0	49.6	49.2	48.8	48.4	48.0	47.6	47.2	46.8	
Union City	24	1.5852	2339	129.7	128.9	128.1	127.2	126.2	125.3	124.3	123.3	122.3	121.3	120.3	119.2	118.2	117.2	116.2	
El Cerrito	39.4	0.0783	70	6.4	6.4	6.3	6.3	6.2	6.2	6.1	6.1	6.0	6.0	5.9	5.9	5.8	5.8	5.7	
San Francisco	40.8	2.8731	3494	235.1	233.6	232.1	230.5	228.8	227.0	225.2	223.4	221.6	219.8	218.0	216.1	214.2	212.4	210.5	
Richmond	40.8	0.3407	313	29.5	29.3	29.1	28.9	28.7	28.5	28.3	28.1	27.8	27.6	27.4	27.1	26.9	26.7	26.4	
Fremont	24.2	0.4535	664	37.1	36.9	36.7	36.4	36.1	35.9	35.6	35.3	35.0	34.7	34.4	34.1	33.8	33.6	33.3	
	30.64615385	28.1746	Totals	2305.5	2291.0	2275.9	2260.0	2243.4	2226.4	2208.9	2191.2	2173.6	2155.5	2137.4	2119.2	2100.9	2082.8	2064.7	76,446.77

CEMEX Eliot
1544 Stanley Blvd
Pleasanton, CA 94566

City	Miles from facility	Proportion	Number of Trucks	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	Totals
San Leandro	21.1	1.6726	2807	136.9	136.0	135.1	134.2	133.2	132.2	131.1	130.1	129.0	128.0	126.9	125.8	124.7	123.6	122.6	
Alameda	27.2	1.9411	2528	158.8	157.8	156.8	155.7	154.6	153.4	152.2	151.0	149.8	148.5	147.3	146.0	144.7	143.5	142.3	
Oakland	30	11.6428	13744	952.6	946.6	940.4	933.8	927.0	920.0	912.7	905.4	898.1	890.7	883.2	875.6	868.2	860.6	853.2	
Piedmont	30.6	0.3134	363	25.6	25.5	25.3	25.1	25.0	24.8	24.6	24.4	24.2	24.0	23.8	23.6	23.4	23.2	23.0	
Hayward	17.1	2.5073	5193	205.2	203.9	202.5	201.1	199.6	198.1	196.5	195.0	193.4	191.8	190.2	188.6	187.0	185.3	183.7	
Emeryville	32.1	0.3484	384	28.5	28.3	28.1	27.9	27.7	27.5	27.3	27.1	26.9	26.7	26.4	26.2	26.0	25.8	25.5	
Berkeley	34.1	3.7808	3906	307.7	305.8	303.8	301.7	299.5	297.2	294.9	292.5	290.1	287.7	285.3	282.9	280.4	278.0	275.6	
Albany	37	0.6379	611	52.2	51.9	51.5	51.2	50.8	50.4	50.0	49.6	49.2	48.8	48.4	48.0	47.6	47.2	46.8	
Union City	24	1.5852	2339	129.7	128.9	128.1	127.2	126.2	125.3	124.3	123.3	122.3	121.3	120.3	119.2	118.2	117.2	116.2	
El Cerrito	39.4	0.0783	70	6.4	6.4	6.3	6.3	6.2	6.2	6.1	6.1	6.0	6.0	5.9	5.9	5.8	5.8	5.7	
San Francisco	40.8	2.8731	3494	235.1	233.6	232.1	230.5	228.8	227.0	225.2	223.4	221.6	219.8	218.0	216.1	214.2	212.4	210.5	
Richmond	40.8	0.3407	313	29.5	29.3	29.1	28.9	28.7	28.5	28.3	28.1	27.8	27.6	27.4	27.1	26.9	26.7	26.4	
Fremont	24.2	0.4535	664	37.1	36.9	36.7	36.4	36.1	35.9	35.6	35.3	35.0	34.7	34.4	34.1	33.8	33.6	33.3	
	30.6462	28.1746	Totals	2305.5	2291.0	2275.9	2260.0	2243.4	2226.4	2208.9	2191.2	2173.6	2155.5	2137.4	2119.2	2100.9	2082.8	2064.7	76,446.77

			Difference between Facility and Project Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Cost Saving 2018	$502,996	[illegible] Aggregates	Metric Tons GHG/year	1120.82	1102.4	1093.3	1084.3	1078.0	1072.1	1064.4	1059.1	1053.7	1045.6	1043.2	1040.1	1036.9	1032.8	1027.4	1021.9	1016.3	1010.6
			Total Metric Tons GHG/year	33311.00																	
			Average Metric Tons GHG/year	1009.42																	
Cost Savings 2030	$432,775		LDA cars/year	291.20	292.5	296.6	301.0	306.3	311.7	316.5	321.9	327.3	331.6	337.6	343.2	348.7	353.6	357.8	361.7	365.4	368.7
	$2,831,435		Total Cars (33 years)	11682.19																	
			Average LDA Cars/year	354.01																	
			Elec DU Equivalent	337.28	331.7	329.0	325.3	324.4	322.6	320.3	318.7	317.1	314.6	313.9	313.0	312.0	310.8	309.2	307.5	305.8	304.1
			Total Homes (33 years)	10024.13																	
			Elec DU Equil Avg	303.76																	
Cost Saving 2018	$805,994	CEMEX Clayton Quarry	Metric Tons GHG/year	1795.09	1765.5	1751.1	1736.5	1726.5	1717.0	1704.8	1696.1	1687.5	1674.6	1670.9	1665.7	1660.6	1654.1	1645.4	1636.7	1627.7	1618.6
			Total Metric Tons GHG/year	53350.61																	
			Average Metric Tons GHG/year	1616.69																	
Cost Savings 2030	$1,332,766		LDA cars/year	465.38	468.5	475.1	482.1	490.6	499.2	506.8	515.4	524.2	531.1	540.8	549.7	558.4	566.3	571.0	579.4	585.2	590.5
	$4,534,802		Total Cars (33 years)	18710.09																	
			Average LDA Cars/year	566.97																	
			Elec DU Equivalent	540.39	531.3	526.9	522.6	529.5	516.7	513.0	510.4	507.8	503.9	502.8	501.3	499.7	497.8	495.1	492.5	489.8	487.1
			Total Homes (33 years)	16054.56																	
			Elec DU Equil Avg	486.50																	
Cost Saving 2018	$775,516	Vulcan Materials	Metric Tons GHG/year	1728.07	1699.7	1685.7	1671.7	1662.0	1652.9	1641.1	1632.9	1624.6	1612.1	1606.5	1603.5	1598.6	1592.3	1584.0	1575.6	1566.9	1559.1
			Total Metric Tons GHG/year	5135[illegible].69																	
			Average Metric Tons GHG/year	1556.32																	
Cost Savings 2030	$1,283,967		LDA cars/year	448.97	451.0	457.4	464.1	472.3	480.5	487.9	496.3	504.6	511.3	520.6	529.2	537.6	545.1	551.6	557.7	563.3	568.4
	$4,365,489		Total Cars (33 years)	18011.52																	
			Average LDA Cars/year	545.80																	
			Elec DU Equivalent	520.02	511.5	507.3	503.1	500.1	497.4	493.9	491.4	488.9	485.1	484.0	482.5	481.1	479.2	476.7	474.1	471.5	468.9
			Total Homes (33 years)	15455.14																	
			Elec DU Equil Avg	468.34																	
Cost Saving 2018	$775,516	CEMEX Eliot	Metric Tons GHG/year	1728.07	1699.7	1685.7	1671.7	1662.0	1652.9	1641.1	1632.9	1624.6	1612.1	1606.5	1603.5	1598.6	1592.3	1584.0	1575.6	1566.9	1559.1
			Total Metric Tons GHG/year	51358.03																	
			Average Metric Tons GHG/year	1556.32																	
Cost Savings 2030	$1,283,967		LDA cars/year	448.97	451.0	457.4	464.1	472.3	480.5	487.9	496.3	504.6	511.3	520.6	529.2	537.6	545.1	551.6	557.7	563.3	568.4
	$4,365,489		Total Cars (33 years)	18011.52																	
			Average LDA Cars/year	545.80																	
			Elec DU Equivalent	520.02	511.5	507.3	503.1	500.1	497.4	493.9	491.4	488.9	485.1	484.0	482.5	481.1	479.2	476.7	474.1	471.5	468.9
			Total Homes (33 years)	15455.14																	
			Elec DU Equil Avg	468.34																	

Difference between Facility and Project:

			Year	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
		Ebi Aggregates	Metric Tons GHG/year	1004.6	998.3	991.7	984.8	977.5	970.2	962.5	954.8	947.1	939.3	931.3	923.4	915.5	907.5	899.7
Cost Saving 2018	$502,996		Total Metric Tons GHG/year															
			Average Metric Tons GHG/year															
			LDA cars/year	371.7	374.4	376.8	378.9	380.7	382.3	383.7	384.9	386.0	386.8	387.5	388.1	388.6	389.1	389.4
Cost Savings 2030	$832,775		Total Cars (33 years)															
	$2,831,435		Average LDA Cars/year															
			Elec DU Equivalent	302.3	300.4	298.4	296.3	294.2	291.9	289.6	287.3	285.0	282.6	280.3	277.9	275.5	273.1	270.7
			Total Homes (33 years)															
			Elec DU Equil Avg															
		CEMEX Clayton Quarry	Metric Tons GHG/year	1609.0	1598.3	1588.3	1577.2	1565.6	1553.8	1541.5	1529.2	1516.9	1504.3	1491.6	1478.9	1466.2	1453.5	1440.9
Cost Saving 2018	$805,594		Total Metric Tons GHG/year															
			Average Metric Tons GHG/year															
			LDA cars/year	595.2	599.6	603.5	606.9	609.7	612.4	614.5	616.4	618.2	619.5	620.6	621.6	622.4	623.1	623.6
Cost Savings 2030	$1,333,765		Total Cars (33 years)															
	$4,534,802		Average LDA Cars/year															
			Elec DU Equivalent	484.2	481.1	478.0	474.6	471.1	467.6	463.9	460.2	456.5	452.7	448.9	445.0	441.2	437.4	433.6
			Total Homes (33 years)															
			Elec DU Equil Avg															
		Vulcan Materials	Metric Tons GHG/year	1548.9	1539.1	1529.0	1518.3	1507.2	1495.8	1484.0	1472.1	1460.3	1448.1	1435.9	1423.7	1411.5	1399.2	1387.1
Cost Saving 2018	$775,516		Total Metric Tons GHG/year															
			Average Metric Tons GHG/year															
			LDA cars/year	573.0	577.2	580.9	584.2	587.0	589.5	591.6	593.4	595.1	596.4	597.5	598.4	599.2	599.8	600.3
Cost Savings 2030	$1,283,967		Total Cars (33 years)															
	$4,365,489		Average LDA Cars/year															
			Elec DU Equivalent	466.1	463.2	460.1	456.9	453.5	450.1	446.6	443.0	439.4	435.8	432.1	428.4	424.7	421.1	417.4
			Total Homes (33 years)															
			Elec DU Equil Avg															
		CEMEX Blot	Metric Tons GHG/year	1548.9	1539.1	1529.0	1518.3	1507.2	1495.8	1484.0	1472.1	1460.3	1448.1	1435.9	1423.7	1411.5	1399.2	1387.1
Cost Saving 2018	$775,516		Total Metric Tons GHG/year															
			Average Metric Tons GHG/year															
			LDA cars/year	573.0	577.2	580.9	584.2	587.0	589.5	591.6	593.4	595.1	596.4	597.5	598.4	599.2	599.8	600.3
Cost Savings 2030	$1,283,967		Total Cars (33 years)															
	$4,365,489		Average LDA Cars/year															
			Elec DU Equivalent	466.1	463.2	460.1	456.9	453.5	450.1	446.6	443.0	439.4	435.8	432.1	428.4	424.7	421.1	417.4
			Total Homes (33 years)															
			Elec DU Equil Avg															

A-2 EMFAC2017 Emission Factors

EMFAC2017 Emission Factors
Metropolitan Transportation Commission (MTC)
2018-2050
aggregate model year
aggregate speed

		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
T6 Instate Small	Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	CO2e (g/mile)	1023.612	1002.977	990.2454	977.3389	966.2945	955.138	942.7151	932.2768	921.8605	909.1278
T7 Single	Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	CO2e(g/mile)	1554.141	1532.478	1524.301	1516.344	1512.916	1510.511	1505.368	1503.563	1501.548	1495.614
Average	Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	CO2e(g/mile)	1288.877	1267.728	1257.273	1246.841	1239.605	1232.825	1224.041	1217.92	1211.704	1202.371
LDA	Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	Metric Tons CO2e/Vehicle	3.849	3.769	3.686	3.602	3.519	3.440	3.364	3.290	3.220	3.153

		2028	2029	2030	2031	2032	2033	2034	2035	2036
T6 Instate Small	Year	2028	2029	2030	2031	2032	2033	2034	2035	2036
	CO2e (g/mile)	901.2256	893.0055	884.966	876.6108	867.9475	859.3184	850.7673	842.2616	833.8121
T7 Single	Year	2028	2029	2030	2031	2032	2033	2034	2035	2036
	CO2e(g/mile)	1498.13	1498.995	1499.7	1498.636	1494.857	1490.963	1486.621	1482.004	1476.653
Average	Year	2028	2029	2030	2031	2032	2033	2034	2035	2036
	CO2e(g/mile)	1199.678	1196	1192.333	1187.623	1181.402	1175.141	1168.694	1162.133	1155.233
LDA	Year	2028	2029	2030	2031	2032	2033	2034	2035	2036
	Metric Tons CO2e/Vehicle	3.090	3.030	2.974	2.921	2.871	2.825	2.782	2.741	2.703

EMFAC2017 Emission Factors
Metropolitan Transportation Commission (MTC)
2018-2050
aggregate model year
aggregate speed

T6 Instate Small

Year	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e (g/mile)	825.4596	817.1919	809.022	800.9567	793.0022	785.1608	777.4409	769.8484	762.3789	755.0296	747.7976	740.6851	733.6982	726.832

T7 Single

Year	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e(g/mile)	1470.429	1463.617	1455.84	1447.281	1438.245	1428.505	1418.531	1408.41	1397.794	1386.93	1375.929	1364.787	1353.544	1342.363

Average

Year	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
CO2e(g/mile)	1147.944	1140.404	1132.431	1124.119	1115.623	1106.833	1097.986	1089.129	1080.087	1070.98	1061.863	1052.736	1043.621	1034.598

LDA

Year	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Metric Tons CO2e/Vehicle	2.667	2.632	2.599	2.568	2.537	2.509	2.481	2.454	2.428	2.403	2.379	2.356	2.333	2.311

CITY OF OAKLAND

DALZIEL BUILDING • 250 FRANK H. OGAWA PLAZA • SUITE 3315 • OAKLAND, CALIFORNIA 94612

Planning and Building Department
Bureau of Planning

(510) 238-3941
FAX (510) 238-6538
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October 29, 2018

William Crotinger / Sean R. Marciniak, *for* Silverado Contractor
2855 Mandela Parkway, 2nd Floor
Oakland, CA 94608

SUBJECT: DET180082- Expansion of an existing Heavy Industrial / High Impactive Activity (concrete processing / rock crushing) to increase and expand it's facilities to include processing within a portion of an existing structure located at 685 85th Avenue (APN: 042-4318-008-00)

Project Address: 8291, 8300, and 8304 Baldwin Street (APN's: 042-4318-044-00, 043-00, and 042-00), & 685 85th Avenue (proposed) (APN: 042-4318-008-00).

Dear Mr. Crotinger

This letter is in response to your request for a zoning determination to expand a Heavy Industrial / High Impact activity. The previously existing activity was defined by Zoning Clearance (ZC131567) to allow for the continuation of a Legal Nonconforming Heavy Industrial operation (cement processing). This Clearance was based on supporting documents dated from 1998 thru 2012, and was issued on July 16, 2013. Staffs currently defines this and similar activities as Heavy Industrial / High Impact activity.

This Determination (DET180082) is to address the expansion of the current activity to include facilities located at 685 85th Avenue (an adjacent building). The activities approved by ZC131567 at 8300 Baldwin Street are considered to be legal non-conforming as it is a continuation of a prior activity at the site. The expansion of this operation into the structure at 685 85th Avenue came after the clearance was granted and therefore is <u>not</u> recognized as a continuation of the non-conforming activity and would require a Major Conditional Use Permit to legalize the expansion of the facility and activity.

Given the above, ether this activity needs to cease or you may apply for a Major Conditional Use Permit to attempt to legalize this.

Attachment B

This determination is only regarding the Zoning Code and no representations are to be made from this determination regarding requirements from the Bureau of Building, Fire Department, or any other City agency.

If you, or any interested party, seeks to challenge this decision, an appeal **must** be filed by no later than ten calendar (10) days from the date of this letter, by **4:00 pm on** 11/8/16. An appeal shall be on a form provided by the Planning and Zoning Division of the Community and Economic Development Agency, and submitted to the same at 250 Frank H. Ogawa Plaza, Suite 2114, to the attention of **Moe Hackett, Planner II**. The appeal shall state specifically wherein it is claimed there was error or abuse of discretion by the Zoning Manager or wherein his/her decision is not supported by substantial evidence and must include payment of $1622.57 in accordance with the City of Oakland Master Fee Schedule. Failure to timely appeal will preclude you, or any interested party, from challenging the City's decision in court. The appeal itself must raise each and every issue that is contested, along with all the arguments and evidence in the record which supports the basis of the appeal; failure to do so may preclude you, or any interested party, from raising such issues during the appeal and/or in court. However, the appeal will be limited to issues and/or evidence presented to the Zoning Manager prior to the close of the previously noticed public comment period on the matter.

If you have any questions, please contact the case planner, **Moe Hackett, Planner II** at (510) 238-3973 or mhackett@oakland.com, however, this does not substitute for filing of an appeal as described above.

Respectfully,

ROBERT MERKAMP
Acting Zoning Manager

Cc: Brian Mulry, City Attorney's Office

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November 13, 2018

VIA E-MAIL AND MESSENGER

Moe Hackett
Planner II
City of Oakland
Planning and Building Department
250 Frank H. Ogawa Plaza, Ste. 2340
Oakland, CA 94612-2031
Email: mhackett@oaklandnet.com

Re: Appeal of Zoning Determination Letter (DET 180082)

Dear Mr. Hackett:

Miller Starr Regalia represents Silverado Contractors, Inc. and Argent Materials, Inc. (collectively, "Silverado") in their recycling operations at 685 85th Avenue and 8291-8304 Baldwin Street in the City of Oakland.[1] On July 13, 2018, we had submitted a request for a zoning determination regarding the compliance of Silverado's operations with the City's Planning Code. We are in receipt of the City's zoning determination letter dated October 29, 2018, in which the Zoning Manager determined that Silverado's outdoor uses were legal and non-conforming, but that Silverado's indoor operations at an adjacent warehouse were not legal, non-conforming uses. We hereby appeal this determination with regard to Silverado's warehouse operations, for the reasons set forth below.

The zoning determination letter contains errors, and its determinations constitute an abuse of discretion and are unsupported by substantial evidence, for the following reasons:

- **The zoning determination letter incorrectly frames our client's request.** The City's letter indicates it was prepared "in response to [our] request for a zoning determination to *expand* ... the current activity to include facilities located at 685 85th Avenue (adjacent building)." We did not request that the City determine whether our client's "expansion" into the warehouse was lawful because, simply, our client never expanded into the warehouse.

[1] The assessor parcel numbers for 8291, 8300 and 8304 Baldwin Street are, respectively, 042-4318-044, 042-4318-043, 042-04317-042. The assessor parcel number for 685 85th Avenue is 042-4318-008.

Attachment C

Silverado, and the concrete recycling company that operated on the premises before it, always used *the entirety of the warehouse* as an integral part of their recycling activities. It seems the City's zoning determination letter misunderstood the facts and the nature of our request.

- **The current warehouse uses are not materially different than what occurred under prior zoning.** One of the requests in our letter was to determine that Silverado's warehouse operations were legal, non-conforming uses because this activity preceded the City's rezoning of the property in 2008, replacing an industrial (M-40) district with a mixed commercial/industrial (CIX-2) zoning district. With this change, certain heavy industrial uses were no longer permitted on the property. As detailed in our request for a zoning determination letter, the warehouse has always been used in conjunction with concrete recycling that occurring in the outdoor yard at 8291-8304 Baldwin Street, both before and after the City's zoning change in 2008.

- **The zoning determination letter did not acknowledge the extensive evidence provided by Silverado of the warehouse's historical use.** The City's zoning determination letter does not seem to acknowledge or account for the great deal of evidence that Silverado submitted to show the warehouse was used for recycling activities prior to the City's rezoning action in 2008. This evidence includes old lease materials; declarations by employees of the previous recycling operator, signed under penalty of perjury; declarations by an employee of a third-party trucking operation, signed under penalty of perjury; and Alameda County records, all of which show the warehouse has been used, for more than a decade, to store recycling equipment and materials, and for the repair of heavy recycling equipment. We have consulted Bay Area planners, who have indicated such evidence is routinely accepted as proof of a legal, non-conforming use, and have attached a letter by a former City of Oakland planner that confirms this practice.

- **The zoning determination letter did not address, at all, our client's claim that Silverado's indoor operations are permitted by right.** Staff's position has been that past Zoning Clearances only address Silverado's outdoor activities, which staff determined were Heavy Industrial Uses, whereas we presented substantial evidence that Silverado's indoor uses are Light Industrial or General Industrial Uses, which are permitted by right in CIX-2 districts. This issue was not addressed in the City's zoning determination letter.

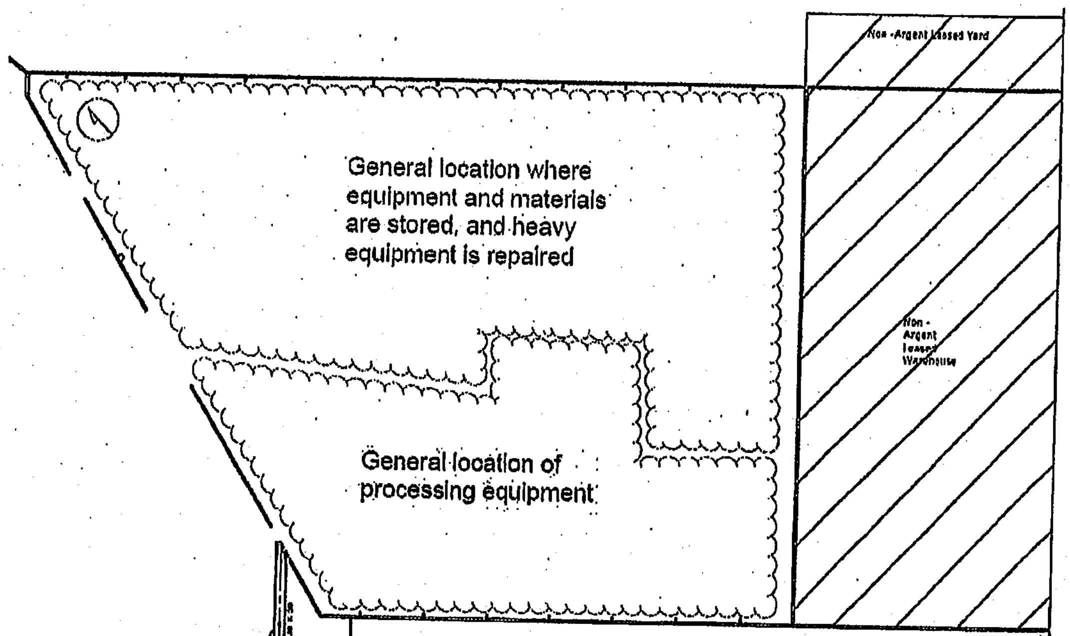
Below, we have set forth in more detail why Silverado's warehouse activities are properly categorized as legal, non-conforming uses. In support of this position, we hereby incorporate by reference the contents of our July 13, 2018 request for a Zoning Determination Letter and each of its seven attachments, as well as our

March 9, 2018 Appeal Letter and each of its 14 exhibits. Both of these are enclosed in this submittal, for your convenience.

I. Silverado's use of the warehouse is a legal, non-conforming use because this space always has been integral to the larger site's concrete recycling activities.

A. *Brief summary of Silverado's uses.*

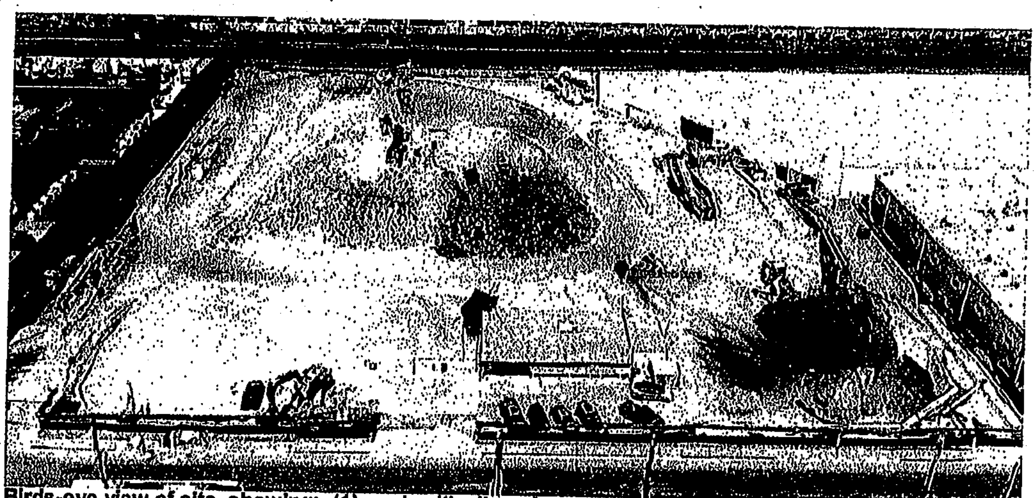
Silverado conducts a concrete and asphalt recycling operation in its yard at 8291-8304 Baldwin Street and in its warehouse at 685 85th Avenue. This warehouse space, in particular, accommodates: (1) the storage of equipment and materials, (2) the repair of heavy equipment, and (3) secondary processing and sorting equipment. In all, the warehouse encompasses 40,000 square feet, whereas approximately 24,000 square feet of this space is used to store materials and repair heavy equipment, and about 16,000 square is used to accommodate the secondary processing and sorting equipment. A site plan for the warehouse, showing the indoor spaces devoted to the foregoing uses, is included below:



Site plan view of warehouse, showing location of Silverado's different recycling activities. Boundaries are approximate, as there are no walls nor other dividers in the interior space that clearly demarcate these activity areas. Aman, meanwhile, used the entirety of the space for the storage of equipment and materials, and the repair of heavy equipment (i.e., the blue shaded area). The hatched portion on the right is warehouse space belonging to a different tenant; there is a wall separating Silverado's space from this other tenant's space.

Ultimately, the yard space and warehouse are operated as an integrated whole, and it is a dynamic operation. This means that, on a day-to-day basis, the many different steps required to recycle large amounts of concrete change in scope — both in terms of their intensity and in terms of where these steps are conducted. For instance, on a day-to-day basis, the piles of raw materials on the site change shape based on how much recyclable materials Silverado receives, requiring employees to move around their equipment, change the locations where they must repair this equipment, and otherwise adjust operations. The warehouse space is a fluid part of this operation, accommodating stored materials and equipment repair when needed, and it has been this way since at least 2007.

Below is a birds-eye view of Silverado's yard and warehouse.



Birds-eye view of site, showing: (1) yard, with piles of materials located in the center and elsewhere on the site, as well mobile crushing equipment; and (2) the warehouse, in the upper right portion of the photo, with conveyor belts that transport crushed rock leading into the structure's openings.

A recycling yard is not an office use, with static walls and other boundaries, and the nature of the industry demands flexibility. Because of Silverado's operational plasticity, the company has been able to recycle about 425,000 tons of aggregate annually. In past years, Silverado has taken down and recycled enormous projects such as the Bay Bridge and Candlestick Park, and diverted recycled building materials back into local construction projects.

Silverado's operations have become increasingly important for the Bay Area construction economy as a source of aggregate. Historically, this material was available from a number of quarry and aggregate mining activities, scattered throughout the Bay Area — some in rivers and other wetland areas. One by one, almost of all these quarry have closed, primarily for environmental reasons, but the construction need for materials has increased significantly. Silverado's operation provides a source of vitally important aggregate close to urban construction needs, without the accompanying environmental damage of quarry in rural areas. As discussed further below, Silverado's use is a "green" one, and results in a reduction of greenhouse gas emissions that is equal to the emissions generated by about 10 percent of Oakland's entire housing stock.

B. ***Silverado's predecessor conducted substantially the same type of recycling operations within the warehouse.***

Much of the information below is a reiteration of what we included in our zoning determination letter, though we have streamlined its presentation here for the sake of readability. It does not appear the City's zoning determination letter accounted for this information, which constitutes substantial evidence to support a determination that Silverado's warehouse activities are legal, non-conforming uses. These facts also highlight the errors and omissions of fact that underlie the City's conclusions in its zoning determination letter.

The relevant facts are as follows:

- Silverado is not the first recycling business to use the Properties to process asphalt and concrete. Since at least the late 1990s, two sister companies[2] — Aman Environmental Construction, Inc. and the Cleveland Wrecking Company ("Aman") — had performed and supported the same recycling operations, turning asphalt and concrete into reusable products. (*See* Appeal Letter, Exhibit 2, ¶ 7.)
- Aman occupied, and used in an integrated manner, the entirety of outdoor yard area and the 40,000-square-foot warehouse space. Evidence supporting this includes:
    - **A copy of Aman's lease with the owner of the Properties**, which shows Steve Aman and his companies had the right to use the warehouse space starting in November 27, 2006. (*See* Zoning Determination Letter Request, Attachment 1, [*see* Paragraph 1, which gave Aman rights to use 40,000 square feet of building space at 689-691 85th Avenue[3]].)

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[2] It is not unusual for sister companies to be associated with recycling processes. One company usually specializes in the demolition of structures, serving as a source of materials for a recycling operation managed by an affiliated company, which receives materials from that and other sources..

[3] The 689-691 85th Avenue is a street address used to describe the same warehouse that the 685 85th Avenue address describes. We are unaware as to how the street addresses were assigned, but can confirm it is all the same property.

- **Eyewitness statements of people who worked for and with Aman, signed under penalty of perjury.** These documents include the statements of workers employed by Aman and a third-party trucking company, who utilized the Properties on a frequent basis. (*See* Zoning Determination Letter Request, Attachment 2a-2c.) These individuals, which include an operations superintendent, a site foreman, and a truck driver who regularly delivered equipment to the site, report that the warehouse was used for storage (e.g., the storage of materials, equipment and hazardous substances) and as a shop to repair heavy equipment (e.g., through welding and other processes) — all of which were integral to Aman's recycling operations. (*See also* Appeal Letter, Exhibit 2, Decl. of William J. Torres, former president of an affiliate to Aman, ¶¶ 2-7.)

- **Government documents, showing usage of the warehouse for the repair of heavy industrial equipment by Aman.** Various government forms and other documents show the warehouse was in use by Aman prior to the City's rezoning action in June 2008, including:

  - A June 14, 2007 hazardous materials reporting form that Aman submitted to the Alameda County Department of Environmental Health, which confirms that diesel, oil, hydraulic fluid, propane, spray paint, and waste oil were kept in the warehouse. (*See* Zoning Determination Letter Request, Attachment 3.)

  - A June 8, 2007 Hazardous Materials Inspection Report, which shows the warehouse was used to store diesel, propylene, and used oil. (*See* Zoning Determination Letter Request, Attachment 4.) The warehouse is referred to as a "shop" in this document, which is consistent with recollections by Aman employees that the warehouse was used, in part, as a shop to repair heavy machinery. (*See* Zoning Determination Letter Request, Attachment 2a, ¶ 9; *see also* Zoning Determination Letter Request, Attachment 2b, ¶ 10.)

Based on the foregoing evidence, *none of which has been disputed or contradicted by anything in the administrative record for this matter*, it is clear the warehouse was used for recycling operations before the City rezoned the area in 2008. Heather Coleman, an experienced planner who has worked for the City of Oakland and other Bay Area cities, has indicated that the foregoing types of evidence are commonly accepted by cities as proof of a legal, non-conforming use. (*See* **Attachment 1**.)

C. ***Silverado's predecessor conducted substantially the same type of recycling operations within the warehouse.***

Silverado uses the same exact warehouse space in support of recycling activities that Aman used prior to June 2008. The only difference is that Silverado utilizes 16,000 square feet of the warehouse — about 33 percent of it — for secondary processing[4] and sorting activities, whereas Aman used this space for the repair of heavy equipment and the storage of materials, equipment, and hazardous substances. (*See* warehouse site plan on p. 3 of this letter.) The remaining 24,000 square feet of warehouse space — more than 66 percent of it — has been used by both Silverado and Aman for the exact same purposes: (1) the storage of equipment and materials and (2) the repair of heavy equipment. While Silverado's processing and sorting activities in the southern third of the warehouse are somewhat different than how Aman used the space, it is not different in a material way. The Oakland Planning Code only prohibits changes that either increase the footprint of or relocate a non-conforming use (OPC, § 17.114.080(A); *see* more extensive discussion in our March 9, 2018 Appeal Letter.)

First, Silverado's use of the 16,000-square-foot portion of the warehouse for processing and sorting of materials does not constitute an increase in size. *Silverado currently uses the same exact indoor space that Aman used prior to the City's rezoning of the site in 2008*, and the external footprint of recycling operations on the site has never changed.

Second, Silverado never moved its operations to an area that was not previously used for recycling, but instead reconfigured its existing, industrial space.[5] Silverado therefore has not "relocated" any uses to a space that Aman did not previously use in its recycling operations. Again, the only difference in their operations is that

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[4] When concrete and other materials arrive at the site, they come in a variety of sizes, and often are as large as boulders. In the outdoor yard, these larger pieces are ground into "softball sized" pieces, which then are refined by machinery in the warehouse space into smaller particles. It is this refinement that we are referring to when we use the term "processed."

[5] In determining the meaning of words used in the City's Municipal and Planning Codes, section 1.04.020 of the Municipal Code provides that "[a]ll words and phrases shall be construed according to the common and approved usage of the language." Accordingly, Merriam-Webster's dictionary defines "relocate" to mean "establish or lay out in a *new* place." The term "reconfigure," meanwhile, means "to change the way (something) is arranged or prepared for a particular purpose." The difference, then, is that "relocating" a use contemplates moving an activity into a space that was previously unoccupied, or was occupied with a completely different land use, whereas "reconfiguring" a land use merely contemplates the rearrangement of similar activities within space that is already occupied.

Silverado uses a minor portion of the warehouse to process and sort rock that has already undergone primary crushing. The same floor space in the warehouse was occupied before by Aman employees using loaders to move around piles of rock, and by welders and mechanics to repair heavy equipment.

While zoning laws can be precise, it is not the practice of cities and counties to supervise a property owner's exact configuration of activities on a square-foot by square-foot basis. As explained by Ms. Coleman, in her experience as a professional urban planner and a former City of Oakland employee, activities under the same establishment and management are classified together as a single land use, and moving one accessory use from one part of a site to another does not mean this accessory activity should be reclassified as a separate land use. (*See* **Attachment 1** [November 12, 2018 Ltr. from Heather Coleman]; *see also* OPC,§ 17.10.040.) So long as these activities are in the same land use category or oriented toward a common purpose, agencies general shy away from the micromanagement of operations.[6] For instance, in a restaurant, the City's zoning code is unconcerned about the configuration of tables and chairs and cooking space so long as the property is zoned for restaurant use. (*See, e.g.,* OPC, § 17.73.020 [restaurants permitted in CIX-2 zones, without discussion of restaurants' internal components]; *see also* OPC, §§ 17.10.272, 17.10.274 [City's definitions of restaurants do not address specific locations of kitchens, seating, and other component activities, but are concerned with establishing larger categories of use].) Similarly, in a big box retail store, the City's zoning does not control in which aisles a product is stored or sold, so long as the site has commercial zoning. (*See, e.g.,* OPC, § 17.73.020 [certain retail stores, including General Wholesale Sales, permitted in CIX-2 zones, without discussion of location of component operations]; *see also, e.g.,* OPC, §§ 17.10.340, 17.10.345, 17.10.430 [City's definitions of retail stores do not address specific locations of sales areas, ancillary office uses, and other operational activities].) In each of the above examples, reconfiguring a site by moving its kitchen or refrigerated food storage units does not change or alter the land use.

Here, Silverado's situation is analogous. Where Silverado decides to store materials or repair equipment, or where it conducts processing activities on the site,

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[6] It is more the function of the building code, and its enforcement, to ensure that specific activities are conducted in specific locations, but only to the extent necessary to make sure these activities are conducted in a safe manner. In this instant enforcement action, there is no allegation that Silverado's indoor land use activities violate the building code. The building code violation alleged by the City concerns the structural integrity of two openings to the warehouse but, as discussed in the City's July 3, 2018 letter, this violation is to be addressed once the zoning issues are resolved. Please note, a structural engineering firm, FBA Inc., has determined these "openings do not structurally compromise either the vertical load carrying ability or the lateral stability of the warehouse structures." (March 9, 2018 Appeal Letter, Exhibit 8.)

and whether it shifts operations around, does not alter the site's use. After all, the footprint of the large debris pile in the center of the site changes on a daily basis, based on how much recyclable material is imported and recycled on that specific day. Furthermore, until a few years ago, Aman and Silverado used portable crushing and processing equipment, meaning the configuration of the site changed frequently. Recycling is a dynamic operation, and necessarily must be permitted to change — and we believe the City's code reflects this. To determine that Silverado's warehouse use is legal and non-conforming would not set any precedent, but rather reflect how the City has dealt with other land uses in the past.

In accordance with the above, we are requesting that the City determine Silverado's warehouse activities are legal and non-conforming. The City's zoning determination letter, respectfully, did not account for the evidence we have presented, and its determination that Silverado "expanded" recycling operations into the warehouse after 2008 is at odds with all evidence in the administrative record, and was made in error.

D. ***In the alternative, Silverado's warehouse uses are permitted by right in CIX-2 Zones.***

In the alternative, we request that the City determine Silverado's warehouse activities are permitted by right under current zoning. The City's zoning determination did not address this request..

In June 2008, when the City rezoned the area, Silverado's operations most likely would been categorized under the City's "Intermediate Recycling Processing Facility" category, which was defined as an "activity serving as a collection point for receiving, processing, storage, and distribution of large quantities of recyclable materials delivered from recycling collection centers or other sources." (Former OPC, § 17.10.586.) This term contemplated that recyclable materials, typically, would be "processed entirely indoors." (Appeal Letter, Exhibit 12, p. 6.) On March 17, 2009, the City Council deleted this industrial subclassification through its adoption of Ordinance No. 12923, with the understanding that the City would "revert to the previous practice of considering such businesses as manufacturing (light, general or heavy/high impact, depending on the nature of the operations)." (*See id.*)

For the sake of convenience, we have reproduced sections of the City's March 17, 2009 staff report below:

CITY OF OAKLAND
AGENDA REPORT

FILED
OFFICE OF THE CITY CLERK
OAKLAND
2008 NOV 20 PM 11 02

TO: Office of the City Administrator
ATTN: Dan Lindheim
FROM: Community and Economic Development Agency
DATE: December 2, 2008

RE: **Public Hearing and An Ordinance Amending The Oakland Planning Code To: (1) Amend Chapter 17.102 "General Regulations Applicable To All Or Several Zones" To Include Performance Standards For Primary Collection Center Recycling Uses In All Zones; (2) Amend Chapter 17.73 "CIX-1, CIX-2, IG And IO Industrial Zones" To Include Regulations Concerning Primary Collection Center Recycling Uses In CIX-1, CIX-2 And IG Zones; (3) Amend Chapter 17.10 "Use Classifications" To Delete "Intermediate Processing Facility" As A Land Use Activity Type From O.M.C. Section 17.10.586 "Recycling And Waste-Related Industrial Activities"**

D. Proposed Deletion of "Intermediate Processing Facility" as a land use activity type from O.M.C. Section 17.10.586 "Recycling and Waste-Related Industrial Activities".

As part of the ordinance adopting new industrial zones (Ord. No. 12875 C.M.S.), O.M.C. Chapter 17.10 "Use Classifications" was amended. (The subclassification "Intermediate Processing Facility" (under Recycling and Waste-Related Industrial Activities) was added in order to call out a particular sector of manufacturers using recycled materials to produce new products to facilitate access by these businesses to available loan and grant monies. Such uses are generally distinguishable from Primary Collection Centers in that there are typically no direct transactions with the public; materials are delivered in large quantities (e.g., by the truckload) and are processed entirely indoors.)

(After considerable discussion with members of the public, business owners and other affected stakeholders, it is staff's recommendation to delete this definition and revert to the previous practice of considering such businesses as manufacturing (light, general or heavy/high impact, depending on the nature of the operations).) Introduction of the definition only created a layer of complexity and confusion about what is essentially a manufacturing use.

The proper approach, and the modern one, for the City to classify recycling uses by reviewing them on a case-by-case basis and, after examining the details of a given operation, determine whether it qualifies as a light, general, or heavy industrial use.

The secondary processing and sorting of the rocks in the warehouse, as well as their storage, properly qualify as either a General Manufacturing Industrial Activity or a Light Manufacturing Industrial Activity,[7] both of which are permitted by right in CIX-2 and IG Zones. (OPC, Table 17.73.020.)[8] In the opinion of Ms. Coleman, the use is most appropriately categorized as a General Manufacturing Industrial Activity. (*See* **Attachment 1** [November 12, 2018 Ltr. from Heather Coleman].)

Turning to the facts, Silverado's processing and sorting operations within the warehouse consist of the processing and sorting of small, recycled stones into smaller stones, gravel, and sand. These are not "high impact" or "heavy" manufacturing activities, given that (1) these activities fit within less than 16,000 square feet of indoor space (whereas the remaining ~24,000 square feet of warehouse space is devoted to access and the storage of product, as well as the repair of equipment), and thus do not involve "large-scale facilities;" and (2) these activities do not produce noise, vibration, air pollution, a fire hazard, or noxious emissions that would violate the standards set forth in Chapter 17.120, or any other federal, state or local standards, and thus have minimal impact. (*See* OPC, § 17.10.580; *see also* March 9, 2018 Appeal Letter [detailed analysis showing Silverado's warehouse operations do not produce noise, vibration, air pollution, fire hazards, or noxious emissions that would violate the standards in Chapter 17.120, or any other federal, state, or local standards].) Therefore, the City has the discretion to determine that Silverado's operations qualify as "Light Manufacturing Industrial Activities" or as "General Manufacturing Industrial Activities" under sections 17.10.560 and 17.10.570 of the Oakland Planning Code.

Both General and Light Manufacturing Industrial Activities are permitted by right in CIX-2 and IG Zones. Accordingly, if Silverado's warehouse operations do not qualify as a legal, non-conforming use, we request the City determine they are lawful and permitted under current zoning requirements.

II. Conclusion.

Silverado constitutes an Oakland success story in its recycling and diversion of debris that would otherwise go into precious landfills. Our client's operations also

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[7] We would submit that all of Silverado's activities, both indoor and outdoor, qualify as General or Light Manufacturing Industrial Activities on the basis of facts contained in the administrative record of proceedings.

[8] As indicated in previous sections, we believe the proper way to treat Silverado's crushing, processing, and other accessory activities is to treat them as a cohesive whole. However, if the City decides to carve Silverado's operations into a series of discrete uses, the City would have the discretion to determine the warehouse activities fall under a different land use classification than Silverado's outdoor yard activities because the warehouse is on a separate lot. (*See* OPC, § 17.10.050.) Whereas the outdoor activities occur on APNs 042-4318-042, -043, and -044 (i.e., 8291-8304 Baldwin Street), the warehouse activities occur on APN 042-4318-008 (i.e., 685 85th Avenue).

allow for the sourcing of construction materials without the need to permit additional quarrying sites in the region, which are generally harmful to the environment. The recycling of aggregate generates approximately 50 percent fewer greenhouse gas emissions when compared to the mining of raw materials to produce the same product. (*See* Zoning Determination Letter Request, Attachment 7.) Environmental benefits also accrue from having a local source of aggregate, because less truck trips are needed to produce and deliver materials. The nearest quarries are scattered widely across the Bay Area, and generally are located between 30 to 40 miles away from the Properties. If Silverado's product were not available to local construction companies, truck deliveries from regional quarries would significantly increase vehicle miles traveled ("VMT"), and the diesel particulate matter and greenhouse gas emissions associated with these trucking routes would also increase. The estimated VMT-related greenhouse gas emission savings from operation of Silverado's site is equal to the emissions generated by about 18,000 passenger vehicles, or by about 16,000 single-family homes (which is the equivalent of 10 percent of Oakland's entire housing stock). (*See id.*) Meanwhile, Silverado's decision to move processing operations indoors confers a more localized environmental benefit, as dust from these operations is captured indoors, and does not disperse into the community. Lastly, Silverado's processing and sorting equipment is electrically powered and its diesel equipment runs on 100 percent renewable diesel fuel, further reducing emissions. In the long-term, our client hopes to install solar panels on the warehouse roof, thereby minimizing its carbon footprint.

Turning to the legalities, as discussed above, we believe the City can lawfully and appropriately determine Silverado's uses, both outdoors and indoors, are legal, non-conforming activities. Substantial evidence shows that Silverado's outdoor operations on the properties are a continuation of recycling operations that have occurred on each and every one of the outdoor properties since at least 1998. With respect to Silverado's warehouse operations, these activities, too, are lawful. Our client's predecessor in interest, Aman, used the warehouse for the storage of equipment and materials, and for the repair of heavy equipment, since at least 2007. Since taking possession of the warehouse, Silverado also has used the space, and a majority of it, for storage and equipment repair, and has occupied the remaining space with processing and sorting activities. The footprint within which recycling operations occur on the properties, including the warehouse, has not changed in any meaningful way and, to the extent Silverado has refined its operations, this change constitutes a reconfiguration, and not an expansion or relocation, of industrial activities. The indoor activities occurring in the warehouse therefore qualify as legal, non-conforming uses.

Even if Silverado's warehouse operations did not qualify as a legal, non-conforming use, they would remain lawful. These indoor activities constitute recycling operations that should be classified as either light or general uses after an evaluation of the specific facts involved. The facts here show that Silverado's processing and sorting of materials comply with each of the City's environmental standards in Chapter 17.120, and thus could be categorized as either a General or

Light Manufacturing Industrial Activity. Both of these uses are permitted by right in the governing CIX-2 zones, without the need for additional permits.

Thank you for your attention to these important matters, and please let us know if you have any questions.

Very truly yours,

Miller Star Regalia

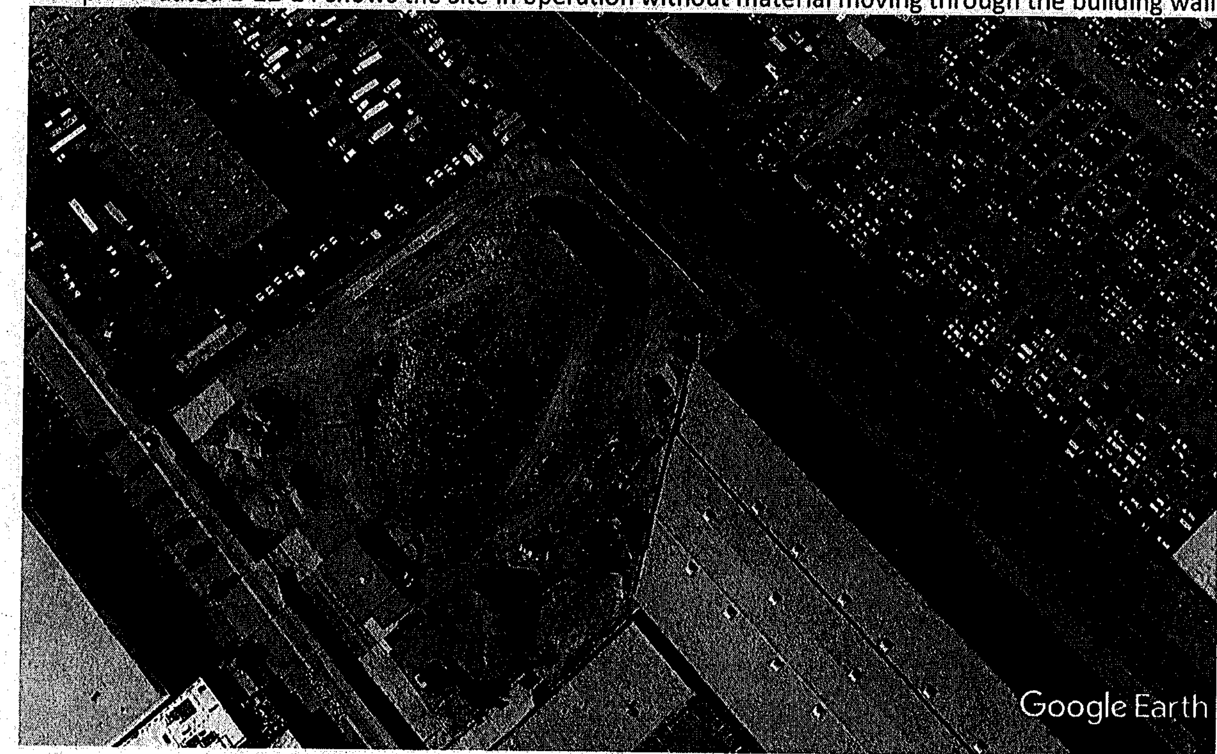
Sean Marciniak

SRM:kll

November 12, 2018 Letter from Heather Coleman
July 13, 2018 Zoning Determination Request Letter and Attachments 1-7
March 9, 2018 Appeal Letter and Attachments 1 – 14

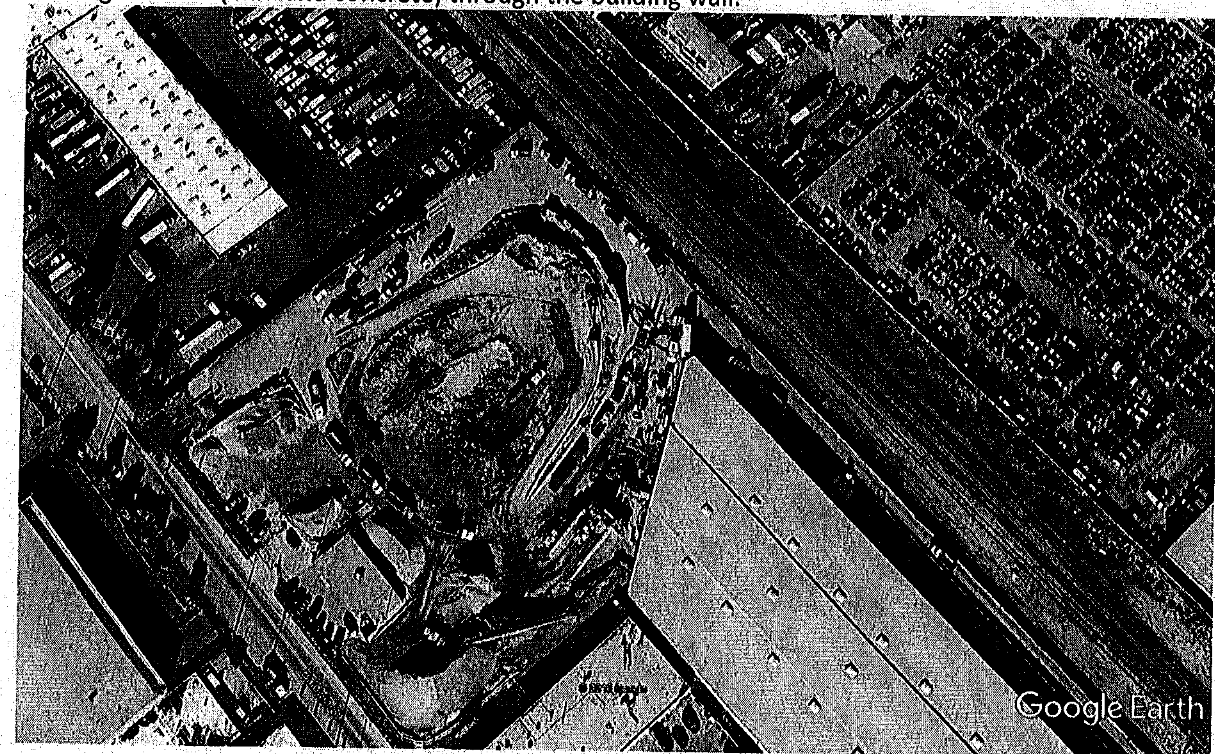
cc: Robert Merkamp, Acting Zoning Manager, City of Oakland, rmerkamp@oaklandnet.com
Brian Mulry, Deputy City Attorney, City of Oakland, bmulry@oaklandcityattorney.org
Wilson Wendt, Esq., Miller Starr Regalia
Bryan Wenter, Esq., Miller Starr Regalia

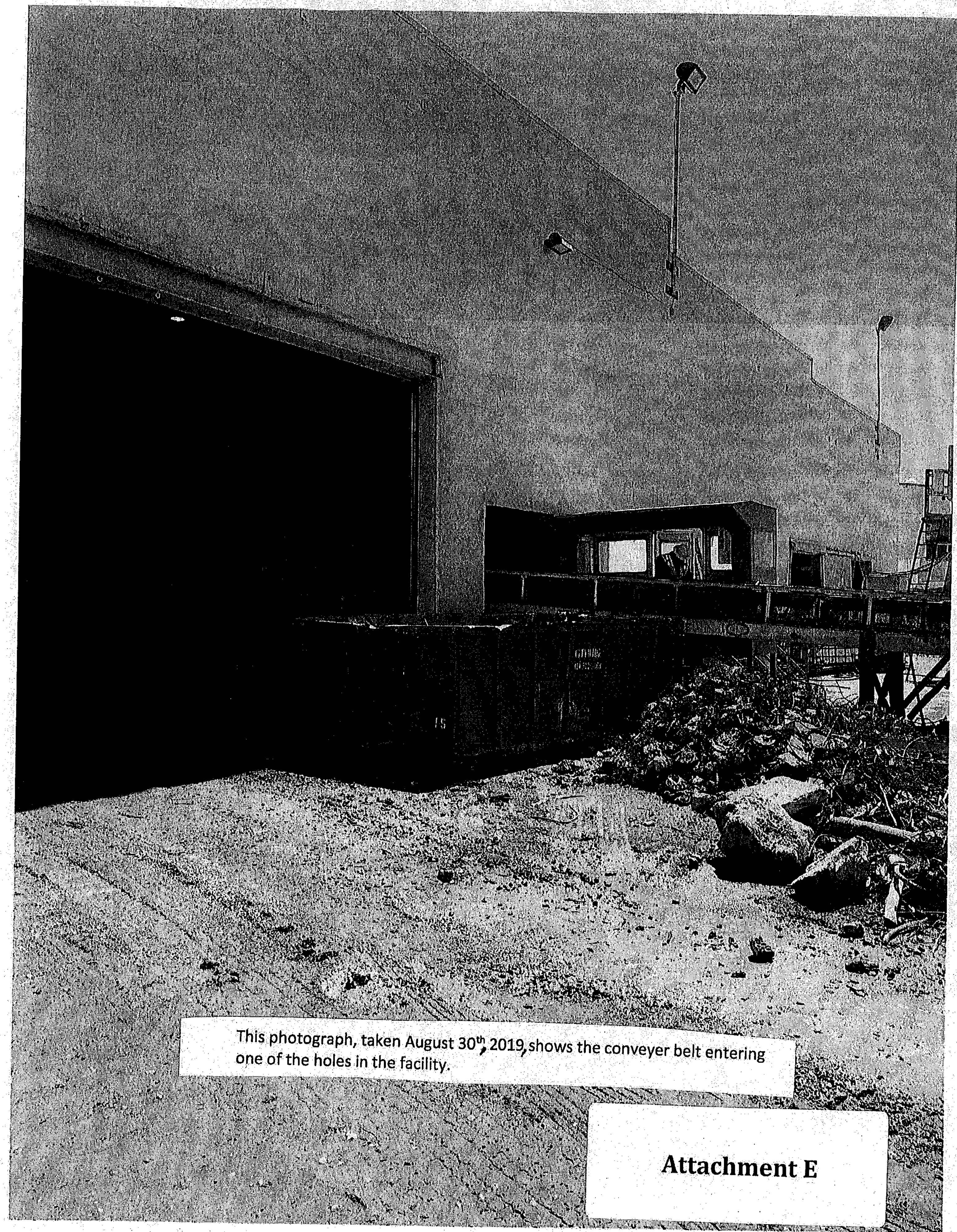
This photo dated 2-22-14 shows the site in operation without material moving through the building wall.



ATTACHMENT D

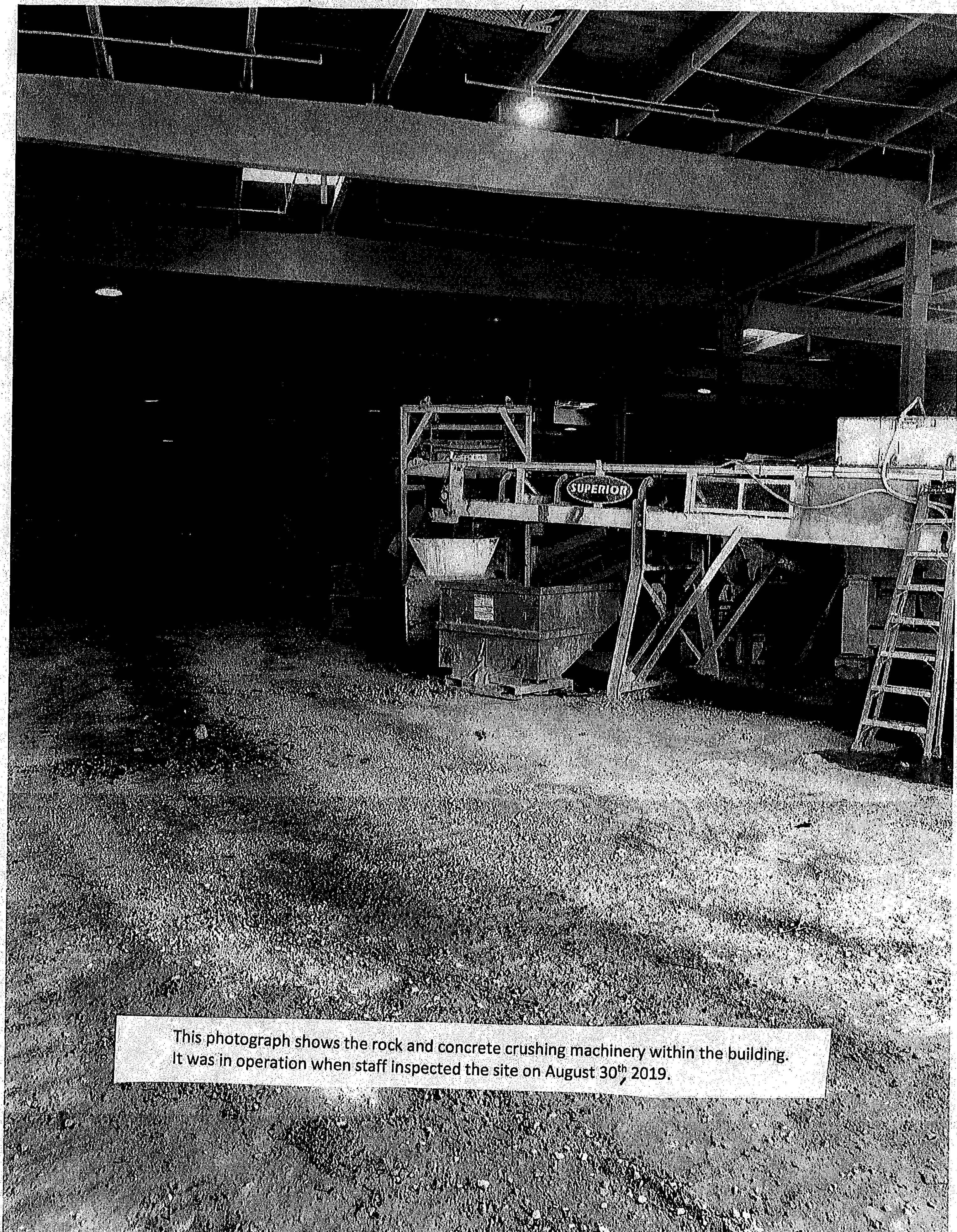
This photograph, dated 10-26-18, shows the current configuration of the site, with conveyor beats moving material (rock and concrete) through the building wall.





This photograph, taken August 30th, 2019, shows the conveyer belt entering one of the holes in the facility.

Attachment E



This photograph shows the rock and concrete crushing machinery within the building. It was in operation when staff inspected the site on August 30th, 2019.

Ken Morris
685th 85th Ave
8291 and 8304 Baldwin Street

To the Honorable City of Oakland Planning Commissioners

Thank you for the opportunity to share with you a variety of reports and studies regarding the use of the property located at 8291 and 8304 Baldwin Street and 685 85th Ave. We want to once again emphasize that we continue to be concerned about the illegal and non-conforming use of the properties in question. We wanted to share with you in advance of the meeting dated for February 19, 2019 our perspective.

Mr. Morris will be 88 years old in April, he is a self-taught entrepreneur, with a trucking background who made some wise investments early on. Mr. Morris is a trusting individual with a big heart. His loyalty and commitment to others goes beyond words, he is forever genuine and loving. He is not, what he has been portrayed to be. "A difficult person to work with or the elephant in the room".

Mr. Morris's goal and commitment are to live by the rules, regulations and polices that are set forth by the governing bodies. He is sensitive to the well-being of others and is not looking for more money as stated, he is not interested in selling his property in Oakland as suggested, nor is he interested in having his property rezoned.

We humbly want to apologize for not attending the September 18, 2019 meeting. Not only was Mr. Morris under the weather, being new to this process we were under the impression that the appeal was between the City of Oakland and Silverado Inc, based on the city not fulfilling its due diligence in determining the findings/violation. In light of what we know now, we recognize that it was not the best decision made on our behalf. However, we intend address some of the inappropriate and false statements made that night within this agenda packet.

We ask the City of Oakland Planning Commission to support the ruling of the City's Planning Department and rule that the operations occurring at 685 85th Ave, 8291 and 8304 Baldwin Street are upheld as Illegal and Non-Conforming as outlined in the city's ordinances, and determined by the staff.

Please find attached critical information regarding Mr. Morris property: **a**). Background on "How We Got Here" **b).** Corrected statements regarding the September 18, Planning Commission meetings, **c).** Appeal of Argent Materials from CBE, **d**). A Literature Review regarding the State-of-the-Science Review of the Occupational, Health Hazards of Crystalline Silica in Abrasive, Blasting Operations and Related Requirements for Respiratory Protection Information.

Thank you,

Kenneth Morris
Property Owner

Leah Duncan
Representative

ATTACHMENT B

Kenneth Morris
685 85th Ave
8291 and 8304 Baldwin Street

How Did We Get Here!

- On December 13, 2017 The City of Oakland Issued a Letter of Determination Regarding Complaint #1704270 prohibiting rock & cement crushing & asphalt recycling in a CIX-2 Zone that does not permit this activity.
- On February 07, 2018 the City Issued a Notice of Violation to Mr. Morris for illegal and Non-Conforming use at 685 85th Ave Parcel # 42-4318-08
- The Violation are as Follows:
  - Not Zoned for heavy machinery work, such as rock, cement or asphalt crushing…
  - No Permit found on file for saw cutting and change of use at the warehouse.
  - On February 12, 2018 Silverado was put on Notice to cease and desist by the owner
  - Silverado filed an appeal
  - No clearances were ever issued and there was never permission given to the tenant by the owner of the property

Usage of Warehouse: Prior Tenant Aman

- Aman leased 8291 Baldwin Street Parcel #42-4318-44 Baldwin, St. parcel #42-4318-43 with zoning clearance #ZC 131567 and 8304 Baldwin St Parcel #42-4318-42 on May 24, 1998 and vacated May 31, 2012.
- Aman leased the warehouse property located on 85th Avenue November 2006-2012. The warehouse was used as a storage, for tools and supplies to make the repairs to their vehicles and forklifts.
- They never at any time crushed rock or cement inside the warehouse. Neither to our knowledge did they store any hazardous or toxic waste in the warehouse.
- All required permits were obtained from the City to meet all the regulations and codes of the City.

Usage of Warehouse: Current Tenant Silverado Contractors

- The current tenant (Silverado) leased the property on August 9, 2013 to the current date. The property was vacant for one (1) year two (2) months and 12 days (June 1, 2012 to August 12, 2013).
- The current tenant Silverado Contractors, Inc. On August 9, 2013, commencing August 12, 2013 expiring 7-31-2018, Extension 1 with option (Use Period Extension 1) expiring 7-31-2023, and Extension 2 (Use Period Extension 2) maturity of 7-31-2028.
- The lease consists of (Parcel # 042-4318-42) 8304 Baldwin Street, (Parcel #424318-43) 8300 Baldwin Street, (Parcel # 42-4318-44) 8291 Baldwin Street and (Parcel #42-4318-08-00) 685 85th Avenue Oakland, CA.
- Silverado Contractors, Inc. and/or any sub-leasee controlled by it, is operating a heavy/high impact concrete crushing and recycling operation without the proper permits and planning/zoning approvals.
- Per the City of Oakland's "Zoning Determination" it clearly states "Without documentation showing that the rock crushing operation continually operated from at least 1998 to the present, the activity on those parcels is considered illegal and nonconforming."

Kenneth Morris
685 85th Ave
8291 and 8304 Baldwin Street

Impact of Current Use to Mr. Morris Health

- The Illegal and Non-Conforming use of his properties has been detrimental to Mr. Morris's health:

- After signing the lease with Silverado, Mr. Morris has had several surgeries including a cardiac pacemaker and stents implanted.
- He has consistently endured chronic lower back pain, extreme weight loss, has suffered from two strokes and he has lost most of his hearing.
- His quality of life has diminished over the last few years. The long strung out process and the intimidation by Silverado Contractors and Argent Materials have caused great strain on Mr. Morris's health.

- Apologize for not attending September 18, 2019 Planning Commission Meeting
    - It definitely was not because of the Lack of interest. We were unable to attend due to Mr. Morris's health and we were under the impression the meeting was between Silverado and the City of Oakland Planning Department not doing there due diligence. We are in complete agreement with the City of Oakland and do not want the City to reverse your decision. Silverado Contractors was and still is in Violation and working illegally in the warehouse on 85th Ave and on two parcels located on Baldwin St.

- Mr. Crotinger stated "We have won in court".
    - This is not true; this law suit is still pending subject to a decision by this Planning Commission.

- Mr. Marciniak stated "So really this is a case about whether Silverado's use in the warehouse is grandfathered in."
    - The only parcel that was possibly grandfathered in was 8300 Baldwin St not the warehouse parcel. 8300 Baldwin St is the only parcel that was issued a permit to crush rock. The former tenant Aman Enviromental NEVER CRUSHED ROCK INSIDE THE WAREHOUSE. Aman demolished a large warehouse located on 8300 Baldwin St to make more space for crushing on 8300 Baldwin St. When Aman vacated the premises on May 31, 2012 all four parcels remained vacant until August 9, 2013.
    Therefore, none of the parcels should have been grandfathered!

- Large opening roll-up door installed 2006
    - Mr. Morris installed this roll-up door prior to Aman Environmental leasing his property.

- Mr. Marciniak stated, "This is the site as it is today. It looks substantially the same. It's the same area, same warehouse footprint that was used by Aman. Bill is doing the same exact thing.
    - No, Committee members, Bill is not doing exactly the same thing. Bill is conducting business illegally, with no permits, improper zoning and no permission from the owner of the property. Aman made sure they followed all the rules and regulations of the City, County, and all the Governmental agencies. But most of all they never took advantage of Mr. Morris and upheld all the conditions of their lease.

Mr. Joe Capriola stated, "I'm the President of Silverado Contractors, one of the founders of Argent Materials. And the warehouse facility and how it was used previously, the heavy equipment repair, all the storage of materials, of the toxic fluids and everything in there, we've changed that. What we do now is store materials in there and we screen material."

- No, Committee members, Silverado are not only storing materials and screen materials inside the warehouse. They also crush rock and cement, they allow dust to gather and plug the sprinkler system, they cut holes in the walls without permission from the owner and they operate without permits and proper zoning. The floors, the roof, the pillars, the skylights, the sliding doors, the cracks in the walls, the entire inside of the square footage they lease are damaged. The railroad tracks between the warehouse and the open area have to be completely destroyed. That is just a few of what they now are doing in the warehouse. How many people have become ill because of working every day in the warehouse? Is Silverado causing a fire hazard? In my opinion Silverado should have followed through and taken our suggestion on November 17, 2016 if Silverado would move out of the warehouse we would negotiate a reduction of your lease payments. Mr. Morris put Silverado on notice "this is a warehouse and it was not built to handle large equipment and they do not have his permission." We could have worked with Silverado to make this move happen. Mr. Morris and I were not informed that Silverado had already cut holes in the outside wall and moved in large equipment. We were not aware of this until March of 2017 when Bill Crotinger and I were discussing this and he remarked Silverado had no plans to move anything out of the warehouse. Because of the implied remarks made by Mr. Crotinger we contacted an attorney and April 17, 2017 sent a register letter to Silverado demanding to cease all activity of rock and cement crushing in the warehouse and to remove all heavy equipment and machinery by May 17, 2017. Silverado should have been upfront and totally honest with Mr. Morris, however, they choose to continue to operate illegally until someone could put a stop to their operation.

We have some major comments and questions regarding the conversation between the Commissioners and the Staff Meeting September 18, 2019:

1. It is not Silverado's choice to consider using the property as an integrated site because the warehouse was never used for crushing rock and cement therefore; it is illegal to crush rock in the warehouse. This is not a grandfathered parcel.
2. A major variance would require the owner's signature. Not for the rezoning if it's packaged with a bunch of things. (Why would you even consider doing this?)
3. What is a CUP? As stated on page 30 line 25.
4. When a business is legal, nonconforming, if they stop operations for a set time period, it's usually one calendar year, you've lost your ability to then reopen without going through some sort of permitting process if that's available to you. These properties were vacant from June 1, 2012 through August 12, 2013. (1year 2months, 12 days). Since Silverado provided the City with receipts that convinced you that some activity was taking place in the yard the zoning clearance was granted. What property were these receipts relating to? Definitely not 8300 Baldwin Street.
5. Mr. Crotinger says if the appeal is not granted it would be a big impact to their business. We hear they have another location just down the street they could utilize therefore, the impact shouldn't be such a big impact. This should not be based on the impact to their business. It should be on the rules and regulations of the City and the overall impact to the community.
6. Mr. Marciniak said "you see equipment moving all around the site, across property lines." Yes that is true crossing property lines on the three lots consisting of the yard area. Not the lot where the warehouse is located.
7. Committee Members, in response to Mr. Crotinger comments regarding the tire wash. "The property owner currently will not even grant me the right to install a wheel wash,

………… simply because he knows it will cause me problems. So I can't even get approval to do that………………

And it's simply just to cause us more problems, quite simply.

No documentation was submitted to Mr. Morris as to what actions you had taken to make sure all City Regulations and Codes were even reviewed. We were instructed by the City Planning Department. Both Zoning and planning review is needed for the installation of a tire wash. Multiple agencies are involved in the approval. Storm water runoff, toxic waste, and other debris can flow directly into the City drains-into our shoreline-into the Bay-and the Ocean. Pollution – Environment of a substance that has harmful or poisonous effects. None of this was investigated by Silverado.

8. Several comments have been made "So it's just a property line". No it is not just a property line. It is a violation of Silverado doing business without the benefit of obtaining a permit and operating in a location that is not zoned for a use that fits their business. They have continually crushed rock and cement causing major damage to a building that was not built for crushing. It has always been a warehouse and was never used for Heavy High impact activity.
9. Site two the warehouse activity is not grandfathered. Site 1 only one lot located at 8300 Baldwin St. is grandfathered. As I understand the way the zoning code works is when you have something that's grandfathered if it was permitted to you –they get to enjoy what the –past operator was able to enjoy.
10. The warehouse has not been operating a long time as an integrated site. Silverado moved across the property line without Mr. Morris's permission neither did they follow the Regulations and the Codes of the City of Oakland established for all business to follow the rules. On November 17, 2016 two of the owners of Silverado and Bill Crotinger met with Mr. Morris and Mrs. Duncan for the purpose of negotiating restructuring the Lease dated August 9, 2013. There were 6 major points to discuss.
    a. California Association of Realtors Commercial Lease Agreement
    b. Name change from Silverado Contractors, Inc to Argent Materials,Inc
    c. Right of First Refusal
    d. The section in the lease covering Termination of Lease
    e. No appraiser for establishing property values – value to be based on market value
    f. What is your intent for the Use of the estimated square feet 35,000 of the warehouse

The last item was a question to Silverado "What is your intent for the use of the estimated 35,000 sf (should have been approximately 40,000 sf) of the warehouse". We ask Silverado "What would it take for you to release this space back to Ken?" Mr. Capriola comment was "they would look at it" and "would Mr. Morris reduce the rent". Our answer to Mr. Capriola was "definitely that would be negotiable, let's talk! This discussion never happened, they choose to use the property illegally.

February 12, 2020

Oakland Planning Commission
1 Frank H Ogawa Plaza
Council Chambers, 3rd Floor
Oakland, CA 94612

COMMUNITIES FOR A BETTER ENVIRONMENT
fighting for environmental health & justice
CBE
www.cbecal.org

Re: Appeal of Argent Materials - 8201, 8300, and 8304 Baldwin St. & 685 85th Ave.

To the Oakland Planning Commission,

On behalf of the East Oakland community that is overburdened by the cumulative air quality impacts of decades of environmental injustice, Communities for a Better Environment ("CBE") urges the Commission to reject Argent Materials ("Argent")'s appeal, uphold the determination made by Planning Department staff, and find that the remainder of Argent's operation is not a legal nonconforming activity.

CBE's mission is to build people's power in California's communities of color and low-income communities to achieve environmental health and justice by preventing and reducing pollution and building green, healthy and sustainable communities and environments. The Commission has the opportunity to help reduce pollution in East Oakland by correctly concluding that this industrial facility, that adds dusty particulate matter to a community already affected by poor air quality, is not, in fact "grandfathered".

This letter supplements the information in the Oakland Planning staff report dated September 18, 2019 and sets out the additional bases on which CBE urges the Commission to act. In summary:

- Argent appears historically to have sought to avoid regulatory compliance as it misrepresented its' operations to a state agency and failed to seek air district permitting for crushing and screening equipment until served with two Notices of Violation
- Once forced to follow air permit procedures, Argent sought to almost double throughput and to expand to another lot across the street
- Argent is estimated to be emitting around 33 pounds of particulate matter every day
- Dust from Argent's operations has become even more noticeable in the community
- Argent's operation changes appear to be violating Planning Code standards regarding nonconforming uses
- Gaps in air district rules and enforcement underscore the importance of Oakland Planning taking action to ensure full application of Oakland's zoning requirements.

We understand this appeal is solely concerning the determination that the portion of Argent's operations currently within the warehouse at 685 85th Avenue is not a legal nonconforming activity. However, CBE believes there is enough evidence also to find that the outside portion of Argent's operations at 8300 Baldwin Street is not a legal nonconforming activity.

1. Argent mischaracterized their operations to a state agency and avoided air district equipment permitting until caught

Argent's unpermitted expansion into a warehouse[1] is only one troubling example of its' regulation compliance history. Another example is how Argent obtained a California Air Resources Board ("CARB") permit for a jaw crusher by misrepresenting to CARB how long and where the crusher would be used. CARB regulates mobile, not stationary sources of pollution, so regulations regarding that permit specify that the local air district (here, the Bay Area Air Quality Management District or "BAAQMD") must be contacted if the crusher will be in one location for longer than 12 months.[2] Argent understood this, as shown by a March 26, 2015 letter submitted with a permit application to CARB stating that it would be "our responsibility to register for an air permit," that the rental of the crusher should be for no more than 6 months starting in July 2015, and that if they intended to purchase the crusher or continue past the 6 month date, they would "send in the appropriate paperwork."[3] A diagram included with that letter also indicated that the crusher would be deployed on site to process rubble from Candlestick Park.[4]

However, after more than two years of operation, Argent never submitted the appropriate paperwork to BAAQMD for **any** of their processing equipment, not just the crusher. It wasn't until Argent received two Notices of Violation for using unpermitted equipment in October 2017 that it finally submitted an air permit application to BAAQMD for the crushing and screen equipment at the Oakland facility.[5] Only then was it revealed that Argent's crusher did not match the 2015 assurances to CARB.

In a November 2017 email to BAAQMD staff regarding equipment at the Oakland facility, Argent states that the crushing plant was "installed in March 2015 under a California Air Resources Board permit" and that they thus should only be charged back fees to March of 2016.[6] This installation date contradicts most of the statements Argent made in the March 2015 CARB permit application letter: that their crusher would not begin use until July 2015, that they would only rent it for 6 months, that it would be used on-site at Candlestick Park, not at Argent's facility, and that they would register for an air permit.[7] Argent's behavior suggests a pattern of engaging in polluting activities first and seeking regulatory permission after the fact, when an agency becomes aware of their activities.

2. Argent has been permitted to double their throughput and expand across the street

After finally coming into compliance regarding their processing equipment, Argent recently sought and received permits from BAAQMD drastically increasing the throughput capacity of two material stockpiles. In June 2014, Argent submitted an initial application to BAAQMD for those

[1] As described in the Oakland Planning staff report dated September 18, 2019

[2] Section 2452(dd) of the PERP Regulation, found at https://ww2.arb.ca.gov/sites/default/files/2018-12/Combined_RegATCM%2012.5.18.pdf

[3] Attachment A: March 26, 2015 Letter from Argent Materials to CARB re: Permit Application 14860, p. 1.

[4] Id., p. 2.

[5] Attachment B: BAAQMD Memorandum re: Notices of Violations Issued and Settlements in Excess of $10,000 in the month of October 2017, p. 2; Attachment C: Argent BAAQMD Application 28951 for Crushers, Screens, Conveyor, Oct. 2017, p. 1.

[6] Attachment C, p. 3.

[7] Attachment A, p. 1-2.

two material stockpiles that was eventually granted for a throughput of 500,000 tons per year.[8] In April 2019, Argent asked BAAQMD to **double** the throughput for these two stockpiles from 500,000 tons per year to 1,000,000 tons per year, and in June 2019 it was granted.[9] Not only did Argent double its' permitted stockpile throughput, but also nearly doubled throughput of its' crushing and processing equipment from 500,000 tons per year to 900,000 tons per year.[10] Since BAAQMD deemed the crushing and processing equipment "exempt," no emissions estimate was made by the air district.[11]

However, BAAQMD estimated that emissions of particulate matter larger than 10 microns (PM_{10}) from **just the two outdoor stockpiles** to be 4.859 tons per year, or **more than 26 pounds of PM_{10} every day.**[12] This number doesn't even include the 6.9 pounds of PM_{10} per day emitted just from equipment located within the warehouse estimated by Argent's own emissions report, which would increase to 9.9 pounds per day if moved outside.[13] Altogether, Argent's current operations are estimated to emit **more than 33 pounds of PM_{10} every day.**

This still may not include the full picture of Argent's air impacts, however. In September 2019, Argent submitted an application to BAAQMD for yet another stockpile at 8501 San Leandro Street, a "storage/overflow yard of finished product from our primary site at 8300 Baldwin St."[14] Though unclear whether this application has been granted and what emissions are estimated by BAAQMD, the yard appears already to be in use. These increases in intensity of Argent's operations are, unfortunately, being felt by the surrounding community.

3. Community members have noticed an increase in dust coming from Argent

East Oakland residents and workers have noticed Argent's dust and how it has increased over the past year. Many community members can testify that dust from Argent is pervasive, visibly floating through the air around the community and settling on cars, streets, and sidewalks. Others have seen dust kicked off Argent's dry stockpiles or from trucks entering or existing their facility. An unhoused community member nearby even had to relocate due to the pervasive dust.

4. Argent's operation changes appear to be violating Planning Code standards regarding nonconforming uses

Argent's throughput increases and expansion appear to conflict with the Oakland Planning Code regarding nonconforming uses. Planning staff have classified Argent's 8300 Baldwin operation as a legal nonconforming use – a "grandfathered" heavy industrial use operating in a CIX-2 zone.[15] The

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8 A Public Records Request for BAAQMD Application #26341 is still open, but we know that Argent submitted an application in June 2014 from: Attachment D: BAAQMD New Applications Report, Jun. 10, 2014; that the stockpiles were previously permitted under that Application # from Attachment E: Argent BAAQMD Application 29851 for Stockpiles, Jun. 2019, p. 1, and that the throughput limit was 500,000 tons/yr. from Attachment E, p. 3.

9 Attachment E, p. 2.

10 Attachment C, p. 3.

11 Id., p. 5.

12 Attachment E, p. 2; 4.859 tons x 2000 pounds/ton = 9718 pounds/365 days = 26.6 pounds/day

13 Air Quality, Greenhouse Gas and Dispersion Modeling Report, Argent Materials, Table 4; 6.9 / .7 (Indoor Control Efficiency from Table 1) = 9.9 pounds/day.

14 Attachment F: Argent BAAQMD Application 30122 for Storage Yard, Sep. 2019, p. 2, 3.

15 October 29, 2018 Zoning Determination Letter.

section of the Oakland Planning Code that allows the ongoing nonconforming uses also specifies that "no substitution, extension, or other change in activities and no alteration or other change in facilities is permitted."[16] While it is true that "[c]hanges that do not constitute substitutions may be made in any activity which is nonconforming…," "[n]o substitution or other change shall be made in any nonconforming activity **which would conflict, or further conflict**, with any applicable provision of the performance standards in Chapter 17.120".[17] Among the performance standards in that chapter, one reads: "All Commercial and Industrial Activities which are located in […] the M-20, S-3, **CIX**, […] Zones, […] shall be so operated as **not to emit particulate matter of air contaminants which are readily detectable without instruments by the average person** at or beyond any lot line of the lot containing such activities.[18]

Both the increase in throughput of Argent's stockpiles and crushing and screening equipment could be considered changes in activity that conflict with the particulate matter performance standard of the Oakland Planning Code. There is plenty of data to indicate that particulate matter is readily detectable without instruments beyond Argent's lot lines: community testimony of their experience with the dust, complaints to BAAQMD both confirmed and unconfirmed, and the sheer amount of PM_{10} emissions estimated by BAAQMD and Argent.[19] But if that were not enough, the dispersion model provided as part of Argent's emissions report shows emissions extending well beyond their lot lines.[20] Increases in the throughput of Argent's crushing, screening, and stockpiling activities increase Argent's particulate matter emissions. This is also supported by Argent's emissions report, which calculates their emissions from their average process rates.[21]

The expansion of Argent's operations to include another storage yard for finished product across the street also seems to conflict with the law regarding nonconforming uses. Another restriction on nonconforming uses from the Oakland Planning Code reads: "no open parking, loading, […] production, or **storage area** accommodating or serving such [nonconforming nonresidential] activity shall be relocated or increased in size…"[22] The expansion of Argent's stockpiles to include a whole new storage yard at 8501 San Leandro St. certainly appears to be an impermissible increase in size of a storage area serving Argent's nonconforming activities at 8300 Baldwin. It is irrelevant that 8501 San Leandro is zoned differently from Argent's other lots since this lot accommodates and serves the primary nonconforming activity at 8300 Baldwin.[23] Thus, the storage yard at 8501 San Leandro should be determined to be a storage area accommodating a nonconforming use that was impermissibly expanded.

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[16] Oakland Planning Code (O.P.C.) § 17.114.040.A; An alteration is defined as "an enlargement; addition; demolition; removal; relocation; repair; remodeling; […] or any other change in a facility…" O.P.C. § 17.114.020
[17] O.P.C. § 17.114.070.A; O.P.C. § 17.114.070.A.5 (emphasis added).
[18] O.P.C. § 17.120.080 (emphasis added).
[19] Attachment G: Complaints to BAAQMD re Argent Materials, 2017-2019; Attachment E, p. 2.
[20] Air Quality, Greenhouse Gas and Dispersion Modeling Report, Argent Materials, Figure 3.
[21] Id., Table 1.
[22] O.P.C. § 17.114.080.
[23] Attachment F, p. 2.

5. **Gaps in air district regulations mean that Oakland Planning should take steps to protect community health**

There are numerous gaps in the law that allow polluters to avoid stricter standards or even avoid pollution standards altogether, and Argent is taking advantage of these gaps.[24] BAAQMD rules actually exempt concrete processing equipment from air permitting requirements, including estimating their actual air pollution impacts, based off of a simple measurement of their material's moisture content.[25] In this case, the moisture sample was actually taken by Argent, analyzed by a third-party lab hired by Argent, then sent to BAAQMD, who then exempted Argent from permitting requirements based on a self-procured measurement.[26] Whether Argent keeps material at this moisture level at all times is not monitored nor inspected by BAAQMD. The fact that Argent has been able to not only receive permits, but also permit exemptions, while still sending dust into the East Oakland community should be sufficient demonstration on why "compliance" with air regulations is not enough to protect community health.

That is why it is so important for the Commission and Planning Department to enforce the Planning Code. There is a reason why the land on which Argent sits was rezoned from M-40 to CIX-2 in 2008 – because it was the beginning of a long road by the City to address its long history of conflicting land uses that hurt low-income black and brown Oaklanders most.[27] There is a reason why there are so many restrictions on nonconforming uses – because those uses are not meant to grow but rather meant to recoup their costs, then shrink, change, or go away. There is a reason why there are performance standards for particulate matter – because the City of Oakland also has a responsibility to provide clean air and protect its residents and workers.

The first step is to uphold staff's determination that Argent's warehouse operations are not "grandfathered", which is supported by the facts and law, and the second is to do the same for the rest of the facility. These are some of the tools at your disposal to address the current air quality impacts in East Oakland and to prevent the even worse air quality outcome that has been threatened. If the tools seem harsh, that is because of the way the law is written; but for once the law here can cut in favor of community health rather than for corporate profits. We urge you to take this opportunity to move away from the systemic issues that plague planning everywhere, and instead to move towards a just transition for East Oakland.

____

Tyler Earl, Associate Attorney
Communities for a Better Environment
tyler@cbecal.org (510) 302-0430 x16

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[24] For example, the Commission may be familiar with the concept of "grandfathering" in the land use context; "grandfathering" in the Clean Air Act allows pollution sources in existence prior to the Act to be held to looser air quality standards.

[25] BAAQMD Regulation 2 Rule 1-115.1.4; Attachment C, p. 4-8.

[26] Attachment C, p. 4-8.

[27] Oakland General Plan, Land Use and Transportation Element, Chapter 1, A Livable and Sustainable Oakland p. 27; Chapter 2, Policy I/C4.2 Minimizing Nuisances. p. 42.

CBE Attachment A

March 26, 2015 Letter from Argent Materials to CARB re: PERP Permit Application 14860

№ - - 14860

ARGENT MATERIALS

8300 Baldwin Street Oakland, CA 94621

Phone 510-638-7188 Fax 510-638-7189

March 26, 2015

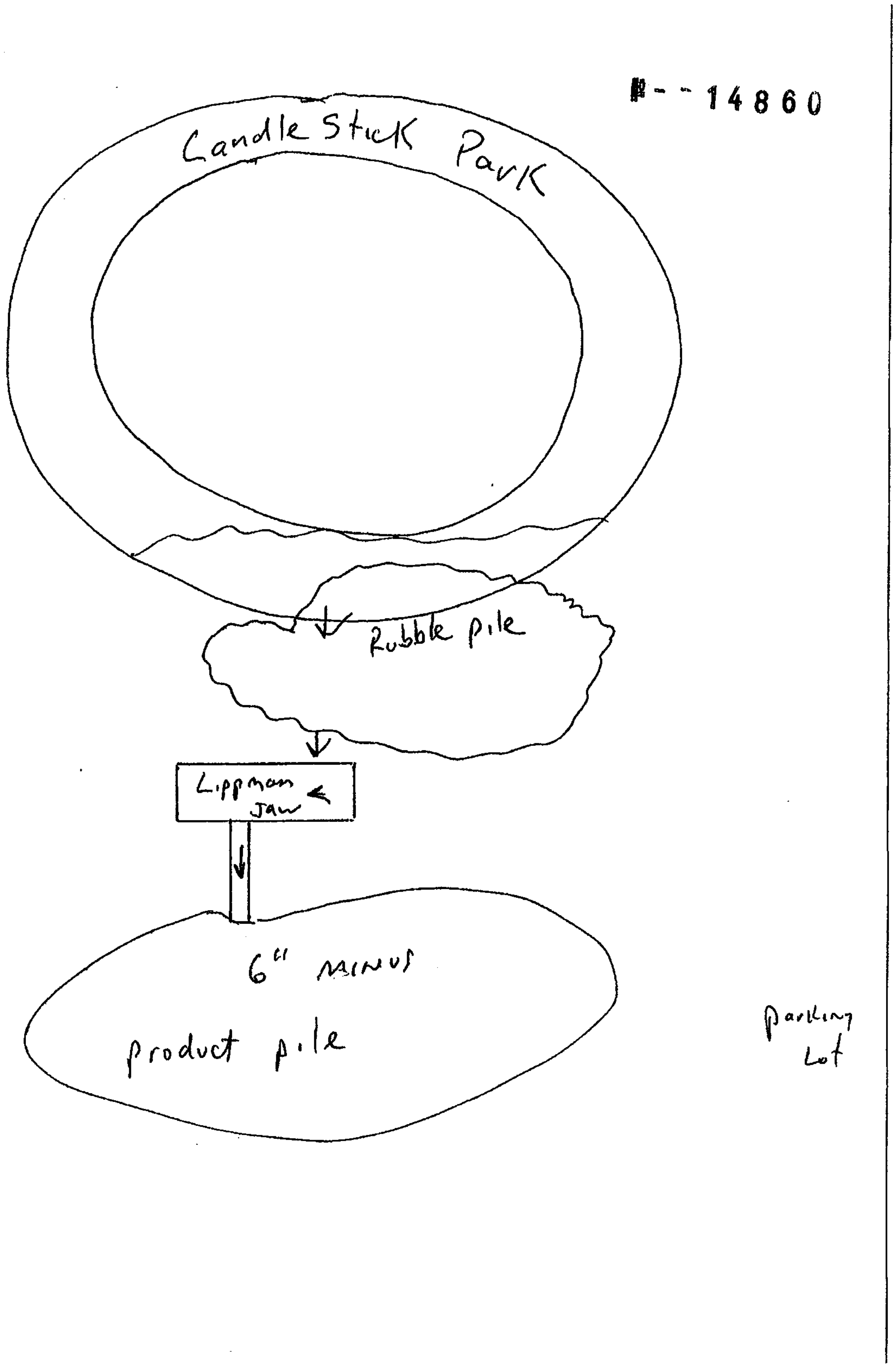
ARB/PERP
Air Resources Board
P.O. Box 2038
Sacramento, CA 95812

To Whom it May Concern,

Enclosed please find a permit application for the second portable plant seeking registration by Argent materials. This plant will be rented from General Equipment and our responsibility to register for an air permit. The duration of the rental should be no more than 6 months beginning approximately July 1, 2015. If Argent intends to purchase or continue the rental past the 6 month date, we will send in the appropriate paperwork.

Regards,

Bill Crotinger General Manager
Argent Materials Inc.
8300 Baldwin St.
Oakland, CA 94621


P--14860
Candle Stick Park
Rubble pile
Lippman Jaw
6" minus
product pile
parking Lot

CBE Attachment B

BAAQMD Memorandum re: Notices of Violations Issued and Settlements in Excess of $10,000 in the month of October 2017

AGENDA: 7

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Memorandum

To: Chairperson Liz Kniss and Members of the Board of Directors

From: Jack P. Broadbent
Executive Officer/APCO

Date: November 2, 2017

Re: Notices of Violations Issued and Settlements in Excess of $10,000 in the month of October 2017

RECOMMENDED ACTION

None; receive and file.

DISCUSSION

In accordance with Resolution No. 2012-08, attached to this Memorandum is a listing of all Notices of Violations issued, and all settlements for amounts in excess of $10,000 during the calendar month prior to this report.

BUDGET CONSIDERATION/FINANCIAL IMPACT

The amounts of civil penalties collected are included in the Air District's general fund budget.

Respectfully submitted,

Jack P. Broadbent
Executive Officer/APCO

Prepared by: Brian C. Bunger

Attachment 7A: Notices of Violation for the Month of October 2017

CBE Attachment B

BAAQMD Memorandum re: Notices of Violations Issued and Settlements in Excess of $10,000 in the month of October 2017

AGENDA 7A: ATTACHMENT

NOTICES OF VIOLATION ISSUED

The following Notice(s) of Violation were issued in October 2017:

Alameda						
Site Name	**Site #**	**City**	**NOV #**	**Issuance Date**	**Regulation**	**Comments**
AC Transit District - Central Maintenance Building	A2258	Oakland	A56394A	10/16/17	9-7-307	Failed NOx Source test
Argent Materials Inc	E2474	Oakland	A56395A	10/19/17	2-1-301	Unpermitted source in operation
Argent Materials Inc	E2474	Oakland	A56395B	10/19/17	2-1-302	Unpermitted source in operation
Conflo Services, Inc.	Z0924	Hayward	A57433A	10/11/17	11-2-303.1	No containment, no wetting
Conflo Services, Inc.	Z0924	Hayward	A57433B	10/11/17	11-2-303.6	No containment, no wetting
Conflo Services, Inc.	Z0924	Hayward	A57434A	10/11/17	11-2-304.1	Improper waste handling, no notification
Conflo Services, Inc.	Z0924	Hayward	A57434B	10/11/17	11-2-401.3	Improper waste handling, no notification
Form Factor	B4266	Livermore	A57380A	10/6/17	2-1-307	Exceeded throughput for IPA usage permit condition 19709
Gallagher & Burk, Inc	A0073	Oakland	A56393A	10/16/17	2-1-307	Failed PM source test
Thermo Fisher Scientific	B4976	Pleasanton	A57381A	10/10/17	9-7-403	No annual source test/initial demonstration of compliance
Thermo Fisher Scientific	B4976	Pleasanton	A57381B	10/10/17	9-7-506	No annual source test/initial demonstration of compliance

CBE Attachment C

Argent BAAQMD Application 28951 for Crushers, Screens, Conveyor, Oct. 2017

Bay Area Air Quality Management District
Engineering Division

Company Name: Argent Materials INC — Application Number: 028951
Equipment Address: 8300 Baldwin Street — Site Number: 22474
City, Zip Code: Oakland, CA 94621 — Assigned Engineer: SD

Application Type:

- [X] Standard
- [ ] Title V
- [ ] Portable Equipment
- [ ] Accelerated
- [ ] Synthetic Minor
- [ ] GDF
- [ ] Precertification
- [ ] Banking
- [ ] Other ____
- [ ] Experimental Exemption
- [ ] ERC Transfer

Application Status:

	Date	Initials	Recommendation
Application Received	10/24/17	D.M.	
Permit Operation Review	/ /		
Assigned to Engineer	10/24/17	D.M.	
Incomplete	11/15/17	/ /	
Reactivated	1/2/18	/ /	
Application Deemed Complete	1/2/18		
Public Notice	/ /		
Engineer	1/4/18	BAL for SD	Issue exemption
Supervisor	1/4/18	BAL	EXE
Manager	1/9/18	SK	EXE
Permit Operations	/ /		

S-3, S-4, S-5, S-6(?), S-9

Toxics Review:

- [X] Not Required
- [ ] Required

	Date	Initials	Cancer Risk	Chronic Hazard Index	Acute Hazard Index
Review Complete	/ /				

Emission Offsets:

- [X] Not Required
- [ ] Required / Surrendered
- [ ] Required / Deferred

Emissions Summary (tons/years):

Pollutant Increase	Increase Amount	Pollutant Decrease	Decrease Amount	Basis (1)	Offset Ratio	Bank Number	Regulation (Decreases)
Ø							

(1) Basis:
- Bank — Emission Bank Withdrawal
- BACT — Best Available Control Technology
- BARCT — Best Available Retrofit Control Technology
- RACT — RACT Reduction
- ONS — On Site Credit

Title V:

Plant Title V Status ____

Comments:

Argent Materials INC. 028951

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

November 15, 2017

8300 Baldwin Street
Oakland, CA 94621

Attention: Matthew Chasm

Application No.: 28951
Plant No. 22474
Equipment Location:
8300 Baldwin Street
Oakland, CA 94621

Dear Applicant:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION

Your application for the following equipment:

S-3 Jaw Crusher, 800 tons/hr
S-4 Cone Crusher, 450 tons/hr
S-5 Materials Screen
S-6 Materials Screen
S-7 Materials Conveyor

has been assigned the above application number and is currently incomplete. In order to complete our evaluation we need the following information:

1. Description of material being processed.
2. Maximum annual quantity of material crushed by S-3.
3. Maximum annual quantity of material crushed by S-4.
4. Maximum annual material processed by S-5, S-6, and S-7.
5. Hourly process rates for S5, S-6, and S-7.
6. Please specify which sources are directly abated by the water sprayers and misters.
7. Please confirm that there are 4 water sprayers and 1 water mister.
8. Please indicate when each source was installed. Back fees will be calculated to collect yearly permit to operate fees that would have been required had the equipment been permitted before construction.

An invoice will be generated and sent when the above information is received.

Please submit the above items within 60 days or the application will be canceled. Your submittal will be acted upon within 15 working days of receipt of the above items, and if complete, your permit will be issued within 39 working days.

Under the California Public Records Act, all information in your permit application will be considered a matter of public record and may be disclosed to a third party. If you wish to keep certain items in your application trade secret, please follow the guidelines described in Regulation 2, Rule 1, Section 202.7 for submittals containing trade secret information.

CBE Attachment C

Argent BAAQMD Application 28951 for Crushers, Screens, Conveyor, Oct. 2017

Simrun Dhoot

From:	Matt Chasm <matt@argentmaterials.com>
Sent:	Wednesday, November 15, 2017 11:32 AM
To:	Simrun Dhoot
Cc:	Bill Crotinger
Subject:	RE: Application # 28951
Follow Up Flag:	Follow up
Flag Status:	Flagged

Hello Simrun,

I appreciate your prompt reply, and the work that you have been doing in regards to this application. When we initially spoke you asked how much throughput we had for our production and I told you that our other application stated 500,000. Would it be possible to raise that for the purposes of this application to 900,000? We would like to make very sure that we stay within the parameters of our permit, and raising the ceiling would ensure that. The additional information you requested reflects a throughput of 900,000 and is as follows:

1) We recycle clean concrete and asphalt from local demolition, producing primarily class II base rock, and drain rock.
2) Approximately 500,000 tons
3) Approximately 250,000 tons
4)
   S-5 approximately 900,000 tons
   S-6 approximately 500,000 tons
   S-7 approximately 900,000 tons
5) Approximately 300 tons per hour
6) The sources that are directly abated by water sprayers are S-5, S-6, and parts of S-7
7) There are 5 sprayers, located on the jaw aperture, under the cone plant, on two of the conveyers leaving the shop building, and at the head of the stacking conveyor. There is a mister on the conveyor under the cone.
8) Our current crushing plant installed in March of 2015 under a California Air Resources Board permit, so as I understand it back fees would be calculated beginning in March of 2016.

Thank you,
Matt

March 2015
March 2016
March 2017

2 months

From: Simrun Dhoot [mailto:sdhoot@baaqmd.gov]
Sent: Wednesday, November 15, 2017 9:46 AM
To: Matt Chasm <matt@argentmaterials.com>
Cc: Bill Crotinger <bill@argentmaterials.com>
Subject: RE: Application # 28951

Hi Matt,

Please see the letter attached. It details the additional information I need to be able to complete my evaluation and also issue an invoice.

Thank you,

Simrun Dhoot | Air Quality Engineer II
Engineering Division
Bay Area Air Quality Management District

Engineering Evaluation
Argent Materials, Inc.
Application No. 28951
Plant No. 22474

BACKGROUND

Argent Materials, Inc. (Argent) accepts broken concrete and asphalt to create recycled aggregates. The facility has applied for an Exemption for the following sources:

S-3	**Jaw Crusher, Lippman, Model: J3062-VGF628, 800 tons/hr; abated by A-3 Water Spray**
S-4	**Cone Crusher, Cedar Rapids, Model: MOP 450x, 450 tons/hr; abated by A-4 Water Spray**
S-5	**Materials Screen, Cedar Rapids, Model: LJ-TSH8203-32; abated by A-5 Water Spray**
S-6	**Materials Screen, Cedar Rapids, Model: LJ-TSH8203-32; abated by A-6 Water Spray**
S-7	**Materials Conveyor; abated by A-7 Water Spray**

The sources listed above are located at 8300 Baldwin Street, Oakland, CA 94621.

The site consists of an outdoor concrete and asphalt raw feed pile that is 30,000 square feet in area and two outdoor finished product stockpiles of Class II Base Rock and Drain Rock that totals 10,000 square feet. Class II Base Rock is made from a mixture of different sizes of crushed rock from ¾" to fine dust. Class II Base Rock meets the specifications of the State of California Standard Specifications, Section 26. Drain rock is typically ¾" and often used in French drains and leaching fields.

The facility has a permit to operate for two stockpiles (S-1 and S-2) under Application No. 26341. The facility also operates two crushers (S-3 and S-4), two materials screens (S-5 and S-6), and one conveyor system (S-7), which are all abated by water spray systems.

A test of the moisture level of the material processed by S-3 and S-4 was conducted on April 28, 2017 by Structure Groups. The water content of the material was 28.7%. Since the water content of the material handled by the crushers is greater than 20%, the sources are exempt from permitting per Regulation 2-1-115.1.3. The Regulation states:

2-1-115 Exemption, Particulate Sources at Quarries, Mineral Processing and Biomass Facilities: *The following potential PM2.5 and PM10 sources are exempt from the requirements of sections 2-1-301 and 302, provided that the source does not require permitting pursuant to Section 2-1-319.*

> *115.1 Sources located at quarrying; mineral or ore handling or processing; concrete production; asphaltic concrete production; marine bulk transfer stations; concrete or asphaltic concrete recycling; vehicle shredding; glass manufacturing; handling or processing of cement, coke, lime, flyash, fertilizer, or catalyst; or other similar facility which meets one of the following:*
>
> > *1.3 Operating, loading and unloading a crusher or grinder which processes exclusively material with a moisture content greater than or equal to 20 percent by weight;*

The material processed by the conveyor system (S-7) is fed to the material screens (S-5 and S-6). Therefore, the moisture content of the material being processed is the same for all sources. A test conducted on March 14, 2017 by Structure Groups on this material showed that the lowest moisture content reading was 7.4%. Since the water content of the material handled by the screens and the conveyor system is greater than 5%, the sources are exempt per Regulation 2-1-115.1.4. The Regulation states:

> *1.4 Operating, loading and unloading the following sources which process exclusively material with a moisture content greater than or equal to 5 percent by weight:*
> *1.4.1 Screen or other size classification;*
> *1.4.2 Conveyor, screw, auger, stacker or bucket elevator;*

Plant #22474 (Argent Material[illegible]c.) **Application #28951**

The Air District Inspector assigned to the facility confirmed in a phone call on January 2, 2018 that in his multiple visits to the facility, the material processed by these sources was very wet and that these moisture levels were likely accurate.

EMISSIONS CALCULATIONS

Emissions for the above sources were not calculated because the sources are exempt from permitting requirements.

PLANT CUMULATIVE EMISSIONS

Emissions for the above sources were not calculated because the sources are exempt from permitting requirements. Therefore, there is no cumulative increase in emissions.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

In accordance with Regulation 2-2-301, BACT is triggered for any new or modified source with the potential to emit 10 pounds or more per highest day of POC, NPOC, NOx, CO, SO_2 or PM10, PM2.5.

Since the sources listed above are exempt from permitting requirements, BACT does not apply.

TOXIC RISK SCREENING

A health risk screening analysis is not required because no toxic emissions will be emitted from this project.

OFFSETS

Per Regulation 2-2-303, offsets must be provided for any new or modified source at a facility that emits more than 10 tons/yr of PM10. Offsets are not required for this application.

STATEMENT OF COMPLIANCE

Sources S-3 and S-4 are exempt from permitting requirements per Regulation 2-1-115.1.3 since the moisture content of the material being processed by these sources is greater than 20%.

Sources S-5, S-6, and S-7 are exempt from permitting requirements per Regulation 2-1-115.1.4 since the moisture content of the material being processed by these sources is greater than 5%.

This project is not within 1,000 feet of a school. Therefore, a public notice is not required.

NSPS, PSD, and NESHAPS are not triggered.

RECOMMENTATION

Issue an Exemption to Argent Materials for the following sources:

S-3	**Jaw Crusher, Lippman, Model: J3062-VGF628, 800 tons/hr; abated by A-3 Water Spray**
S-4	**Cone Crusher, Cedar Rapids, Model: MOP 450x, 450 tons/hr; abated by A-4 Water Spray**
S-5	**Materials Screen, Cedar Rapids, Model: LJ-TSH8203-32; abated by A-5 Water Spray**
S-6	**Materials Screen, Cedar Rapids, Model: LJ-TSH8203-32; abated by A-6 Water Spray**
S-7	**Materials Conveyor; abated by A-7 Water Spray**

By: Simrun Dhoot
Simrun Dhoot
Air Quality Engineer

Date: 1/4/18

Page 2 of 2

STRUCTURE GROUPS
CREATING PARTNERSHIPS ONE PROJECT AT A TIME

Determination of Water Content of Soil/ Rock

ASTM D2216

Project Name:	Argent Materials	Sample Date:	4/28/2017
Project Number:	17-0447	Test Date:	4/28/2017
Sample Location:	Yard	Report Date:	5/1/2017
Client Project :	Argent Materials	Sampled By:	Client
Project Location :	8300 Baldwin St., Oakland, CA	Lab Number:	17-329
Material:	Oversize Aggregate		

	Results	Spec.
Percent Water Content:	28.7%	[redacted]

Reported By: Benjamin Reeves
Laboratory Manager

[illegible]

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

January 5, 2018

Argent Materials Inc
8300 Baldwin Street
Oakland, CA 94621

Attention: Bill Crotinger

Application Number 28951
Plant Number: 22474
Equipment Location: *same as above*

Dear Applicant:

SUBJECT: LETTER OF EXEMPTION

We have completed our evaluation of your application for a Permit to Operate the following equipment:

S-3 **Jaw Crusher, Lippman, Model J3062-VGF628, 800 tons/hr abated by A-3 Water Spray**
S-4 **Cone Crusher, Cedar Rapids, Model MOP 450x, 450 tons/hr abated by A-4 Water Spray**

We have determined that your operation is exempt from permitting per the following:

2-1-115 **Exemption, Particulate Sources at Quarries, Mineral Processing and Biomass Facilities:** The following potential PM_{10} sources are exempt from the requirements of sections 2-1-301 and 302, provided that the source does not require permitting pursuant to Section 2-1-319.

115.1 Sources located at quarrying; mineral or ore handling or processing; concrete production; asphaltic concrete production; marine bulk transfer stations; concrete or asphaltic concrete recycling; vehicle shredding; glass manufacturing; handling or processing of cement, coke, lime, flyash, fertilizer, or catalyst; or other similar facility which meets one of the following:

1.3 Operating, loading and unloading a crusher or grinder which processes exclusively material with a moisture content greater than or equal to 20 percent by weight;

(Amended 6/7/95; 5/17/00)

This exemption applies solely to permits. The equipment must be operated in compliance with any applicable District regulations and with other regulatory agency requirements. The District's regulations may be viewed online at www.baaqmd.gov/. Note that this exemption is not permanent. Any change in your operation or in District regulations may require you to obtain permits in the future.

Please include your application number with any correspondence with the District. If you have any questions on this matter, please call **Simrun Dhoot at (415) 749-5074**.

Very truly yours,

Acting Director
Director of Engineering

by Sanjeev Kamboj
Air Quality Engineering Manager

115.01.03.9

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

January 5, 2018

Argent Materials Inc
8300 Baldwin Street
Oakland, CA 94621

Attention: Bill Crotinger

Application Number 28951
Plant Number: 22474
Equipment Location: *same as above*

Dear Applicant:

SUBJECT: LETTER OF EXEMPTION

We have completed our evaluation of your application for a Permit to Operate the following equipment:

S-5 **Material Screen, Cedar Rapids, Model: LJ-TSH8203-32 abated by A-5 Water Spray**
S-6 **Material Screen, Cedar Rapids, Model: LJ-TSH8203-32 abated by A-6 Water Spray**
S-7 **Materials Conveyor abated by A-7 Water Spray**

We have determined that your operation is exempt from permitting per the following:

2-1-115 **Exemption, Particulate Sources at Quarries, Mineral Processing and Biomass Facilities:** The following potential PM_{10} sources are exempt from the requirements of sections 2-1-301 and 302, provided that the source does not require permitting pursuant to Section 2-1-319.

115.1 Sources located at quarrying; mineral or ore handling or processing; concrete production; asphaltic concrete production; marine bulk transfer stations; concrete or asphaltic concrete recycling; vehicle shredding; glass manufacturing; handling or processing of cement, coke, lime, flyash, fertilizer, or catalyst; or other similar facility which meets one of the following:

1.4 Operating, loading and unloading the following sources which process exclusively material with a moisture content greater than or equal to 5 percent by weight:

1.4.1 Screen or other size classification;
1.4.2 Conveyor, screw, auger, stacker or bucket elevator;
1.4.3 Grizzly, or other material loading or unloading;
1.4.4 Storage silos;
1.4.5 Storage or weigh hopper/bin system.

(Amended 6/7/95; 5/17/00)

This exemption applies solely to permits. The equipment must be operated in compliance with any applicable District regulations and with other regulatory agency requirements. The District's regulations may be viewed online at www.baaqmd.gov/. Note that this exemption is not permanent. Any change in your operation or in District regulations may require you to obtain permits in the future.

Please include your application number with any correspondence with the District. If you have any questions on this matter, please call **Simrun Dhoot at (415) 749-5074.**

Very truly yours,

Acting Director
Director of Engineering

by [signature]
Air Quality Engineering Manager

115.01.04.9

CBE Attachment D

BAAQMD New Applications Report, Jun. 10, 2014

New Applications Received

Date Rcv	App No	Facility	Project Description	Facility Address	Facility City
6/2/2014	408110	Bethel Harbor LTD	GDF - Mod	3405 Harbor Road	Bethel Island, CA 94511
5/29/2014	26348	Futuris Automotive	Foam Production	6601 Overlake Place	Newark, CA 94560
5/30/2014	408108	Avis Rental Car RAC QTA	GDF - Mod	1050 Wright Street	Oakland, CA 94621
6/2/2014	26341	Argent Materials Inc	Baldwin Street	8300 Baldwin Street	Oakland, CA 94621
5/30/2014	26344	Stanford University	Synthetic Minor:Synthetic Minor	ESF-480 Oak Road	Palo Alto, CA 94305
6/2/2014	26338	Black Point Environmental Inc	APP:New Facility/SVE	101 N McDowell Blvd	Petaluma, CA 94954
6/4/2014	26345	Trans Bay Cable LLC	Emergency Standby Generators (3)	696 W 10th St	Pittsburg, CA 94565
6/4/2014	26343	SOMA Environmental Engineering, Inc	Multi Phase Extraction (MPE) Mobile Treatment	3317 Vincent Road	Pleasant Hill, CA 94523
5/28/2014	408096	Alameda County Fairgrounds Assoc	GDF - Mod	4501 Pleasanton Ave	Pleasanton, CA 94566
2/28/2013	26339	Four Seasons Hotel San Francisco	Boilers	757 Market St	San Francisco, CA 94103
6/4/2014	26340	Trans Bay Cable LLC	Emergency Standby Generators (3)	23 rd St, &Illinois Street	San Francisco, CA 94107
5/30/2014	408107	Avis Rent A Car Systems, Inc	GDF - Mod	675 Post St	San Francisco, CA 94109
5/29/2014	408106	Chevron SS #9-0032	GDF - Mod	6000 Geary Blvd	San Francisco, CA 94121
6/3/2014	26342	Bay-View Greenwaste Management	Grinding & Screening of Green Waste	1300 Carroll Ave	San Francisco, CA 94124
6/2/2014	26337	Advanced Custom Shtters, Inc	Industrial Painting Booth	2130 Trad Zn Blvd #20	San Jose, CA 95131
6/5/2014	26346	Irvine Company, LLC	Emergency Standby Generator Parcel (1)	3471 N 1st Street	San Jose, CA 95134
6/2/2014	408109	Golden Gate Bridge & Transportation	GDF - MOD	1011 Andersen Dr	San Rafael, CA 94901
6/3/2014	26347	JDSU	Thermal Oxidizer Replacement	2789 Northpoint Pkwy	Santa Rosa, CA 95407

CBE Attachment E

Argent BAAQMD Application 29851 for Stockpiles, Jun. 2019

[redacted]

BAAQMD Engineering Division

Permit Application

Facility Name	Argent Materials Inc.	**Application #**	029851
Equip. Address	8300 Baldwin Street	**Plant #**	22474
City, Zip Code	Oakland, CA 94608	**Engineer**	RJA

Application Type: ☐ Standard ☐ Banking ☐ ERC Transfer ☐ Other ____________

Application Status:

	Date	Initials
Application Received	4 / 5 / 19	RJW
Received in Division	4 / 8 / 19	DQM.
Assigned	4 / 15 / 19	RJA

Incomplete	4 / 25 / 19 (RJA)	/ /	/ /
Reactivated	/ /	/ /	/ /
Deemed complete	6 / 4 / 19 (RJA)		

		Initials	Recommendation
Staff	6 / 5 / 19	RJA	Issue P/O
Supervisor	6 / 6 / 19	BK	PO
Manager	/ /		

Health Risk Assessment: ☑ Not Required ☐ Streamlined ☐ Performed

	Date	Initials	Risk	Hazard Index
Route for processing	/ /			
HRA results	/ /			

Public Notice: ☑ Not Required ☐ Required

	Date	Staff	Supervisor
Route for processing - Draft files ready	/ /		

Emission Offsets: ☑ Not Required ☐Required / Surrendered ☐Required / Deferred

Emissions Summary (tons/year):

Pollutant Increase	Increase Amount	Pollutant Decrease	Decrease Amount	Basis[1]	Offset Ratio	Bank Number	Regulation (Decreases)
PM_{10}	0.098						
$PM_{2.5}$	0.015						

Basis[1]: **Bank** - Emission Bank Withdrawal **ONS-** On Site Credit **RACT-** Required Reduction

		Date	Staff	Supervisor	Manager
Authority to Construct	1	/ /			
Renewal	2	/ /			

Comments: Archived old cumulative increases under App# 26341. New cumulative added to this application.

CBE Attachment E

Argent BAAQMD Application 29851 for Stockpiles, Jun. 2019

Date: 17Jun19
Application: 29851 Trade Secrets (Y/N/?): N
Plant number: 22474
Site number: E2474
Plant name: Argent Materials Inc
Plant emissions: none
Location: 8300 Baldwin Street, Oakland, CA 94621
UTM coordinates: 571.12 Longitude 4177.9 Latitude
Project title: Material Stockpiles
Applic. Contact: Matt Chasm
Company name: Argent Materials Inc
Mailing address: 8300 Baldwin Street, Oakland, CA 94621
Telephone: (415) 686-6051
Engineer: Ryan Atterbury [1615]
Folder : Ryan Atterbury
Received: 04/05/19 . . Completeness review due by: 04/26/19
Incomplete: 04/25/19 . . . . . Cancellation due by: 07/24/19
Re-activated: 05/16/19 . . Completeness review due by: 06/07/19
Complete: 06/04/19 . . . . . . Evaluation due by: 07/04/19

Final disposition: Waived A/C 06/17/19 (archived record)

Emission increase and offsets (tons/yr)

	PM>10	POC	NOx	SO2	CO	PM10
increase	.000	.000	.000	.000	.000	4.859

Device No.: S-1 <c>
Description: Stockpile, Concrete and ASphalt Raw Feed Pile
Codes: NHC/Condition
Condition No.: 26498 <<c>>
Final App Status: P/O issued, 06/17/19 <<archived>>
Current Status: P/O Issued, expires 07/01/20

Device No.: S-2 <c>
Description: Stockpile, Finished Product Pile
Codes: NHC/Condition
Condition No.: 26498 <<c>>
Final App Status: P/O issued, 06/17/19 <<archived>>
Current Status: P/O Issued, expires 07/01/20

To whom it may concern at the BAAQMD,

My company is seeking to increase our annual throughput limits for our material stockpiles from 500,000 tons per year to 1,000,000 tons per year. I believe that our dust levels will still be lower than when we initially received our Authority to Construct or Permit to Operate. Our primary dust abatement is wetting of our stockpiles using a water truck, but in the last year we have removed more than half of the exposed face of our feed stockpile by constructing a wall to contain it.

I look forward to hearing from you soon.

Thank you,

Matt Chasm
Safety and Compliance Officer
Argent Materials INC
(415) 686-6051

ORIGINAL

CBE Attachment F

Argent BAAQMD Application 30122 for Storage Yard, Sep. 2019

BAY AREA AIR QUALIT MANAGEMENT DISTRICT
375 Beale Street, Suite 600, San Francisco, CA 94105
Engineering Division (415) 749-4990
www.baaqmd.gov fax (415) 749-5030

Form P-101B
Authority to Construct/
Permit to Operate

030122

1. Application Information

BAAQMD Plant No. 24537 Company Name Argent Materials Inc

Equipment/Project Description Storage Yard

2. Plant Information *If you have not previously been assigned a Plant Number by the District or if you want to update any plant data that you have previously supplied to the District, please complete this section.*

Equipment Location 8501 San Leandro st.

City Oakland Zip Code 94621

Mail Address 8300 Baldwin st.

City Oakland State CA Zip Code 94621

Plant Contact Matt Clasm Title Safety & Compliance Officer

Telephone (415) 686-6051 Fax (510) 638-7189 Email matt@argentmaterials.com

NAICS (North American Industry Classification System) see www.census.gov/eos/www/naics/ ______

3. Proximity to a School (K-12)

The sources in this permit application (*check one*) ☐ Are ☒ Are not within 1,000 ft of the outer boundary of the nearest school.

4. Application Contact Information *All correspondence from the District regarding this application will be sent to the plant contact unless you wish to designate a different contact for this application.*

Application Contact Matt Chasm Title Safety & Compliance Officer

Mail Address 8300 Baldwin st.

City Oakland State CA Zip Code 94621

Telephone (415) 686-6051 Fax ( ) Email matt@argentmaterials.com

5. Additional Information *The following additional information is required for all permit applications and should be included with your submittal. Failure to provide this information may delay the review of your application. Please indicate that each item has been addressed by checking the box. Contact the Engineering Division if you need assistance.*

- ☑ If a new Plant, a local street map showing the location of your business
- ☑ A facility map, drawn roughly to scale, that locates the equipment and its emission points
- ☐ Completed data form(s) and a pollutant flow diagram for each piece of equipment. (See www.baaqmd.gov/forms/permits)
- ☐ Project/equipment description, manufacturer's data
- ☐ Discussion and/or calculations of the emissions of air pollutants from the equipment

6. Trade Secrets *Under the California Public Records Act, all information in your permit application will be considered a matter of public record and may be disclosed to a third party. If you wish to keep certain items separate as specified in Regulation 2, Rule 1, Section 2-1-402.7, please complete the following steps.*

- ☐ Each page containing trade secret information must be labeled "trade secret" with the trade secret information clearly marked.
- ☐ A second copy, with trade secret information blanked out, marked "public copy" must be provided.
- ☐ For each item asserted to be trade secret, you must provide a statement which provides the basis for your claim.

ORIGINAL

7. Small Business Certification *You are entitled to a reduced permit fee if you qualify as a small business as defined in Regulation 3. In order to qualify, you must certify that your business meets all of the following criteria:*

☐ The business does not employ more than 10 persons and its gross annual income does not exceed $750,000.

☐ And the business is not an affiliate of a non-small business. (Note: a non-small business employs more than 10 persons and/or its gross income exceeds $750,000.)

8. Green Business Certification *You are entitled to a reduced permit fee if you qualify as a green business as defined in Regulation 3. In order to qualify, you must certify that your business meets all of the following criteria:*

☐ The business has been certified under the Bay Area Green Business Program coordinated by the Association of Bay Area Governments and implemented by participating counties.

☐ A copy of the certification is included.

9. Accelerated Permitting *The Accelerated Permitting Program entitles you to install and operate qualifying sources of air pollution and abatement equipment* ***without waiting for the District to issue a Permit to Operate.*** *To participate in this program you must certify that your project will meet* ***all*** *of the following criteria. Please acknowledge each item by checking each box.*

☑ Uncontrolled emissions of any single pollutant are each less than 10 lb/highest day, or the equipment has been precertified by the BAAQMD.

☑ Emissions of toxic compounds do not exceed the trigger levels identified in Table 2-5-1 (see Regulation 2, Rule 5).

030122

☑ The source is not a diesel engine.

☑ The project is not subject to public notice requirements (the source is either more than 1000 ft. from the nearest school, or the source does not emit any toxic compound in Table 2-5-1).

☑ For replacement of abatement equipment, the new equipment must have an equal or greater overall abatement efficiency for all pollutants than the equipment being replaced.

☑ For alterations of existing sources, for all pollutants the alteration does not result in an increase in emissions.

☐ Payment of applicable fees (the minimum permit fee to install and operate each source). See Regulation 3 or contact the Engineering Division for help in determining your fees.

10. CEQA *Please answer the following questions pertaining to CEQA (California Environmental Quality Act).*

A. Has another public agency prepared, required preparation of, or issued a notice regarding preparation of a California Environmental Quality Act (CEQA) document (initial study, negative declaration, environmental impact report, or other CEQA document) that analyzes impacts of this project or another project of which it is a part or to which it is related? ☐YES ☑NO If no, go to section 10B.

Describe the document or notice, preparer, and date of document or expected date of completion:

B. List and describe any other permits or agency approvals required for this project by city, regional, state or federal agencies:

C. List and describe all other prior or current projects for which either of the following statements is true: (1) the project that is the subject of this application could not be undertaken without the project listed below, (2) the project listed below could not be undertaken without the project that is the subject of this application:

This application is for a storage / overflow yard of finished product from our primary site at 8300 Ballon St., BAAQMD Plant No.

11. Certification *I hereby certify that all information contained herein is true and correct. (Please sign and date this form)*

Matt Chase	Safety & Compliance Officer	[signature]	9/6/19
Name of person certifying (print)	Title of person certifying	Signature of person certifying	Date

Send all application materials to the **BAAQMD Engineering Division, 375 Beale Street, Suite 600, San Francisco, CA 94105.**

- 2

ORIGINAL

(revised 4/12/16)

Engineering Division

Application No.: 30122
Project Title: Storage Yard

Invoice No. :	4GF88
Invoice Date :	9/25/2019
Due Date :	10/25/2019

Device Type	Device No.	Equipment Description	Filing Fee	Initial Fee	Late Fee	Permit Fee	Back Fee	Toxic Fee	Risk Fee	Fee Sched
S	1	Finished Product Stockpile - Recycled Concrete and Asphalt	508.00	661.00	0.00	480.00	0.00	0.00	0.00	F

CBE Attachment G

Complaints to BAAQMD re Argent Materials, 2017-2019

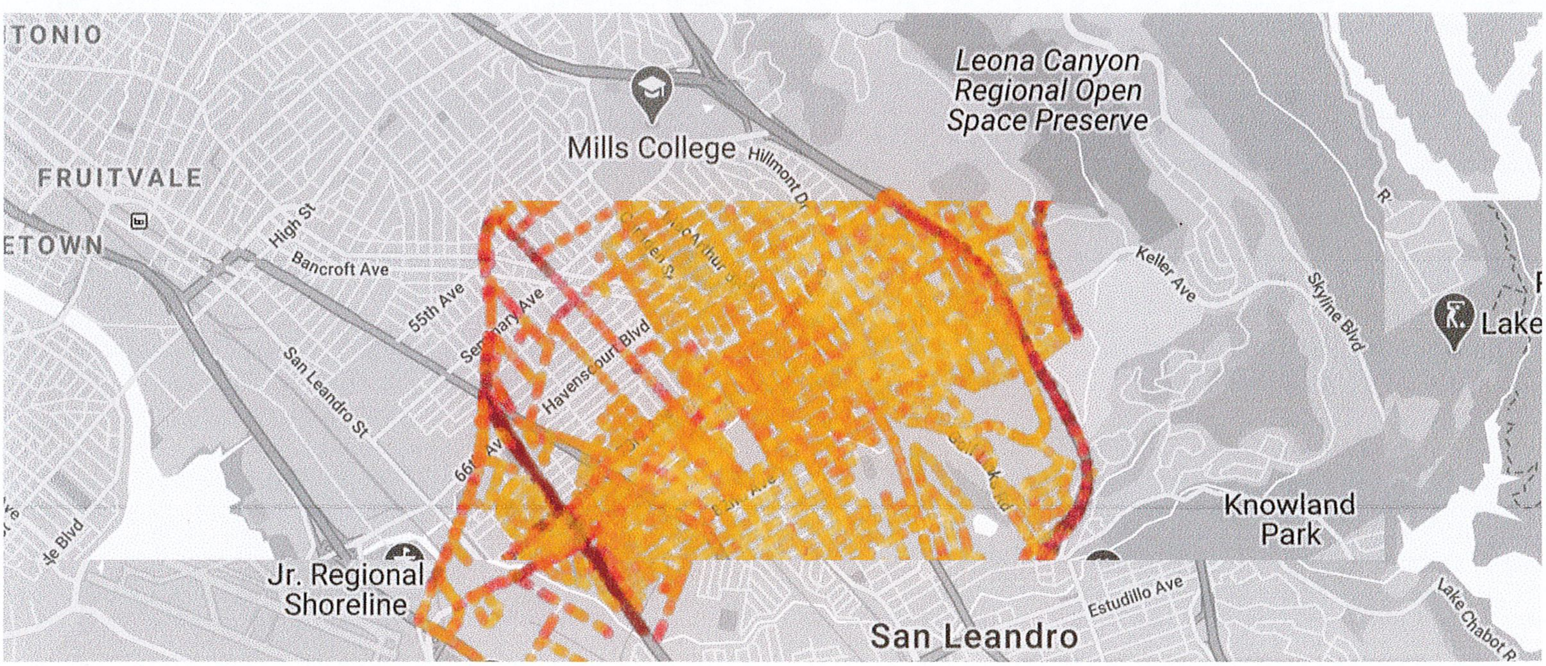
Complaint	Type	Descrip	Date	Site	Site Name	Addr	Confirmation	Employee ID
234399	DST	ridiculous amounts	2/14/18 8:48	Z3202	Argent Materials	8300 Baldwin St	UNCNF	835
239703	DST	concrete	4/10/19 12:30	Z3202	Argent Materials	8300 Baldwin St	UNCNF	835
231188	DST	fugitive dust	4/20/17 11:00	E2474	Argent Materials Inc	8300 Baldwin Street	CNFRM	829
233018	DST	not watering down	10/10/17 9:00	E2474	Argent Materials Inc	8300 Baldwin Street	CNFRM	835
234377	DST	visible dust	2/13/18 8:36	E2474	Argent Materials Inc	8300 Baldwin Street	UNCNF	835
234558	DST	haze	3/7/18 8:30	E2474	Argent Materials Inc	8300 Baldwin Street	UNCNF	835
233149	DST	Heavy dust	10/23/17 11:00	Z1029	NONE	85th & Baldwin	UNCNF	835
240384	DST	Concrete	6/27/19 8:36	W3745	NONE	Hegenberger Road / Baldwin St	UNCNF	835
232877	DST	Heavy dust from coı	9/29/17 11:00	Z0539	Silverado Contractors	685 85th Ave	UNCNF	835

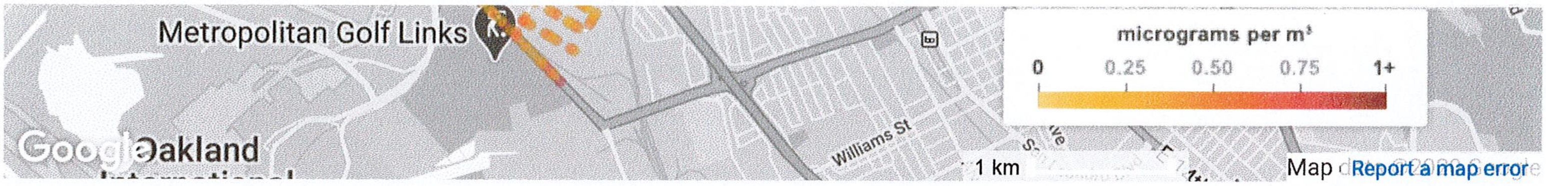
Finding the ways that work

Air pollution and health in East Oakland

EDF deployed Google Street View cars equipped with Aclima's environmental sensing platform to collect data in a 6 square mile area in the easternmost part of Oakland for a year between 2015 and 2016. The resulting map shows elevated levels of air pollution in many parts of East Oakland.

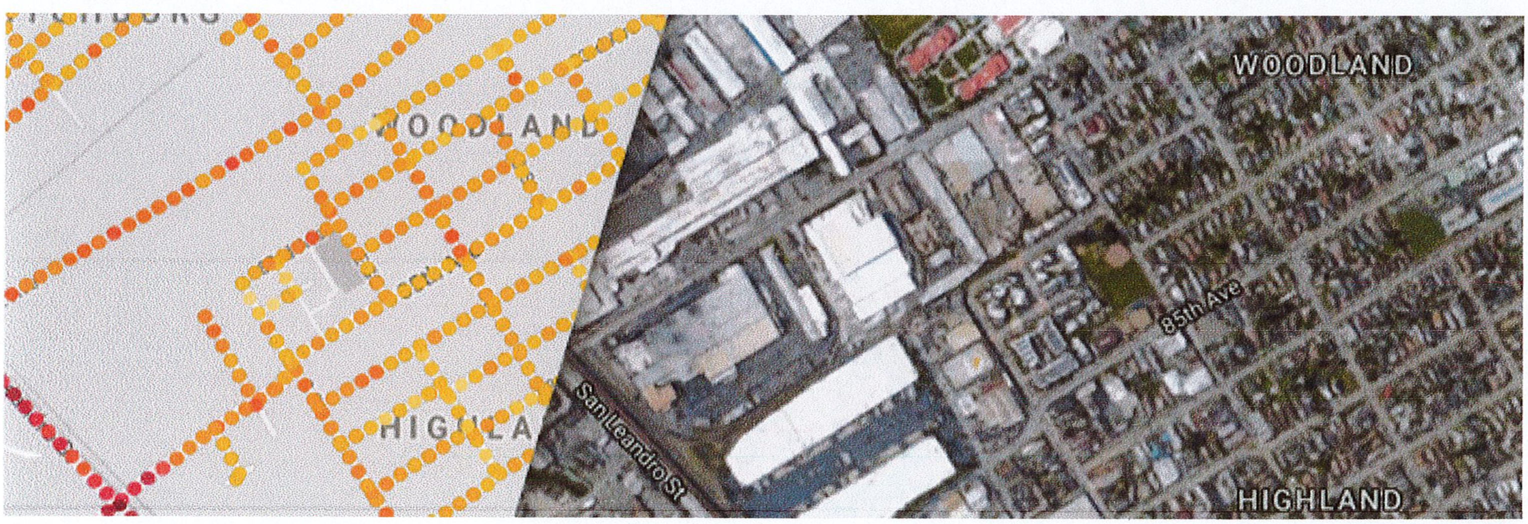
Black carbon particles come from burning fuel, especially diesel, wood and coal. High exposure is associated with heart attacks, stroke and some forms of cancer.





From the map, you can see that I-880 (Nimitz Freeway), a major transportation route serving the Port of Oakland and Oakland International Airport, features significantly higher levels of air pollution. Not surprising, when considering that the I-880 corridor carries the greatest volume of truck traffic [PDF] in the Bay Area region and among any highway in California. The stretch of I-880 shown here sees on average 200,000 vehicle trips per day [PDF].

Other areas of East Oakland with elevated levels of pollution include the busy road corridors shown below, where a number of commercial and industrial facilities are close to residential areas and public spaces. Our map echoes the findings in a 2010 community-based participatory research study [PDF]by Communities for a Better Environment, which found high levels of air pollution along the same roadway, with measurements higher than state and federal standards. The study area is densely populated and includes many places where vulnerable populations gather [PDF], such as schools, senior centers and hospitals, as shown in a 2008 baseline by CBE.



East Oakland's freight corridor, busy roadways and industrial sector have contributed to elevated levels of air pollution, and residents experience some of the highest asthma hospitalization rates compared to the rest of the region, according to a 2016 report by Alameda County Public Health Department.

In an effort to better understand how changes in pollution levels within even small areas could impact health, EDF partnered with Kaiser Permanente and combined our mapping data with electronic health records. We found in a 2018 study that differences in air pollution within neighborhoods or even city blocks can increase risks of heart attack and deaths from heart disease in the elderly.

As in West Oakland, a large percentage of the communities in East Oakland are both low-income and of color. These individuals and families bear a disproportionate burden of environmental impact, resulting in worse health outcomes. East Oakland has higher death rates due to heart disease, stroke and lung cancer than both Oakland and Alameda County. And life expectancy in East Oakland is seven years shorter than the more affluent residents in the Northern area of the city. (Alameda County Public Health 2016 report) While these health outcomes are related to multiple factors, studies have shown that exposure to high levels of air pollution -- from motor vehicles, refineries and other sources -- increases death rates associated with coronary and lung diseases. Our findings, coupled with existing research, highlight the need for stricter regulations to protect the health of communities most impacted by poor air quality.

You can help: Make your voice heard!

Everyone deserves to breathe clean air, and you can make a difference by advocating for common-sense solutions to reduce levels of harmful air pollution.

- **If you live in California**, write to your state leaders in support of the Sustainable Freight Action Plan.

- **If you live elsewhere in the U.S.**, speak up for national safeguards for clean air.

And get involved in your community:

- **If you live in Oakland**, connect with local groups like Communities for a Better Environment, which can help you take action on issues that affect your health and environment.

- Find a clean air advocacy group working near you. For example, Moms Clean Air Force, a national group of more than a million parents, organizes communities to protect clean air and our kids' health in 20 states.

Explore this project

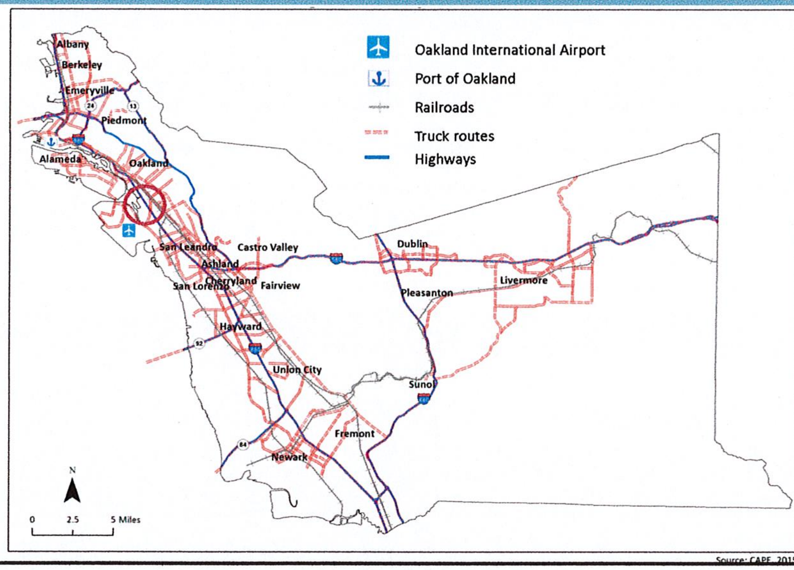
Project overview

Methodology and data

About the partnerships

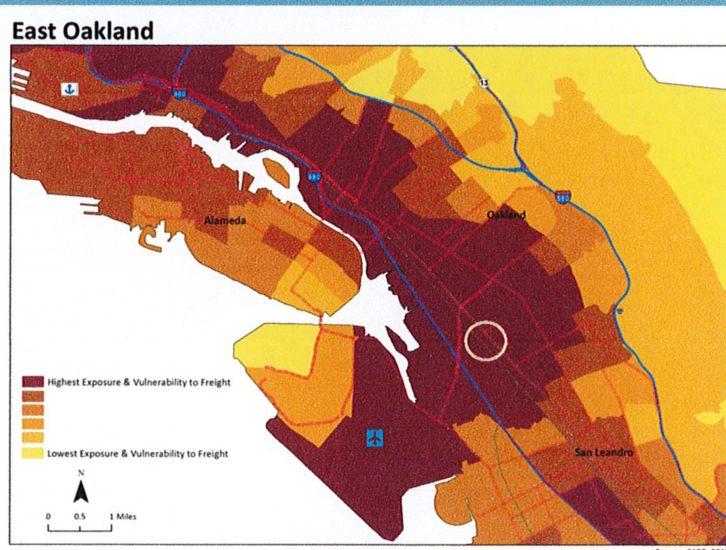
Modeling with collected data

The proposed site for the asphalt/cement crushing business is already heavily exposed to multiple sources of pollution, including the airport, I-880, rail lines, and truck routes.



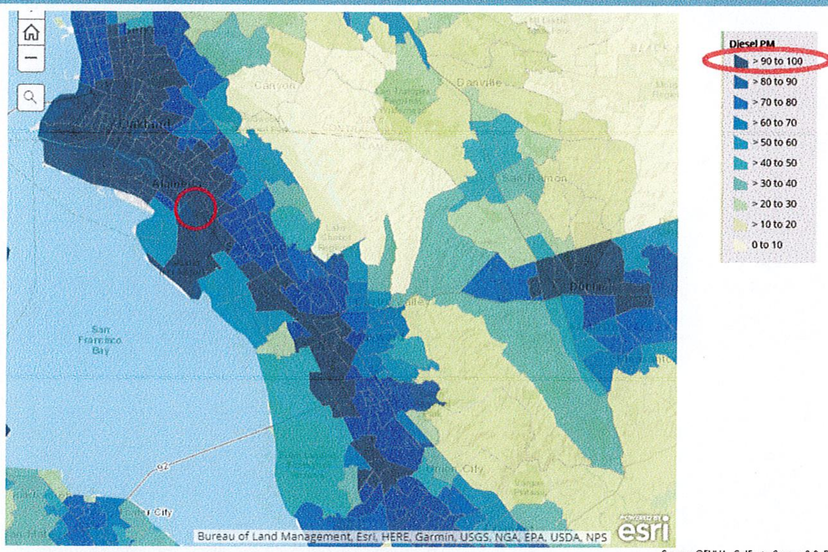
1

The proposed site is in an area that is highly exposed and especially vulnerable to pollution and health impacts from goods movement and freight transport.



2

Some of the highest diesel particulate matter levels in the County and State are reported in and around this proposed site.

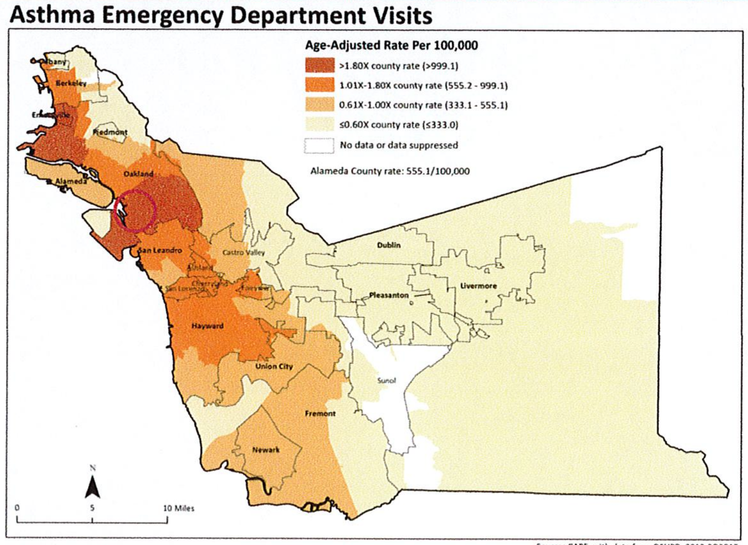


Source: OEHHA, CalEnviroScreen 3.0, Diesel PM

3

Rates of visits to the ED for asthma are among the highest in the County in the zip code where this site is located.

Asthma Emergency Department Visits

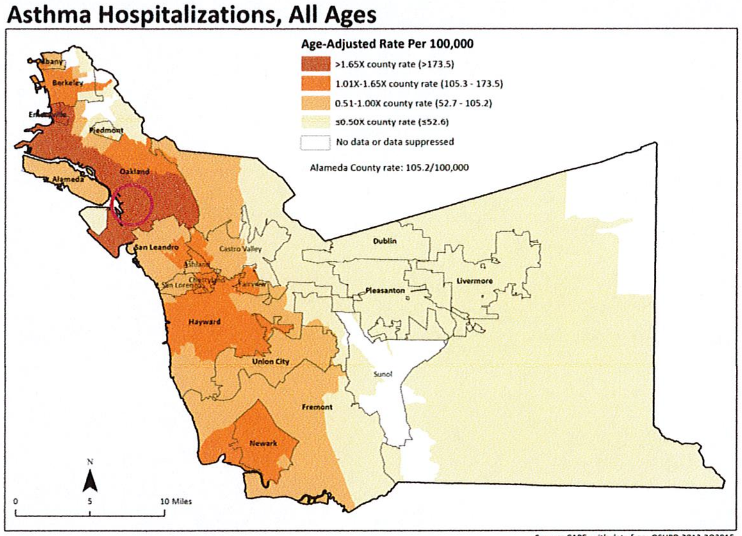


Source: CAPE, with data from OSHPD, 2013-3Q2015.

4

Among the highest rates of asthma hospitalizations…

Asthma Hospitalizations, All Ages

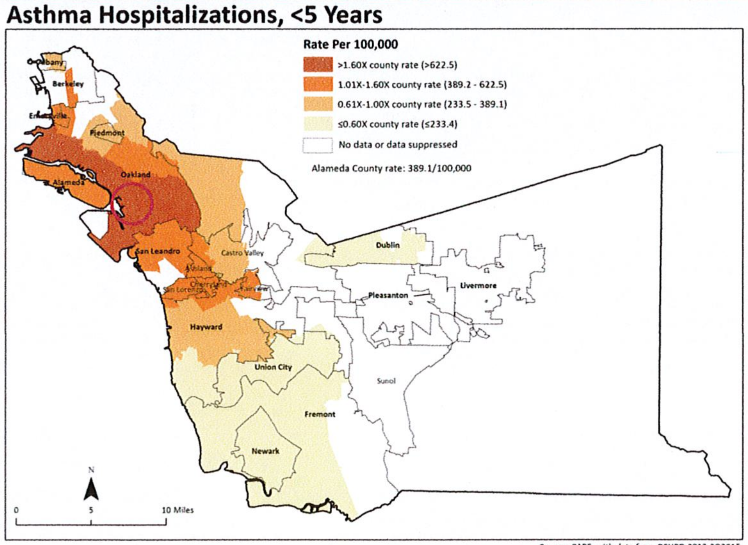


Source: CAPE, with data from OSHPD 2013-3Q2015.

5

…and child (< 5 years old) asthma hospitalizations too.

Asthma Hospitalizations, <5 Years

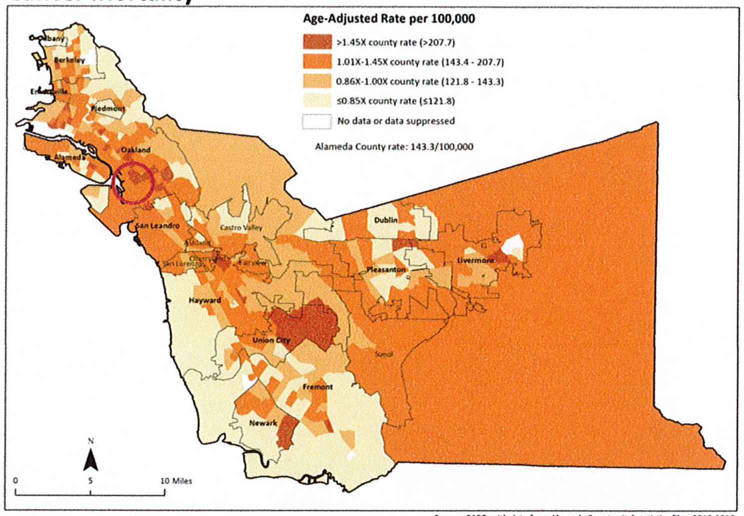


Source: CAPE, with data from OSHPD 2013-3Q2015.

6

Air pollution has been linked with increased risk of cancer and cardiovascular events. The proposed site is in an area with high rates of cancer mortality,...

Cancer Mortality

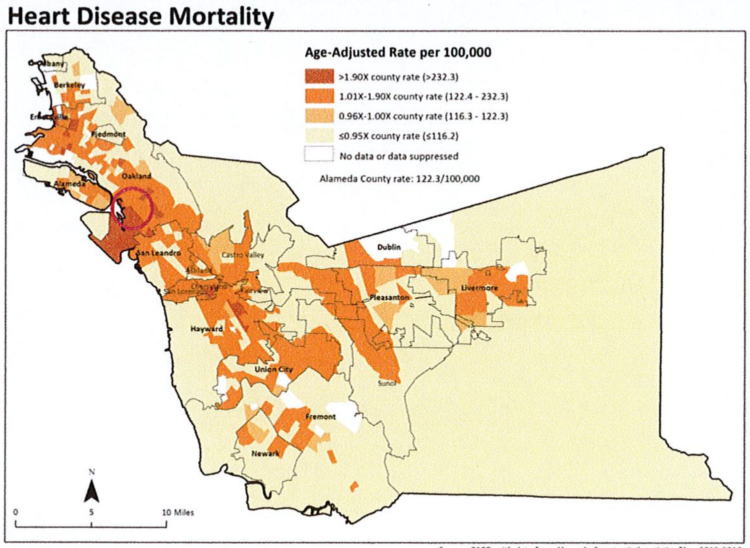


Source: CAPE, with data from Alameda County vital statistics files, 2012-2016.

7

...heart disease mortality,...

Heart Disease Mortality

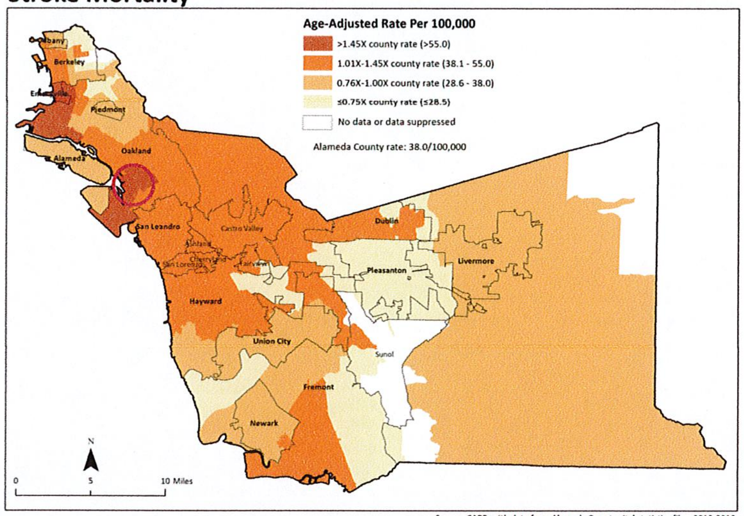


Source: CAPE, with data from Alameda County vital statistics files, 2012-2016.

8

...and stroke mortality.

Stroke Mortality

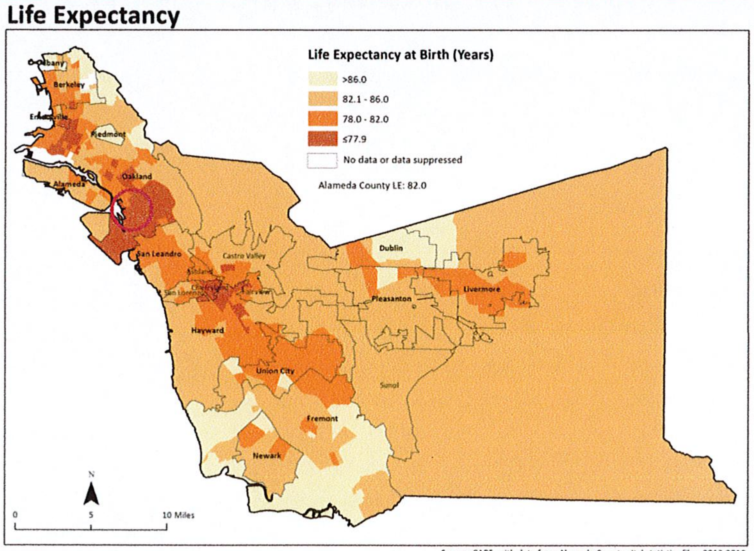


Source: CAPE, with data from Alameda County vital statistics files, 2012-2016.

9

Reflecting cumulative health risks and burdens,
life expectancy is especially low in the area around the proposed site.

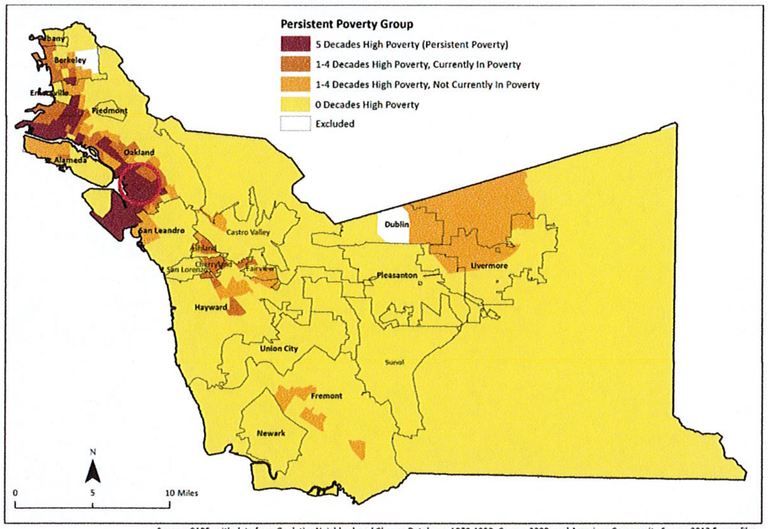
Life Expectancy



Source: CAPE, with data from Alameda County vital statistics files, 2012-2016.

10

The proposed site is in an area of the county with high and persistent poverty. Ongoing disinvestment have left this area with fewer resources to support good health and greater exposure to health risks, including air pollution.



Source: CAPE, with data from Geolytics Neighborhood Change Database, 1970-1990; Census 2000; and American Community Survey 2013 5-year files.

11

For questions or more info:

Tammy Lee
Community Epidemiologist
CAPE Unit, Alameda County Public Health Department
tammy.lee@acgov.org

12

Journal of Toxicology and Environmental Health, Part B

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State-of-the-Science Review of the Occupational Health Hazards of Crystalline Silica in Abrasive Blasting Operations and Related Requirements for Respiratory Protection

Amy K. Madl , Ellen P. Donovan , Shannon H. Gaffney , Meg A. McKinley , Emily C. Moody , John L. Henshaw & Dennis J. Paustenbach

Journal of Toxicology and Environmental Health, Part B, 11:548–608, 2008

ISSN: 1093-7404 print / 1521-6950 online
DOI: 10.1080/10937400801909135

Taylor & Francis
Taylor & Francis Group

STATE-OF-THE-SCIENCE REVIEW OF THE OCCUPATIONAL HEALTH HAZARDS OF CRYSTALLINE SILICA IN ABRASIVE BLASTING OPERATIONS AND RELATED REQUIREMENTS FOR RESPIRATORY PROTECTION

Amy K. Madl[1], Ellen P. Donovan[1], Shannon H. Gaffney[1], Meg A. McKinley[1], Emily C. Moody[1], John L. Henshaw[2], Dennis J. Paustenbach[1]

[1]ChemRisk, Inc., San Francisco, California, USA
[2]Henshaw & Associates, Sanibel, Florida, USA

Excessive exposures to airborne crystalline silica have been known for over 100 years to pose a serious health hazard. Work practices and regulatory standards advanced as the knowledge of the hazards of crystalline silica evolved. This article presents a comprehensive historical examination of the literature on exposure, health effects, and personal protective equipment related to silica and abrasive blasting operations over the last century. In the early 1900s, increased death rates and prevalence of pulmonary disease were observed in industries that involved dusty operations. Studies of these occupational cohorts served as the basis for the first occupational exposure limits in the 1930s. Early exposure studies in foundries revealed that abrasive blasting operations were particularly hazardous and provided the basis for many of the engineering control and respiratory protection requirements that are still in place today. Studies involving abrasive blasters over the years revealed that engineering controls were often not completely effective at reducing airborne silica concentrations to a safe level; consequently, respiratory protection has always been an important component of protecting workers. During the last 15–20 yr, quantitative exposure-response modeling, experimental animal studies, and in vitro methods were used to better understand the relationship between exposure to silica and disease in the workplace. In light of Occupational Safety and Health Administration efforts to reexamine the protectiveness of the current permissible exposure limit (PEL) for crystalline silica and its focus on protecting workers who are known to still be exposed to silica in the workplace (including abrasive blasters), this state-of-the-science review of one of the most hazardous operations involving crystalline silica should provide useful background to employers, researchers, and regulators interested in the historical evolution of the recognized occupational health hazards of crystalline silica and abrasive blasting operations and the related requirements for respiratory protection.

Crystalline silica has been one of the most widely studied chemicals in the history of occupational disease and industrial hygiene. Crystalline silica is an abundant rock-forming mineral and is present in different forms or polymorphs in the environment. While each form is composed of units of silicon dioxide (SiO_2), the forms differ in their atom spacing, lattice structure, and angular relation (NIOSH, 2002a). Quartz (also commonly referred to as "free silica") is most prevalent in the environment and, consequently, in the workplace. Quartz or silica sand is used in abrasives, cleaners, ceramics, electronics, fillers, optics, polishes, and refractory materials. Cristobalite and tridymite, other polymorphs of crystalline silica less commonly found in rocks or soils, may occur in industrial operations involving the heating of quartz or amorphous silica, such as the calcining of diatomaceous earth or during brick manufacturing (NIOSH, 2002a). Although silica may also exist as a non-crystalline form (amorphous), crystalline silica continues to be of national interest. It is the most toxic form of silica, poses a major health hazard with estimates of approximately 1.7 million U.S. workers exposed to respirable crystalline silica in industries and occupations such as construction, sandblasting, and mining, and has been attributed to causing the over 15,000 silicosis deaths over the last three decades (NIOSH, 2005, 2006c).

We thank Mathew Le and Rachel Zisook with ChemRisk, Inc. for their assistance in compiling references and reviewing some of the literature cited in the manuscript. The research and manuscript preparation was funded by AIG claims Services, Inc. and The Hartford, firms that have been involved in silica litigation. The funding organizations have not reviewed any part of this manuscript prior to its publication. At least two of the authors have served or are likely to serve as expert witnesses on the matters relating to industrial hygiene, exposure assessment, risk assessment, or toxicological issues related to silica.

Address correspondence to Amy K. Madl, ChemRisk, Inc., 25 Jessie Street at Ecker Square, Suite 1800, San Francisco, CA 94105, USA. E-mail: amadl@chemrisk.com

Crystalline silica is present in many occupational environments, including mines, metal foundries and mills, agricultural settings, construction, shipbuilding and ship repair, and manufacturing facilities for glass, paints, chemicals, soaps, cosmetics, rubber materials, and plastics (NIOSH, 2002a). Around the turn of the 20th century, changes associated with the industrial revolution led to greater airborne dust concentrations in many occupational settings (Air Hygiene Foundation of America, Inc., 1937b). This increase was primarily due to the use of machinery (e.g., drills, automatic grinders) in applications that had previously been performed by hand. The resulting increase in lung disease among workers in the "dusty trades" prompted studies that led to recognizing silica's role in the development of what would eventually be called silicosis.

Because of silica's abundance in the environment and its widespread use in consumer product and industrial manufacturing (Table 1), exposure occurs in a large variety of industries and occupational settings (NIOSH, 2002a). For example, silica that is naturally present in rocks can be released into the air during mining (e.g., rock drilling, dredging) and quarrying (e.g., crushing stone, stone

TABLE 1. Industries and Operations in which Silica Exposure has been Reported

Industry	Specific Operation/Task	Source Material
Abrasives	Silicon carbide production	Sand
Agricultural chemicals	Raw material crushing, handling	Phosphate ores and rock
Agriculture	Plowing, harvesting, use of machinery	Soil
Arts, crafts, sculpture	Pottery firing, ceramics, clay mixing, kiln repairs, abrasive blasting, sand blasting, engraving, cutting, grinding, piolishing, buffing, etching, engraving, casting, chipping, sharpening, sculpting	Clays, glazes, bricks, stones, rocks, minerals, sand, silica flour
Automobile repair	Abrasive blasting	Sand
Boiler scaling	Coal-fired boilers	Ash and Concretions
Cement	Raw materials processing	Clay, sand, limestone, diatomaceous earth
Ceramics (including bricks, tiles, sanitary ware, porcelain, pottery, refractories, vitreous enamels)	Mixing, moulding, glaze or enamel spraying, finishing	Clay, shale, flint, sand, quartizite, diatomaceous earth
Construction	Abrasive blasting of structures, buildings	Sand, concrete
	Highway and tunnel construction	Rock
	Excavation and earth moving	Soil and rock
	Masonry, concrete work, demolition	Concrete, mortar, plaster
Dental material	Abrasive blasting, polishing	Sand, abrasives
Foundries	Casting, shaking out	Sand
	Abrasive blasting, fettling	Sand
	Furnace installation and repair	Refractory material
Glass (including fiberglass)	Raw material processing	Sand, crushed quartz
	Refractory installation and repair	Refractory materials
Iron and steel mills	Refractory preparation and furnace repair	Refractory material
Jewelry	Cutting, grinding, polishing, buffing	Semi-precious gems or stones, abrasives
Metal products (including structural metal, machinery, transportation equipment)	Abrasive blasting	Sand
Mining and milling	Most occupations (underground, surface, mill) and mines (metal and non-metal, coal)	Ores and associated rock
Paint	Raw materials handling	Fillers (tripoli, diatomaceous earth)
Quarrying and milling	Crushing stone, sand and gravel processing, monumental stone cutting and abrasive blasting, slate work, diatomite calcination	Diatomaceous earth
Roofing and asphalt felt	Filling and granule application	Sand and aggregate, diatomaceous earth
Rubber and plastics	Raw material handling	Fillers (tripoli, diatomaceous earth)
Shipbuilding and repair	Abrasive blasting	Sand
Silicon and ferro-silicon foundries	Raw materials handling	Sand
Soaps and cosmetics	Abrasive soaps, scouring powders	Silica flour

Data from IARC 1997 and NIOSH 2002a.

monument cutting, slate work) operations. Agricultural activities such as plowing and harvesting can disperse silica that is present in soil, and glass manufacturing (including fiberglass), cement, and ceramics may involve silica-containing sand. Various materials used in the construction industry that contain silica include sand, concrete, rock, soil, mortar, plaster, and shingles. Activities in the construction industry, including demolition, highway and tunnel construction, abrasive blasting, concrete work, excavation, jack hammering, and roofing, may result in exposure to respirable silica. Additionally, silica-containing sand was used widely in foundries for metal cast molding and abrasive blasting (NIOSH, 2002a).

Since the 1920s and through the present day, abrasive blasting has consistently been identified as one of the more hazardous operations with respect to potential exposure to airborne crystalline silica. During this process, an abrasive substance is propelled from a hose and nozzle using air or liquid. Abrasive blasting is frequently performed in foundry operations, where it is used to remove appendages from metal castings, during the construction and repair of buildings, bridges, and ships to remove rust or imperfections and to prepare surfaces for painting, and in auto body repair shops, arts and crafts, and dentistry (NIOSH, 2002a).

The potential for exposure to airborne crystalline silica and the associated risk of disease can be significant if abrasive blasting operations are conducted without adequate dust controls. This article presents a comprehensive historical examination of the literature on exposure, health effects, and personal protective equipment related to silica and abrasive blasting operations over the last 100 yr. This review is divided into four time periods: 1900 to 1939, 1940 to 1969, 1970 to 1989, and 1990 to the present (Figure 1). These periods were selected based on what were believed to be sentinel events with respect to the recognition of silicosis as an occupational disease, the development and standardization of respirators and workplace controls, and the promulgation of occupational exposure limits (OELs) for silica.

For each time period, the following subjects are addressed: (1) major developments in the recognition of the health hazards of crystalline silica, including key toxicology and epidemiology studies; (2) guidelines and regulations related to OELs for crystalline silica, as well as development of sampling and analytical methods for characterizing exposures; (3) exposure and health studies of workers performing abrasive blasting, as well as standard practices of various industries involving abrasive blasting; and (4) recommendations for personal protective equipment for abrasive blasting operations, with a particular emphasis on respirators.

The goal of this review is to identify when specific scientific knowledge about the health hazards of crystalline silica was established and communicated among the scientific and industrial hygiene communities. The use of this information in the development of guidelines and regulations for appropriate controls during abrasive blasting operations is also discussed. Given the breadth of silica-related research conducted across the world over the past century, it is not feasible to

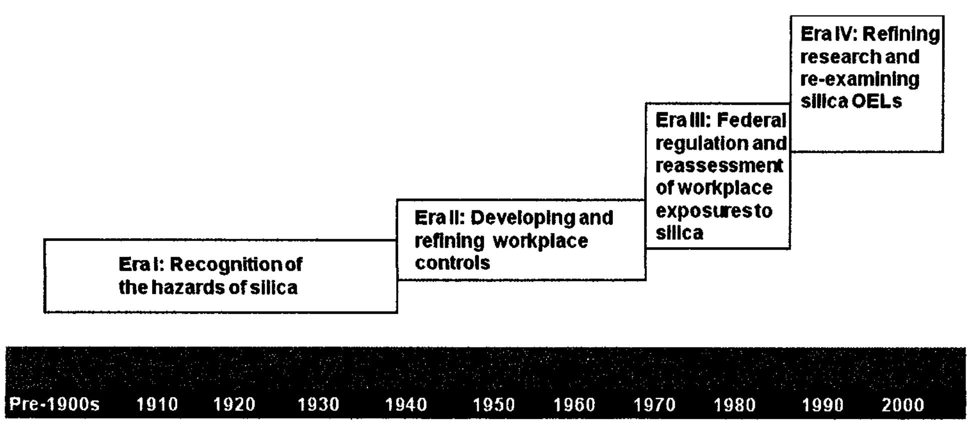


FIGURE 1. Timeline of eras regarding the occupational health hazards of crystalline silica and abrasive blasting operations.

describe in detail all of the studies in every industry. Rather, this article focuses on key industries (e.g., granite, metal mining, diatomite, foundries, shipbuilding), with a particular emphasis on abrasive blasting operations.

OVERVIEW OF SILICOSIS

Silicosis was recognized as an occupational disease very early in the history of occupational medicine and industrial hygiene (Hunter, 1969). There are three forms of silicosis: chronic, accelerated, and acute (NIOSH, 2002a). Chronic silicosis is often considered the classic form of the disease, and can develop after 10 yr or more of sufficiently high exposure. Chronic silicosis may be described as simple silicosis, where individual fibrotic nodules are solitary and less than 1 cm in diameter, as conglomerate silicosis, wherein the nodules become confluent and eventually replace the lung parenchyma, or as progressive massive silicosis, an uncommon lesion composed of confluent silicotic nodules (Silicosis and Silicate Disease Committee, 1988). Patients with simple silicosis may not display any symptoms of pulmonary dysfunction. Symptoms of accelerated silicosis, which usually manifests within 5 to 10 yr from first exposure, are similar to chronic silicosis, but the onset of fibrosis is more rapid, irregular, and diffuse. Acute silicosis, also referred to as "alveolar lipoproteinosis," can occur within weeks to 5 yr after initial exposure to very high airborne concentrations of silica (Silicosis and Silicate Disease Committee, 1988; NIOSH, 2002a). With this form, the nodular pattern of fibrosis is completely absent.

Exposure to crystalline silica leads to tissue fibrosis through a cascade of cellular events. Silica is not readily degraded by macrophage lysosomal enzymes and is directly cytotoxic to macrophages and polymorphonuclear leukocytes. Macrophages that engulf silica particles become necrotic and release lysosomal contents and reactive oxygen species (ROS), leading to local recruitment of polymorphonuclear leukocytes and ultimate damage to the surrounding tissue (Blackford et al., 1997; Huffman et al., 1998; Kim et al., 1999; Kang et al., 2000; Zeidler et al., 2004). A cyclical process of macrophage recruitment, particle ingestion, and cell death can cause a focal point of immune activity and fibrosis in the lung, resulting in chronic inflammation (Huffman et al., 1998; Kim et al., 1999; Kang et al., 2000; Zeidler et al., 2004; Blackford et al., 1997).

A number of studies have shown that silica-induced toxicity appears to be most closely correlated with factors that can influence molecular or cellular interactions with the particle surfaces. Multiple lines of evidence suggest that the formation of ROS, reactive nitrogen species (RNS), or other highly reactive molecules may play key roles in the development of the cell injury, proliferation, apoptosis, and fibrogenesis associated with silica exposure (Blackford et al., 1994; Blackford et al., 1997; Hamilton et al., 2008; Huffman et al., 1998; Kim et al., 1999; Kang et al., 2000; Zeidler et al., 2004). These reactive species can be generated directly via chemical reactions with the silica particle surfaces or indirectly through interactions of silica with various cell types. In vitro studies have shown that freshly fractured silica particles generate more ROS and are more toxic to alveolar macrophages than aged silica particles (Vallyathan et al., 1988). This finding is supported by evidence that surface modifications or coatings have been shown to decrease the pathogenicity of silica particles in vivo (Albrecht et al., 2005). In addition, in vitro studies have demonstrated that hydroxyl or superoxide radicals are formed in the presence of freshly fractured silica, and that crystalline silica is a potent stimulant of the increase in ROS production in alveolar macrophages (Vallyathan et al., 1988; Vallyathan et al., 1992; Castranova, 1994). The sustained presence of ROS resulting from repeated attempts by alveolar macrophages to phagocytize silica particles can cause chronic cell injury or death and may promote fibrogenesis (Zeidler et al., 2004; Blackford et al., 1997; Huffman et al., 1998; Kim et al., 1999; Kang et al., 2000).

OVERVIEW OF ABRASIVE BLASTING OPERATIONS

Abrasive blasting is a process for cleaning metal and other surfaces to remove contaminants, rust, and paint by directing a high-pressure stream of abrasive materials against surfaces. Typically, when sand is used as an abrasive, it is sieved from its natural state to a uniform size and the quartz content is largely dependent on the source of sand. Depending on the abrasive blasting application, industries may specify certain types of abrasive materials (NIOSH, 1976a; Dolley, 2003; Flynn & Susi, 2004). Technically, if sand is used as the abrasive material, the process is referred to as "sand-blasting," although this term is often used generically even when other materials such as such as coal and metal slags, steel shot, and garnet are used as abrasives.

Abrasives can be propelled in several different ways during abrasive blasting. Compressed air is used to project the abrasive during dry abrasive blasting. Other approaches include wet and airless blasting, in which the abrasives are propelled by water and centrifugal force, respectively. General equipment used for all types of abrasive blasting includes (1) a hopper, a reservoir for the abrasive material; (2) a source of pressure (i.e., air, water, gravity) to force the abrasive from the hopper through a hose; and (3) a nozzle, held by the abrasive blaster to direct the spray of abrasive material (Figure 2). To reduce exposure to airborne silica, abrasive blasting operations may be conducted inside enclosed blasting machines and rooms, an approach commonly used by foundries. Smaller enclosed units, such as cabinets, barrels, and tables, were developed for blasting of smaller castings. Both blasting rooms and small blasting units had exhaust ventilation to control airborne exposures to the worker, and included collection systems to collect the abrasive material for recycling. As discussed in this review, these measures were not always feasible or capable of adequately reducing airborne silica exposures, thereby necessitating an additional hierarchy of dust control by using respiratory protection as a secondary line of preventing exposure to abrasive blasters (NIOSH, 1976a). It should be noted, however, that current federal regulations require that substitution, isolation, and ventilation be the principle means of controlling exposure to airborne contaminants during operations such as abrasive blasting, and that respiratory protection should not be the primary method for preventing or minimizing worker exposures (OSHA, 1998a).

Abrasive blasting can present other occupational hazards to the blaster besides exposure to airborne contaminants. Because the abrasive material is projected at high speeds, ricochet of the abrasive material can be a serious physical hazard to the abrasive blasting operator. Protective gear that is generally worn to prevent injury from the ricochet of abrasive material includes a heavy canvas,

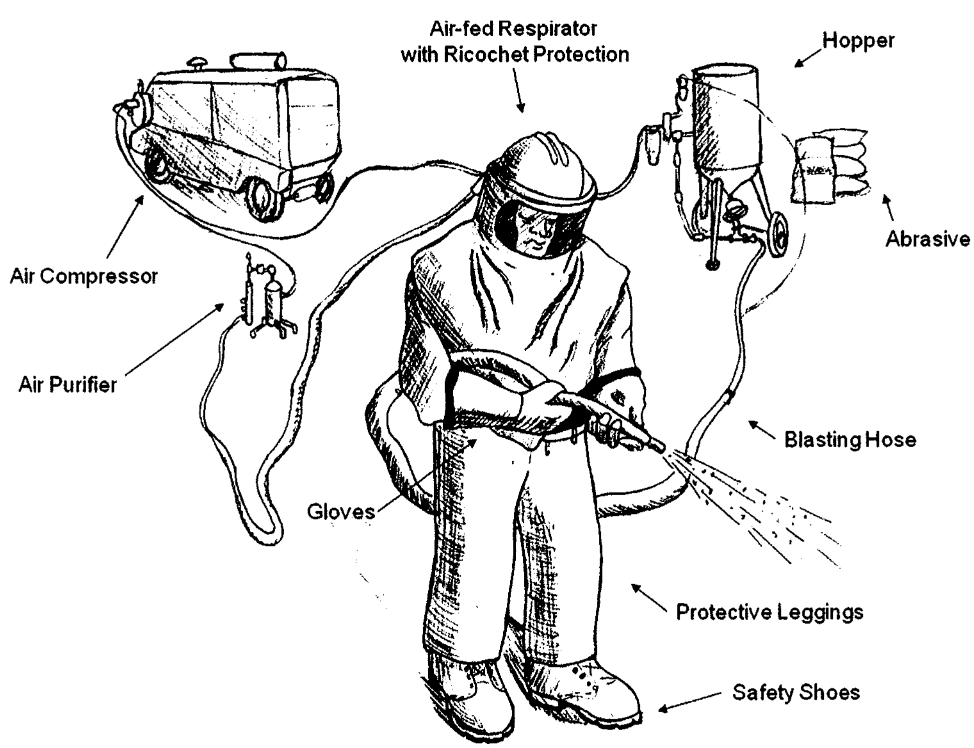


FIGURE 2. Equipment for abrasive blasting operations, including components of an appropriate personal protective equipment (PPE) ensemble.

rubber, or leather ricochet shoulder cape or shroud, with or without a helmet that is worn over the head and shoulders. In addition, an apron or protective suit, leggings, steel-toed boots, and gloves are also worn to protect the blaster (Figure 2) (American National Standards Institute [ANSI], 1968). The head, neck, and shoulders can be protected by a hood or helmet that either is placed over an airline respirator or is designed as an integrated unit, where the respirator is built into the helmet or hood. Airline respirators and air-supplied hoods require the use of air compressors or blowers to deliver an outside source of breathable air, which can produce noise levels inside the hood that may be hazardous to the blaster. Under these circumstances, hearing protection is also used by the blaster.

The fundamental basis of respiratory protection and personal protective equipment for controlling the physical and respirable hazards of abrasive blasting operations in place today was established in the 1920s and 1930s (Bloomfield & Greenburg, 1933; Greenburg & Winslow, 1932; Winslow et al., 1919, 1920). Despite the early development and use of respiratory and personal protective equipment, engineering and administrative controls and substitution of hazardous materials are the primary means of protection against dust hazards (as applied in the hierarchy of controls), a practice fundamental to historical and contemporary industrial hygiene and a requirement by current federal regulations (OSHA, 1998a). When these measures are not effective, respiratory protection is also used and environmental monitoring should be performed regularly to ensure that the Applied Protection Factor (APF) of the respiratory protection is sufficient to keep exposure levels below the permissible exposure limit (PEL) (NIOSH, 1996b).

THE EARLY YEARS (1900–1939) — ERA OF RECOGNIZING THE HAZARDS OF SILICA

Studies of Health Effects

Lung Disease in the "Dusty Trades" The relationship between exposure to dust and lung disease has long been recognized. In the first century, the Greeks described a lung disease that appeared to cause a wasting away of the body, and in Pliny's *Natural History*, devices used by refiners were described as a means of reducing dust inhalation (Mavrogordato, 1929; Lanza, 1938). By the 16th and 17th centuries, lung diseases among miners, smelters, and stone cutters were described by a number of physicians, and occasionally autopsies were performed on workers, revealing the presence of dust in the lungs (Lanza, 1938).

Around the late 1800s, the increasingly widespread use of pneumatic tools and automatic machinery, particularly in the mining and stone-cutting industries, created very dusty work environments. The dust generated by power tools and machinery was finer in consistency and greater in quantity than that created by hand tools. Because few dust-control measures were used and respiratory protection was not worn by workers, disease and mortality rates during these years were significantly higher among workers in "dusty trades" compared to other occupations (Air Hygiene Foundation of America, Inc., 1937b).

Early occupational studies generally did not distinguish among lung diseases caused by different types of dust (e.g., coal, silica, metal, asbestos), chemicals, or bacterial agents. Originally, nearly all respiratory diseases were termed "phthisis" or "consumption," which encompassed both silicosis and tuberculosis (Lanza, 1938). Some of the first reports to correlate disease prevalence with silica content were those published by the Miner's Phthisis Prevention Committee, the Miner's Phthisis Medical Bureau, and the South African Institute for Medical Research between 1903 and 1920. In their 1916 report, it was noted that 26% of approximately 3000 miners showed definite signs of silicosis, with another 5.5% considered probable cases of silicosis, as a result of working in South African gold mines with ore reportedly containing 80 to 90% quartz (Miners' Phthisis Prevention Committee, 1916; Lanza, 1938). These, as well as studies of tin miners in Cornwall and metal, quartz, slate, and sandstone miners in the United Kingdom and Australia that also documented high rates of lung disease, were among the first to provide evidence suggesting that crystalline silica was the causative agent for the lung disease (Lanza, 1938).

Recognition of Silicosis as a Distinct Disease The recognition of silicosis as a distinct disease was confounded by the fact that early medical techniques could not distinguish silicosis from tuberculosis, which was often prevalent in the same populations. During the late 1800s, microbiological methods were developed that allowed researchers to identify *Mycobacterium tuberculosis*, the causative agent of tuberculosis (Ingraham & Ingraham, 1995). Despite this advance, tuberculosis was not differentiated from silicosis in occupational studies until diagnostic techniques, such as the x-ray, were used in combination with sputum analysis. Although chest x-rays were being used frequently by the 1930s, the detection of early-stage silicosis by this method was limited, underscoring the importance of acquiring a complete occupational and medical history (Russell et al., 1929). Because the classification of silicosis by chest x-rays proved to be difficult and required that sputum collection and review be performed by experts, dyspnea, especially upon exertion, was one of the most common criterion by which the disease was identified. Respiratory function tests, sputum tests, and blood pressure monitoring were also used in the medical monitoring of workers, although these were not considered reliable indicators of silicosis (Kuechle, 1934; National Silicosis Conference, 1938c). As a result of workman's compensation acts developed during this time, preemployment and regular follow-up medical examinations were often used in industries that were shown to pose a high risk for silicosis (Russell et al., 1929; Kuechle, 1934; Lanza & Vane, 1934; Air Hygiene Foundation of America, Inc., 1937b; Kammer, 1939).

After the development of medical techniques that allowed physicians to diagnose tuberculosis infections and distinguish them from silicosis, it was reported that rates for both diseases were often increased in the same occupational groups. These observations led scientists to believe that exposure to crystalline silica increased one's risk of developing tuberculosis. In Australia, studies of quartz, slate, and sandstone miners exposed to 20–80% quartz showed tuberculosis rates significantly higher than those found in the general population. In addition, workers from the Bendigo mines, which contained 80% quartz, showed higher rates of tuberculosis than miners working in Western Australia, where the ore contained 20–45% quartz (Air Hygiene Foundation of America, Inc., 1937b). Higher rates of silicosis were also observed in industries where dust contained a high percentage of silica, including the tin mining, slate, refractory, sandstone, pottery, and coal mining industries in Great Britain, sewer workers and metal, quartz, slate, and sandstone industries in Australia (Air Hygiene Foundation of America, Inc., 1937b), and gold mines in South Africa (Miners' Phthisis Prevention Committee, 1916). The significance of this correlation was not overlooked by the scientific community. For example, in 1915, Dr. Collis noted in his Milroy Lectures to the Royal College of Physicians that several studies supported his theory that "free" crystalline silica was the causative agent in nearly all dusts that produced serious lung injury or increased susceptibility to tuberculosis (Lanza, 1938).

Case Reports and Initial Studies in the United States It was not until about 10–15 yr later that similar investigations were carried out in the United States (Figure 3). Although case reports documenting silica-related disease in mines or foundries were published as early as 1900, these reports generated little attention (Betts, 1900). Some of the first large-scale studies of silicosis in the United States were conducted by Dr. Frederick Hoffman, a statistician at the Prudential Insurance Company. Using mortality records and occupational information collected every year by Prudential, Hoffman estimated mortality rates for the general population and for workers in various trades. In 1907, he published his first compilation of records, "Mortality From Consumption in Dusty Trades," in which he noted distinct patterns of mortality from consumption among those working around dust with a marked predisposition to phthisis in industries involving hard stones, such as flint, granite, or sandstone. (Hoffman, 1908). In later studies, Dr. Hoffman's analyses focused on respiratory diseases in the "dusty trades," including occupations that involved exposure to both metallic and mineral dusts (e.g., metal mines, quarries, metal industry, iron and steel foundries) (Hoffman, 1918). In nearly all of his studies, workers employed in dusty trades exhibited higher rates of mortality or lung disease than in the general population.

It was several years after Dr. Hoffman's publications appeared that the U.S. Public Health Service (USPHS) and the U.S. Bureau of Mines (USBM) began to formally study silicosis and other lung diseases among American workers. During the first half of the 20th century, the USPHS expanded its role from monitoring the health of sailors and ship passengers to broader health issues related to sanitation and work conditions (Parascandola, 1998). Similarly, the USBM, which was created in 1910 in response to a large number of coal mine disasters, was authorized to conduct investigations

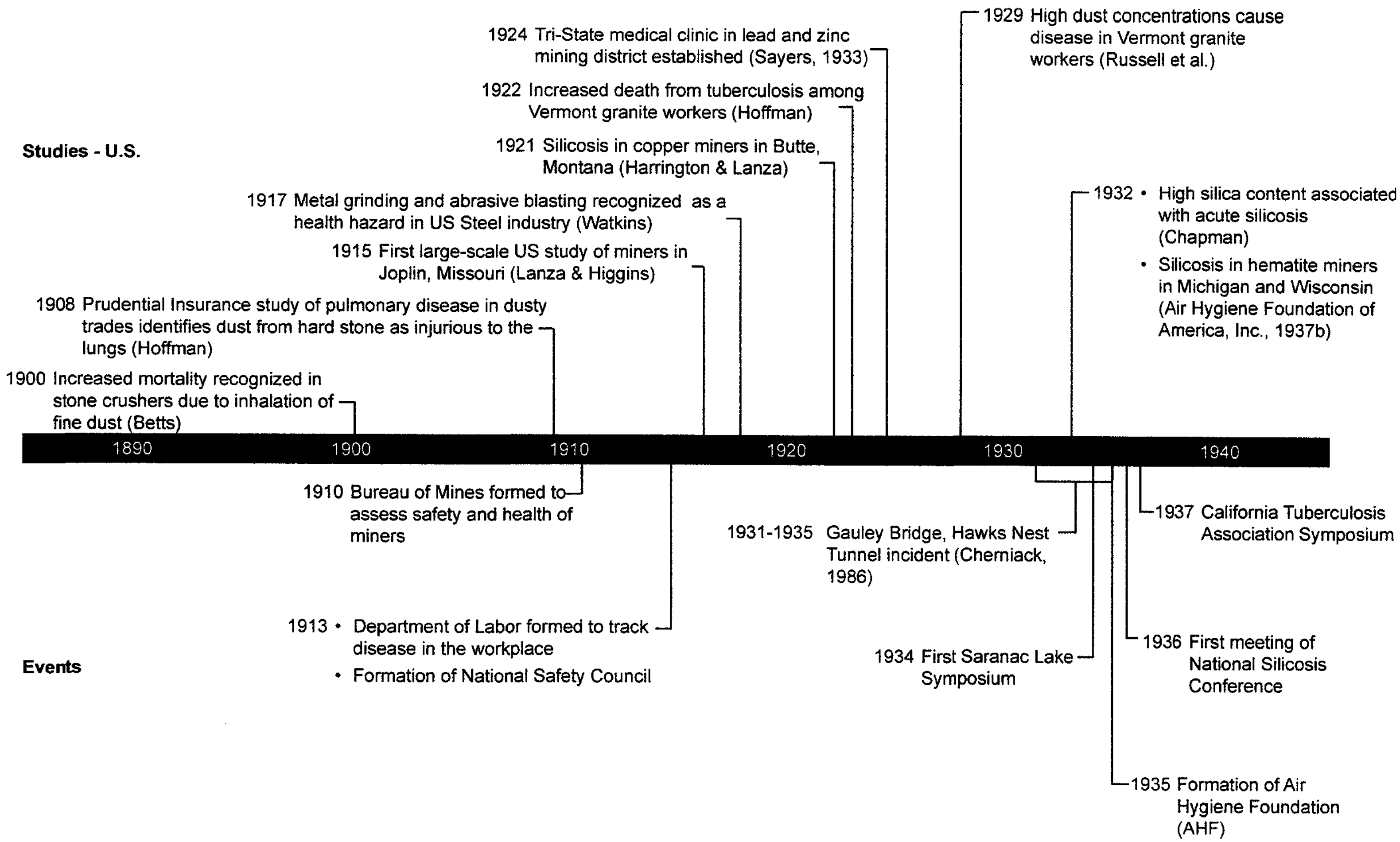


FIGURE 3. Timeline of key studies and events that led to the recognition of the hazards of silica (1900–1939).

of mine safety and health of miners (U.S. Department of Labor, 2008). As such, both agencies played major roles in many large-scale silicosis studies, often in collaboration with other research agencies, industry, and labor, to evaluate mortality, tuberculosis, and pneumoconiosis rates in hazardous operations or industries.

One of the first collaborative investigations between the USPHS and USBM involved miners in Joplin, Missouri, where a high rate of tuberculosis among miners in the area had been noted for years (Lanza & Higgins, 1915; Lanza, 1917; Higgins et al., 1917). Of the 720 workers evaluated in this study, 60.1% had silicosis or "miner's consumption" (as it was called at that time). Of the 433 men with silicosis, 103 (23.8%) also had tuberculosis. These results from the Joplin mines, which contained a high amount of quartz (70–95%), were similar to what had been observed in the South African miners (Lanza, 1917; Higgins et al., 1917).

Large-Scale Studies in the U.S. Mining Industry By 1923, mining operations had expanded due to the increasing need for energy and materials to manufacture goods. In 1924, the USBM established a clinic in the heart of the lead and zinc mining district (Missouri, Kansas, and Oklahoma) and later collaborated with the USPHS and the Metropolitan Life Insurance Company to monitor worker health (Figure 3). More than 60,000 physical examinations were conducted over a 9-yr period, during which the rate of silicosis among metal mine workers in the United States ranged from 20 to 25% (Sayers et al., 1933; Meriwether et al., 1933; Lanza, 1938). It was also noted that the effects of dust exposures could take years to manifest into clinical symptoms, and that removal from exposure did not always prevent later development of disease. Additional studies of metal miners in other states, notably in Butte, Montana, around the same time period also indicated higher rates of tuberculosis and silicosis among the miners (Harrington & Lanza, 1921; National Silicosis Conference, 1938c).

Studies of workers in the bituminous (soft coal), anthracite (hard coal), and hematite mines were among the first to provide evidence among American workers that quartz content was an important determinant of disease risk in the work environment (Brundage & Frasier, 1933). Although lung disease had been reported in nonmetal miners, the prevalence of silicosis and tuberculosis varied by location and industry. The study of the anthracite mines in Pennsylvania was a cooperative effort between the USPHS, the coal mines, the United Mine Workers of America, and the Pennsylvania Department of Labor and Industry that involved the evaluation of approximately 3000 workers (Sayers, 1935). Miners in bituminous mines, which contained low levels of quartz in the surrounding rock, did not show elevated rates of lung fibrosis or tuberculosis, whereas workers in the anthracite mines, which contained about 43% quartz, showed evidence of fibrosis in 23% of those tested (Sayers, 1935; Lanza, 1938). The importance of exposure duration was noted, in that the prevalence of tuberculosis in anthracite workers under the age of 35 was approximately the same as the general population, but about 10-fold higher in workers over the age of 55. It was also reported in this study that the highest rates of disease were observed in rock drillers (Sayers, 1935).

Similar findings were reported by Saranac Laboratories in a study of hematite miners in northern Michigan and Wisconsin that showed that miners who had worked in areas where the rock contained silica developed fibrosis following periods greater than 20 yr of exposure, on average, whereas workers exposed to ore bodies containing little silica for as long as 30 yr of exposure rarely developed nodular fibrosis (Air Hygiene Foundation of America, Inc., 1937b). Taken together, studies conducted in the coal and iron mines indicated that the health hazards experienced by miners were proportional to the amount of silica in the rock being mined. In fact, many of the initial studies, which reported conflicting rates of disease, actually reflected the fact the dust in some mines had higher concentrations of silica than others. It was also apparent from these mining studies that certain operations (i.e., drilling) posed a greater hazard to workers due to the high airborne dust concentrations created during these activities (Lawson et al., 1931; Air Hygiene Foundation of America, Inc., 1937b).

Large-Scale Studies in the U.S. Granite Industry Perhaps some of the most influential early studies were those concerning New England's granite industry (Figure 3). These studies solidified the understanding that not only silica content was important in the development of lung disease, but, also that the intensity and duration of exposure to silica were significant factors. Both the

USPHS and Dr. Fredrick Hoffman conducted separate analyses of granite workers in New England. During the period 1915–1918, the death rate from tuberculosis among the general population in Massachusetts averaged 203.2 per 100,000, whereas the rate for granite workers during the same period was 1056.7 per 100,000. It was further noted that the death rates among stone cutters, who used pneumatic tools, were the highest of all the workers investigated. Additionally, the rate of tuberculosis among the granite workers had increased while tuberculosis rates decreased in the general population (Hoffman, 1922). Dr. Hoffman concluded that the hazardous nature of the dust was directly related to the silica content of dust inhaled.

The USPHS also evaluated the largest granite-cutting center in the United States, in Barre, Vermont. Approximately 1000 granite workers, including stone cutters, carvers, polishers and blasters, were included in a morbidity study, with half involving physical examinations (Russell et al., 1929). This evaluation was one of the most comprehensive studies of its time concerning the exposure-response relationship between airborne silica concentrations and prevalence of silicosis. Findings from this study ultimately served as the basis for the first OELs for silica, which remained in place for decades. Exposures of granite workers to silica were assessed by collecting airborne dust samples and conducting medical surveys using physical exams and chest x-rays to track the health status of workers. After accounting for the employment duration, the results showed a consistent dose-response pattern. Four exposure groups (average plant dustiness of approximately 60, 27–44, 20, and 3–9 million particles per cubic foot [mppcf], respectively) were identified, and the highest prevalence of silicosis (nearly 100% of workers) was observed in the highest exposure groups with 9 yr of service. For example, the majority (90%) of pneumatic tool operators working for 9 yr in an environment containing 60 mppcf of dust had advanced silicosis, whereas only 3 cases of early silicosis were identified in the lowest exposure group among workers with up to 10 yr of employment. Based on the findings of this study, the authors suggested in 1929 that the "safe" limit of dustiness for work with granite dust containing around 35% free silica was somewhere between 9 and 20 mppcf (Russell et al., 1929).

Large-Scale Studies in the Foundries A number of large-scale studies were conducted throughout the 1920s and 1930s in which the incidence of silicosis and other respiratory diseases in 10 to 30 different foundries across several U.S. states was evaluated (Figure 3) (McConnell & Fehnel, 1934; Sander, 1938). This approach allowed for characterization of the industry as a whole, even though conditions varied substantially among foundries depending on industrial practices and the size of the operation. An increased incidence of silicosis was reported among foundry workers (Sander, 1938; McLaughlin et al., 1950). It was also noted in several studies that foundry workers had higher rates of lung disease, in particular pneumonia (Dublin, 1917; McConnell & Fehnel, 1934).

Many of the studies conducted through the 1930s identified mold and core making, shake-out, fettling, cleaning and finishing, and, in particular, abrasive blasting as operations that presented the greatest potential for silica exposure and disease (Sander, 1938; McLaughlin et al., 1950). Local exhaust ventilation and other engineering controls were installed in many facilities, consistent with what was considered to be the hierarchy of control by industrial hygienists (Raterman, 1996, Soule, 2000). If engineering controls were not feasible or were not sufficiently effective, then an industrial hygienist might also implement administrative controls. If both of these control measures failed to reduce exposure to a safe level, the use of respiratory protection, which became more widespread around this time, would also be implemented (Colton & Nelson, 1997; Soule, 2000).

Experimental Animal Studies During the 1920s and 1930s, much of the experimental research related to silica was conducted at the Saranac Lake Laboratory (Figure 4) (Gardner, 1932, 1938a). Many of the findings from these studies were shared in a series of symposia known as the "Saranac Lake Symposia" at the Trudeau School of Tuberculosis (Kuechle, 1934), the proceedings of which were published in medical and industrial hygiene journals. In the late 1920s, studies demonstrated that leukocytes were important for removing bacteria and particles from the lungs, and that exposure to silica somehow depressed the function of these cells (Mavrogordato, 1929). It was later discovered that silica was directly toxic to macrophages, which were the primary immune cell type responsible for clearing bacteria from the lungs. Silica toxicity to these cells resulted in an increased susceptibility to tuberculosis infection. Gardner demonstrated that animals exposed to

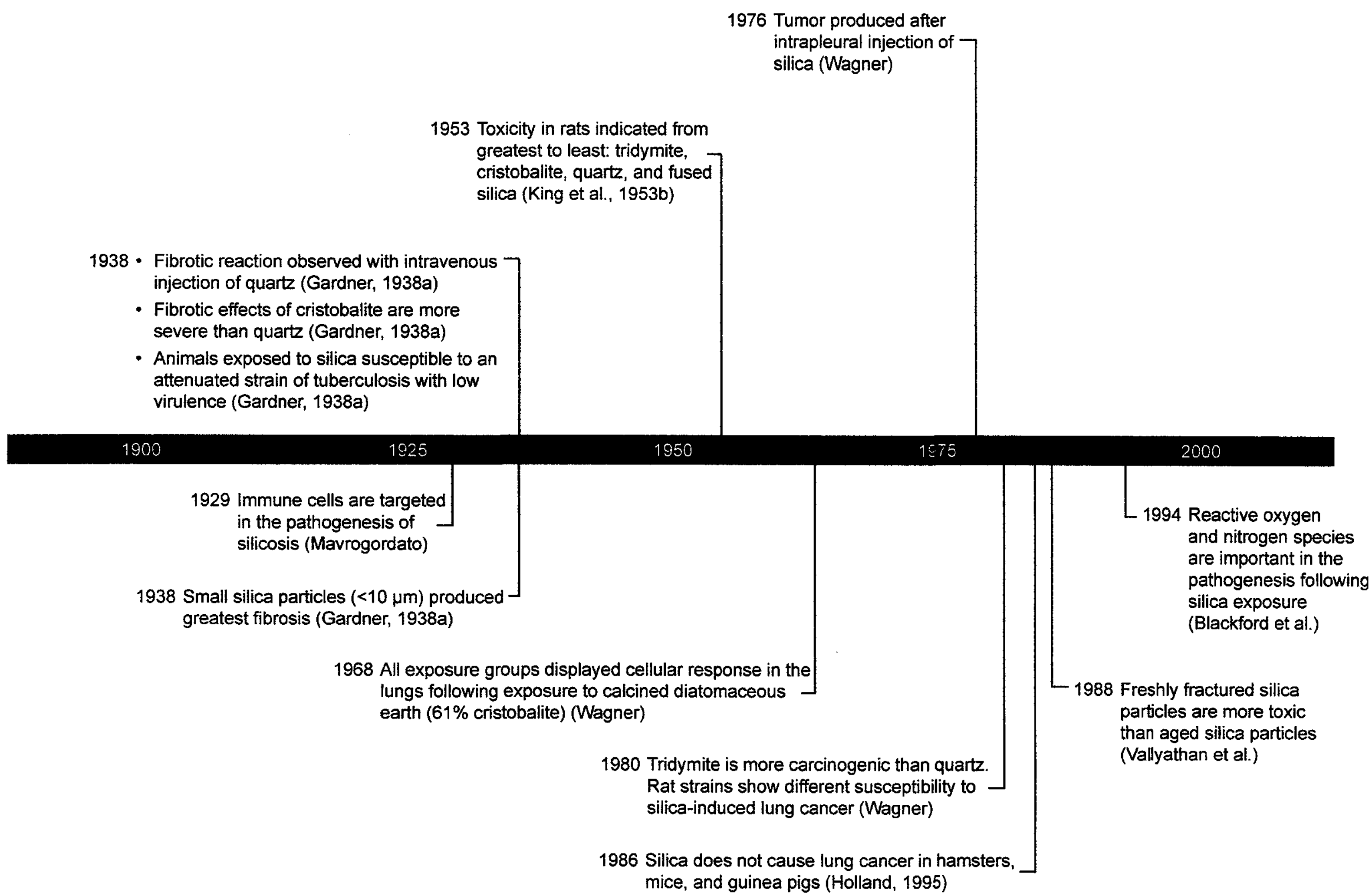


FIGURE 4. Timeline of key animal studies that contributed to the recognition of the hazards of silica (1900–2008).

silica succumbed to infection by an attenuated strain of tuberculosis with low virulence, whereas unexposed animals failed to develop infection (Air Hygiene Foundation of America, Inc.,1937b).

In the late 1930s, Dr. Leroy Gardner was the first to report that different forms of silica caused varying degrees of fibrosis and that the rate and extent of tissue reaction was inversely proportional to particle size, with silica particles greater than 10 μm not producing appreciable reactions (Air Hygiene Foundation of America, Inc.,1937b; Gardner, 1938b). To address the influence of crystalline silica content on fibrogenicity, a number of animal experiments were conducted by administering dusts with varying silica concentrations to guinea pigs. Results showed a dose-response relationship between the concentration and duration for quartz exposure and the extent and rate of onset of fibrosis. While most of these animal studies were conducted by intravenous injection of different silica suspensions, some inhalation studies of crystalline silica in guinea pigs and rabbits reported nodular fibrosis analogous to silicotic lesions in humans (Gardner, 1932). It was also shown that tuberculosis infection prior to exposure to silica dust resulted in exacerbated pulmonary lesions compared to animals with infection or dust exposure alone (Air Hygiene Foundation of America, Inc., 1937b). Collectively, these studies indicated that silica content was important not only for determining the severity and rate of onset of fibrosis, but also for assessing susceptibility to tuberculosis infection.

Occupational Exposure Limits for Silica

Hawk's Nest Incident Prompts Improvement of Occupational Conditions Research conducted through the 1930s revealed the enormity of the silicosis problem in American industry. One of the underlying themes of this work was defining a "safe" level of dust exposure. For many scientists and public health agencies, this goal continued to drive additional research. However, a pivotal event occurred in 1935 that led to an even greater effort to understand the hazards of silica and derive an occupational exposure limit that would protect workers. Even today, it remains one of the greatest industrial disasters involving silica: the Hawk's Nest incident (also referred to as "Gauley Bridge") (Cherniack, 1986). It occurred near Gauley, West Virginia, where thousands of workers were exposed to extremely high levels of silica while drilling a tunnel. Not only was the rock itself nearly pure quartz, but many of the workers drilling in the rock did not use respiratory protection. While an exact death toll from silicosis was never reported, estimates ranged from hundreds to several thousand; however, most reports approximated the number to be around 700 workers (Lucas & Paxton, 2005; Cherniack, 1986). This event was highly publicized and silicosis became an important national health issue.

In the year or two following Hawk's Nest/Gauley Bridge, there was considerable activity on the part of industry and Congress to address silica as an occupational health hazard. Shortly thereafter, the Air Hygiene Foundation (AHF), an industry-based group of industrial hygienists, physicians, and scientists, was formed and held their first meeting, which was devoted to silicosis and finding ways to reduce dust exposures in the workplace (Air Hygiene Foundation of America, Inc., 1937a, 1937b). Around the same time, in 1936, Congressional hearings were held in response to Gauley Bridge. The inquiry ultimately prompted the convening of the National Silicosis Conference, during which labor, health, and industry organizations met to discuss the impact of silicosis in American industry. The hearings and the conference were widely covered in the popular press. The conference convened on April 14, 1936, and was attended by several hundred individuals, representing labor, industry, the public, insurance carriers, and prominent members of the medical, engineering, and legal professions (National Silicosis Conference, 1937). Four committees of experts (medical, engineering, economic/legal/insurance, and regulatory/administrative) were appointed to carry out detailed investigations and to make recommendations for control of the silicosis problem. Meetings were held throughout 1936, and in 1937, the committees jointly presented summary reports of their findings (National Silicosis Conference, 1937, 1938a, 1938b, 1938c, 1938d). At the time, it was estimated that around 1,000,000 U.S. workers were exposed to silica, of which approximately 110,000 had some stage of silicosis (National Silicosis Conference, 1937). Hence, the designation of an OEL was a predominant topic at the meeting, and the occupational studies upon which the first recommendations would be based were presented and discussed.

Establishing the First Occupational Exposure Limits The first recommendations for an OEL in United States were based on studies of granite workers in Barre, Vermont, as well as those of the anthracite mines in Pennsylvania and gold mines in Ontario (Table 2). The 1924–1926 survey of the granite industry revealed little or no disease among workers who were exposed to 9–20 mppcf of dust (particles less than 10 μm) (Russell et al., 1929). Quartz content in the granite dust was estimated to be approximately 35%. In a reexamination of the same worker population in 1941, it was again concluded that concentrations between 9 and 20 mppcf for dusts containing 25–35% quartz were observed to not cause harmful effects. It was therefore recommended that a maximum dust exposure of about 10 mppcf for dust making occupations involving 25–30% free silica in the form of quartz, was a desirable occupational limit. (Russell, 1941). Additional studies conducted around the same time period in the Pennsylvania anthracite mines and the Ontario gold mines, which had quartz content similar to that of the granite dust, provided further support for the recommendations

TABLE 2. Occupational Exposure Limits for Silica (Quartz), 1900–2008

	Year	Organization	Recommended OEL (particle size)
1900–1939			
	1929	USPHS (Vermont Granite Industry)	9–20 mppcf [a] (<10μm)
	1934	Saranac Lake Symposium	5 mppcf [b]
	1936	DOL (National Silicosis Conference)	5 mppcf [c]
	1937	AHF	5 mppcf [d]
	1938	NBS	50 mppcf [e]
1940–1969			
	1946	ACGIH	For dusts containing x percentage of free silica [f] x = <5% → 50 mppcf x = 5 – 50% → 20 mppcf x = >50% → 5 mppcf
	1966	ACGIH	250 / (% quartz + 5) mppcf [g]
1970–1989			
	1971	ACGIH	10 / (% quartz + 2) mg/m^3 [h,l]
	1971	OSHA	10 / (% quartz + 2) mg/m^3 (PEL) [i,j,l]
	1975	NIOSH	0.05 mg/m^3 (REL)[k,l,m]
	1983	ACGIH	0.1 mg/m^3[l]
	1986	ASTM	0.1 mg/m^3[l]
	1986	WHO	0.04 mg/m^3[k,l]
1990–2006			
	2000	ACGIH	0.05 mg/m^3, suspected human carcinogen[l]
	2006	ACGIH	0.025 mg/m^3, suspected human carcinogen[l]

Note: USPHS-U.S. Public Health Service, DOL - Department of Labor, AHF - Air Hygiene Foundation, NBS - National Bureau of Standards, ACGIH - American Conference of Governmental Industrial Hygienists, OSHA - Occupational Safety and Health Administration, NIOSH - National Institute for Occupational Safety and Health, ASTM - American Society for Testing and Materials, WHO - World Health Organization.

[a]*Millions of particles per cubic feet for granite containing 35–70% quartz.*

[b]*Represents a "primary" threshold for working in environment of 100% quartz.*

[c]*Considered safe for dust concentration containing a high percentage of free silica.*

[d]*Stated that concentrations above this limit were dangerous.*

[e]*Limit of exposure to mineral dusts for workers (total dust concentration).*

[f]*ACGIH recommendations called MAC (Maximum Allowable Concentrations) until 1956 when TLV Threshold Limit Value) was substituted. The documentation of TLVs for silica is based on analysis of particles 0.5 – 5μm in size.*

[g]*Adopted by the U.S. Department of Labor under the Walsh-Healey Public Contracts Act.*

[h]*Ayer et al., 1969 found gravimetric method to be consistent with the particle count method; the exposure limit of 9–10 mppcf was equivalent to 0.1 mg/m^3.*

[i]*Permissible Exposure Limit, remains as current value today.*

[j]*Time-Weighted Average, averaged over an 8 hour shift.*

[k]*Recommended Exposure Limit, remains as current recommendation today.*

[l]*Occupational exposure limit for respirable dust.*

[m]*OSHA PEL can also be calculated for mppcf using the same equation as noted for the 1966 ACGIH TLV.*

set forth at the National Silicosis Conference (National Silicosis Conference, 1938c; Sayers, 1935). International studies of workers exposed to dust containing upward of 80% quartz were also considered in the initial discussions of appropriate OELs (National Silicosis Conference, 1938c). Based on the prevalence of silicosis observed in Australian and South African workers, exposure limits from 3 to 6 mppcf were viewed as consistent with the experience of the Barre granite workers.

Based on the understanding that there was increased disease risk in environments with higher quartz concentrations, early recommendations of OELs took into consideration % of quartz in dusts (National Silicosis Conference, 1937). At the Saranac Lake Symposium on silicosis in 1934, it was stated that the current research suggested that exposure to pure crystalline silica at a concentration of 5 mppcf or less would not produce physical impairment to workers within 5 yr, but after that time, "demonstrable" silicosis could appear, depending on exposure levels and individual susceptibilities (Kuechle, 1934). It was emphasized that OELs could be modified for various industries to account for differing concentrations of silica in the dust, or for the presence of "mixed" dusts (e.g., coal). The 1937 National Silicosis Conference echoed the recommendations of the Saranac Lake Conference of a safe limit of 5 mppcf for dusts with a high % of silica, and the reports provided a discussion of how to calculate an exposure limit by multiplying the percentage of quartz by the total particle count of the dust (National Silicosis Conference, 1938c). This recommendation was reiterated at the 1937 Symposium on Silicosis at the Annual Meeting of the California Tuberculosis Association (Sayers, 1937).

The U.S. government provided similar recommendations in 1938 in the Department of Commerce National Bureau of Standards publication "American Standard Safety Code for the Protection of Heads, Eyes and Respiratory Organs." This issue stated that workers should not be exposed to silica-containing dusts greater than "the limit of tolerance" for granite dust that contained 35% quartz; for dusts containing 75% to 100% quartz, it was noted that workers should be exposed to less than this limit (National Bureau of Standards, 1938). The limits themselves were not stated explicitly; however, the purpose of this book was to provide standards regarding personal protective equipment and engineering controls, which the scientific community addressed as key to limiting exposures. A government standard for occupational exposure to quartz would not be established for another 30 yr; in the meantime, industry relied on the USPHS reports and the emerging field of industrial hygiene for expertise and knowledge in how to best protect workers.

By the mid-1930s, it was generally accepted by the scientific community that particles less than 10 μm were the cause of most occupational lung disease in the dusty trades. It was also recognized that the majority of particles in a sample taken from the dusty trades were less than 3 μm in size and the capacity of particles of this size to cause disease was duly noted in animal studies (National Silicosis Conference, 1937; Kuechle, 1934). Therefore, the recommendations for an OEL took into consideration particles less than 10 μm in size. Several methods were available for both sampling and analysis, and it was evident that certain methods were more useful than others and should be chosen based on the environment and sampling objective (National Silicosis Conference, 1938b). In South Africa, the tool predominantly used for sampling was the konimeter.[1] However, it was not efficient for sampling in conditions with a dust content above 35 mppcf, and the sample could not be analyzed chemically or gravimetrically (National Silicosis Conference, 1938b; Bloomfield & Dalla Valle, 1935).

The impinger method proved to be the most efficient and most common sampling method used during the 1920s and 1930s in the United States. Introduced in 1922 by Greenburg and Smith, the impinger was a small device that was used to draw air through a liquid, which would trap the particles for analysis[2] (Drinker & Hatch, 1954). Early studies based on impinger sampling noted that particle counts were highly variable from one operator to the next, and that, overall, the method was labor intensive. However, due to the ease of measuring the particles captured in a fluid, the impinger method remained the most commonly used method of measuring dust concen-

[1]With the konimeter, dust samples were collected via the use of a spring-activated pump and deposited on a plate covered with a film of petroleum or glycerin jelly; particles were then counted under the microscope.

[2]An aliquot from the liquid was taken to count the particles under ligh-field microscopy with 10× magnification. Light-field microscopy enabled the counting of particles as small as 1 μm (Drinker & Hatch, 1954).

trations for decades (Drinker & Hatch, 1954; Institution of Mining Engineers, 1947). Although variable, a correlation was noted in the literature between dust levels measured by impinger in mines and the implementation of engineering controls, in addition to decreases in the prevalence of silicosis among workers (Institution of Mining Engineers, 1947; NIOSH, 1974).

Abrasive Blasting Studies and Developments in Industry

One of the earliest studies specific to abrasive blasting was conducted in 1920 by Dr. C. E. A. Winslow at a large automobile factory in Connecticut (Table 3 and Figure 5). This evaluation was a follow up of a previous study by the same author in the abrasive manufacturing industry, in which engineering controls, such as confinement of dust-producing work to enclosed spaces and the use of exhaust fans or hoods, were evaluated (Winslow et al., 1919). One conclusion of this earlier study was that the exhaust systems were incapable of reducing dust concentrations to a level that would not induce disease. Thus, the 1920 study addressed various engineering controls and the feasibility of requiring air-supplied helmets and respirators to protect workers during blasting (Winslow et al., 1920). Dust concentrations during abrasive blasting were found to be high (Table 3), and the efficacy of various combinations of a respirator (described as an ordinary "muzzle" type with a rubber body fitting over the nose and mouth, an air filter composed of two layers of muslin, and a piece of sponge fitted with an air outlet valve) and helmet (made of cloth-covered cardboard with an inlet tube on top for fresh-air supply) was evaluated. It was reported that respirator use improved worker protection, but that the supply of positive-pressure air to the face mask afforded the greatest protection (Winslow et al., 1920). These results were consistent with a later study carried out by the USPHS in the granite industry, where the efficacies of positive-pressure air supply helmets were evaluated (Table 3) (Russell et al., 1929; Bloomfield, 1929). Between 1929 and 1931, J. J. Bloomfield and Leonard Greenburg of the USPHS, in cooperation with the National Safety Council (NSC), surveyed plants across the United States—primarily foundries—with abrasive blasting operations and evaluated the efficacy of protective equipment in abrasive blasting rooms (positive-pressure air-supplied helmet, respirator and non-air-supplied helmet, and helmets only without separate air supply).[3] (Table 3) (Bloomfield & Greenburg, 1933). The results were very similar to what was observed nearly a decade earlier by Winslow et al. (1920): the use of an air-supplied helmet significantly reduced dust concentrations relative to the other combinations of protective equipment. It was noted by Bloomfield and Greenburg (1933) that dust concentrations in foundries were high, and that the use of positive-pressure air-supply respiratory devices was often the primary means of adequately protecting workers.

An additional study deserving mention was conducted by E. R. A. Merewether in the early 1930s in the sandblasting industry in England (Merewether, 1936). This study reported that the duration of employment of abrasive blasters who died from silicosis was much shorter than that of other trades known to involve high silica exposure (10.3 vs. 40.1 yr, respectively), and that abrasive blasters experienced higher rates of silicosis and silicosis with tuberculosis. In his discussion, Dr. Merewether noted that the severity of silica exposures during abrasive blasting could be due to the creation of extremely fine particles as the abrasive material came into contact with the object being blasted. His report also indicated that the only adequate protection for an abrasive blaster was the use of a helmet with a positive fresh-air supply.

Respiratory Protection Guidelines for Abrasive Blasting

Recommendations for Engineering Controls in Dusty Operations After it became clear to the scientific community and to industry that abrasive blasting operations were among the most hazardous work practices involving crystalline silica, the focus shifted to developing engineering controls to reduce exposures in the workplace. Many of the recommendations during this time period focused on making major changes to plant facilities, such as installing ventilation systems or building separate blast rooms or cabinets. For example, the foundry industry developed ways to

[3]A survey of abrasive blasting equipment manufacturers revealed that approximately two-thirds of plants used sand as an abrasive material (metal shot was the most commonly used alternative).

TABLE 3. Historical Abrasive Blasting Studies: Reported Exposure Levels Measured During the Use of Different Forms of Respiratory Protection

Study (year)	Industry	Measurement Technique	Ambient Dust (mppcf)	Respiratory Protection	Average Dust (mppcf) under PPE	Conclusions
Winslow et al (1920)	Auto parts factory	Palmer water-spray apparatus	60.9	Respirator only	4.5	Combination of respirator and helmet with positive pressure provided greatest protection
				Helmet + respirator (no air-supply)	2.4	
				Helmet with positive-pressure only	0.37	
				Helmet with positive-pressure + respirator	0.15	
Russell et al (1929)	Granite	Greenburg-Smith impinger	157.1	Helmet + no air-supply	11.7	Use of positive air supplied hoods provides a greater advantage to the abrasive blaster
				Helmet + positive-pressure	1.9	
Greenburg and Winslow (1932)*	Abrasive blasting operations	Greenburg-Smith impinger	2392	Helmet + respirator (no air-supply)	1912	Combination of respirator and helmet with positive pressure provided greatest protection
				Helmet + positive-pressure	25	
Bloomfield and Greenburg (1933)*	Abrasive blasting operations (mostly foundries)	Greenburg-Smith impinger	2000	Helmet	1317	Combination of respirator and helmet with positive pressure provided greatest protection
				Helmet + positive-air supply	25	

Note: Ambient dust (mppcf) represents concentrations inside abrasive blasting room during abrasive blasting operations.
*Values reported for operations associated with maximum ambient dust concentrations.

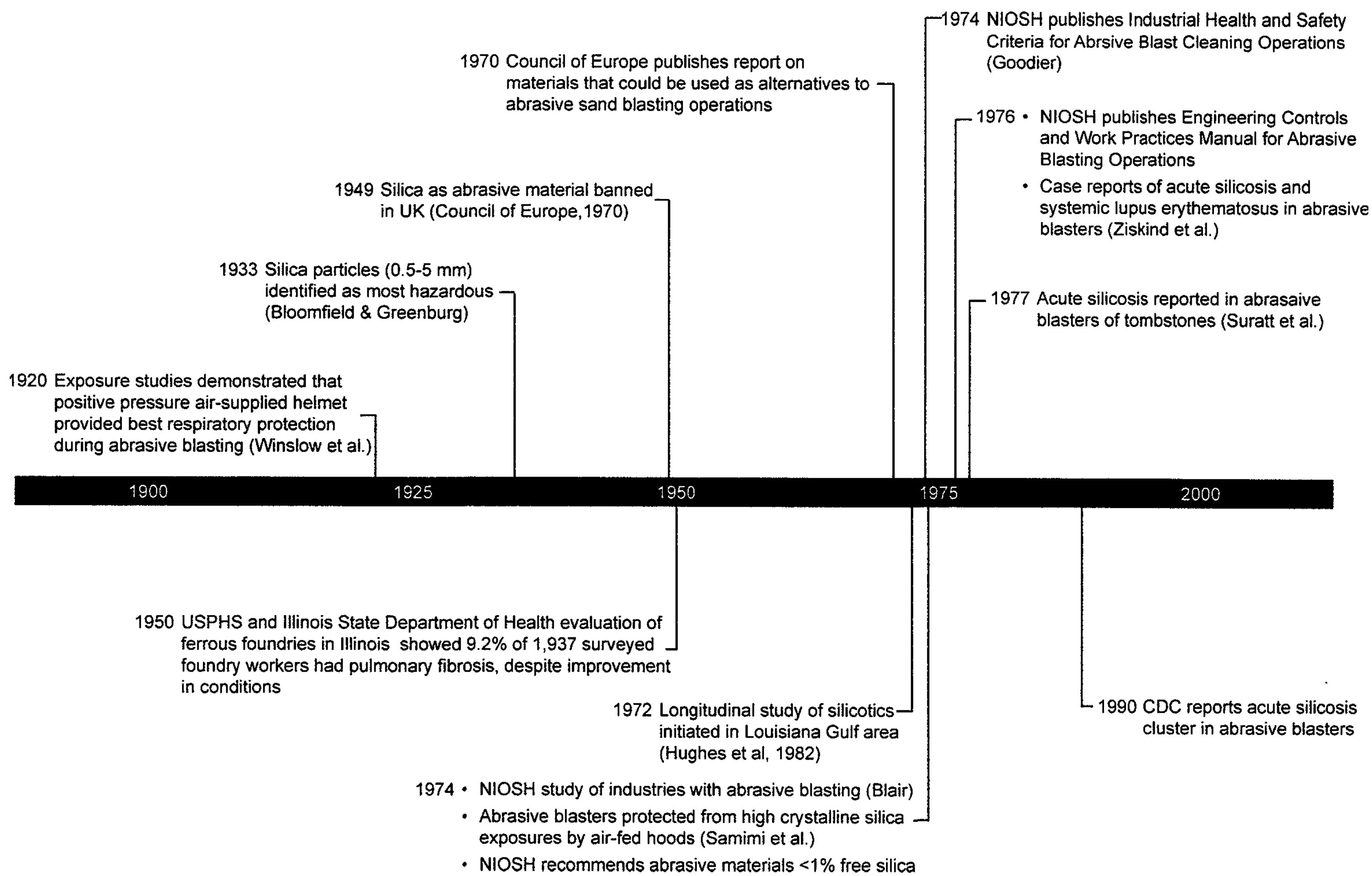


FIGURE 5. Timeline of key events and studies related to abrasive blasting (1900–2008).

isolate abrasive blasting operations, including enclosed blasting machines and rooms devoted to these operations (NIOSH, 1976a). Smaller enclosed units, such as cabinets, barrels, and tables, were developed for blasting of smaller casting. Both blasting rooms and small blasting units were developed with exhaust ventilation to control airborne exposures to the worker, and with a collection system to collect the abrasive material for recycling. In 1937, engineering controls (e.g., use of wet methods and ventilation controls) and good housekeeping practices were recommended for reducing dust exposures by the Committee on the Prevention of Silicosis through Engineering Control, which was formed out of the National Silicosis Conference. The committee also noted that, when these dust suppression and control methods were ineffective at reducing dust levels, respiratory protection for workers was essential (National Silicosis Conference, 1938b).

Implementing effective engineering controls to reduce silica exposure often represented a major cost or effort for small employers, and compliance with these recommendations varied considerably throughout industry during this time period. It was often acknowledged in studies and reports that it was nearly impossible to control dust concentrations to an acceptable level during some foundry operations. As a result, many employers imposed restrictions on the amount of time that workers spent doing the most hazardous jobs. It was not an uncommon practice to restrict workers to abrasive blasting for shorter time periods or to require that they divide their time equally between the positions of blaster or pot tender (i.e., maintaining the hopper during abrasive blasting). However, while it was believed that reducing the amount of time employees worked in dusty conditions would lower their overall lifetime exposure, high short-term exposures could still pose a health hazard. Thus, as the last step in the hierarchy of controls, research focused on developing and using respiratory protection in addition to other controls to ensure worker protection in some of the most hazardous operations, including abrasive blasting.

Earliest Recommendations for Respiratory Protection during Abrasive Blasting When the United States entered World War I in 1917, the threat of chemical warfare increased the demand for American-made respirators; with this demand came a need to ensure that the respirators were providing the protection that they claimed. The USBM published the first requirements for respirator approval in 1919, Schedules 13 and 14, which were specifically established for self-contained breathing apparatus (SCBA) and gas masks, respectively (Held, 1977). Through these schedules, respirator manufacturers could send their product to the USBM for testing and approval. In 1932, in response to the growing awareness of occupational illnesses, the USBM expanded its respirator approval schedules to include Schedule 19 for supplied-air respirators (as would be used for abrasive blasting) (U.S. Bureau of Mines, 1937). The respirator approval schedule was again expanded in 1934 to include dust, mist, and fume respirators (Schedule 21), and a few years later, in 1944, it published Schedule 23 for chemical cartridge respirators (Held, 1977).

While much of the equipment for abrasive blasting was the same across different industries, the means of controlling airborne dust through engineering controls and personal protective equipment often differed. Prior to the 1920s, there were no federal regulations for respiratory protection for abrasive blasting operations in the workplace (Figure 6). Foundries were the first to implement engineering controls and methods of respiratory protection during abrasive blasting. In 1916, the American Foundrymen's Association (AFA) published safety codes for respiratory protection in foundries. The code stated that "Sand-blasting by hand-operating apparatus shall be carried on in suitable sand-blast rooms. Sand or shot blast operatives shall be provided with suitable helmets or masks, respirators, approved safety googles, gloves and leggings." (American Foundrymen's Association, 1916).

In 1923, the first U.S. governmental safety code was published by the Department of Labor (DOL) Bureau of Labor Statistics for foundry workers, which recommended that appropriate helmets or hoods should be provided by the employer to workers engaged in abrasive blasting operations (U.S. Bureau of Labor Statistics, 1923). The AFA and DOL recommendations were derived from many of the early studies on exposure and control of silica during abrasive blasting in foundries. Specifically, Winslow et al. (1920) recommended specifications for appropriate air-supply volumes and length of tubing for the air supply, although it was acknowledged that in environments where the worker would be mobile over large areas, an air-line system delivering positive pressure might not be feasible. A later study conducted by Bloomfield and Greenburg (1933) determined the

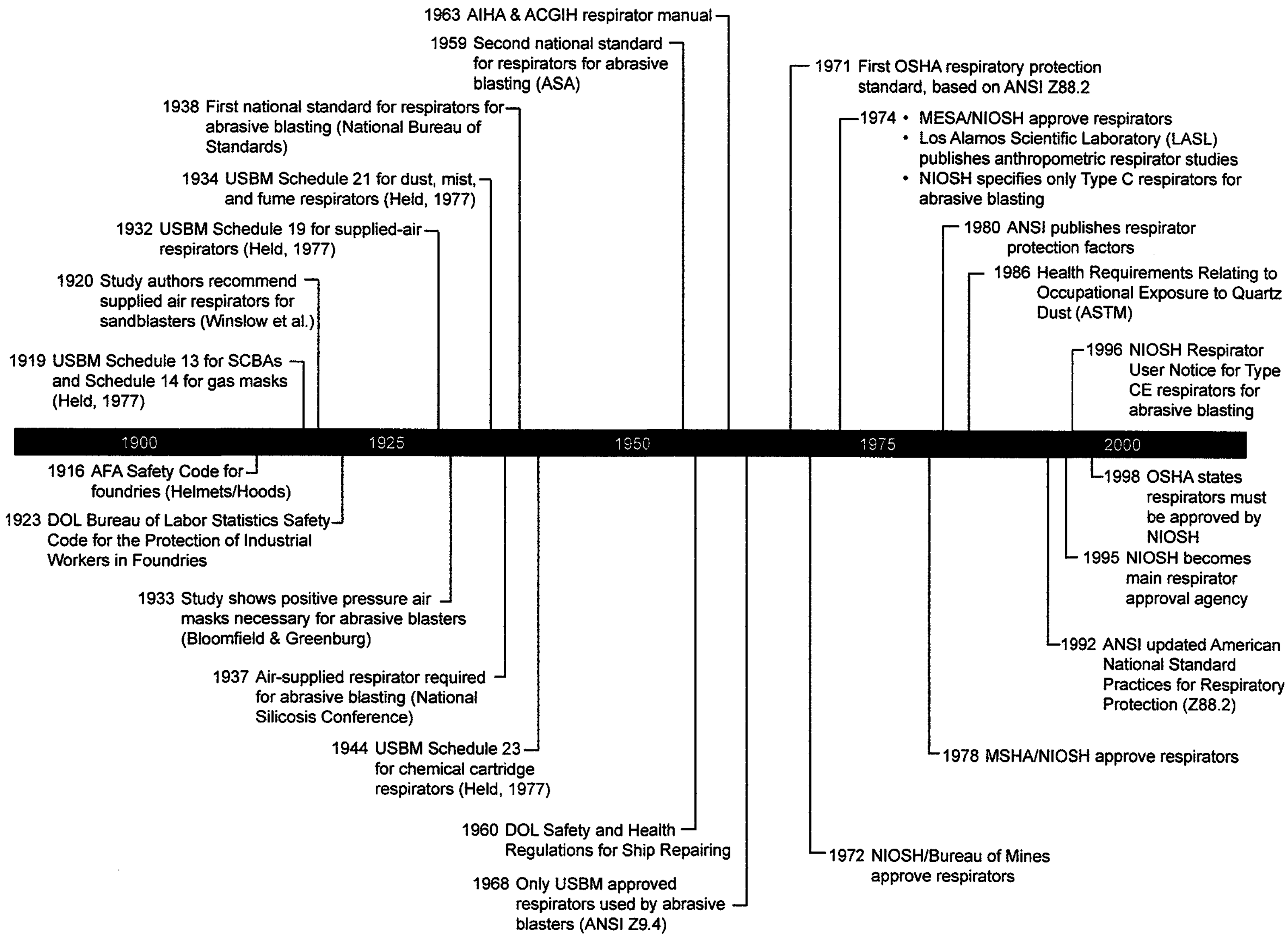


FIGURE 6. Timeline of recommendations and regulations of respiratory requirements and engineering controls for abrasive blasting (1900–2008).

optimal rate of supplied air, six cubic feet per minute, that was most effective in reducing dust levels in the breathing zone of the worker; it was eventually incorporated in the USBM criteria for effective operation of air-supplied respirators (US Bureau of Mines, 1937). These findings were also incorporated in recommendations made by the AFA in 1935 that all helmets were to be supplied with positive-pressure air flow wherever the concentration of dust was thought to be a health hazard (American Foundrymen's Association, 1935).

Positive-pressure respiratory devices were officially deemed by the USBM Schedule 19, in which, supplied-air respirators are categorized as follows: Type A—hose mask with blower; Type B—hose mask without blower; Type C—air-line respirator (to be used in conjunction with a pressurized air system). Additional categories were also defined for supplied-air respirators that could be modified with protective covering for the head and neck for use in abrasive blasting. These modified respirators were referred to as Type AE, BE, and CE, where the letter "E" designation indicated that the respirator had been altered to provide physical protection during abrasive blasting operations (Leitch, 1935).

The research on respiratory protection was incorporated into discussions at the national level during the Second National Silicosis Conference of 1937 (National Silicosis Conference, 1937). In the final report of the Committee on the Prevention of Silicosis through Engineering Control, an abrasive blasting respirator was defined as an air-supplied device or respirator with a covering for the head, neck, and shoulders, designed to protect against rebounding particles. Either a hood with an air-supplied respirator or a helmet with a continuous flow of supplied air was stated to be sufficient for this purpose (National Silicosis Conference, 1938b).

THE MIDDLE YEARS (1940–1969)—ERA OF DEVELOPING WORKPLACE CONTROLS

Studies of Health Effects

By the 1950s, continuing worker compensation claims for silicosis demonstrated that it was still a significant industrial problem in the United States (Doyle et al., 1958). Based on compilations of available data from 1950 to 1955, the USPHS was able to collect information on 12,763 cases of silicosis that had been identified during that 6-yr period (Trasko, 1958). These figures were obtained from x-ray examinations, physician reports, and death records of workers in dusty trades, and it was believed that the true number of silicosis cases were grossly underestimated due to incomplete data and lack of reporting.[4] Two-thirds of the cases were associated with mining industries (i.e., metal, and nonmetallic mining and quarrying). The remaining cases were from manufacturing industries, including foundries, pottery, stone, silica-brick, tile, clay, and glass industries. Most notable, however, was the finding that silicosis was diagnosed in workers who began employment after the mid-1930s, when the majority of dust controls were implemented across most industries.

Reevaluation of the Metal Mining Industry In December of 1956, Congress appropriated funds to the USPHS and the USBM to reevaluate the exposure and health status of workers in the metal mining industry. A direct outcome of this funding was a large-scale environmental and medical survey that was conducted in 1958–1961 in 67 underground mines employing approximately 20,500 persons, which represented over 50% of the U.S. work force within this industry (Flinn et al., 1963). Methods used to reduce airborne dust at the time included the application of water during dusty operations (i.e., drilling, blasting), restriction of dusty operations to certain times of the day, implementation of local and general exhaust ventilation, and use of respiratory protection (i.e., filter-type, air-line). The USPHS and USBM investigations showed that, while dust levels were

[4]In 1949, the International Labor Office (ILO) published guidelines for classifying radiographs of pneumoconiosis based on the size and quantity of the nodules in the lungs. According to medical textbooks at the time, the appearance of nodules surrounded by concentrically arranged bundles of collagen between 1 and 10 mm in diameter on the chest x-ray was generally considered indicative of silicosis (NIOSH, 1974). In addition, a work history was usually required for diagnosis. A standardized approach for diagnosing silicosis had important implications in workplace surveillance programs, as well as worker's compensation claims.

reduced by 80–90% compared to those measured in 1939, some of the engineering controls were ineffective at reducing respirable-sized particles (Flinn et al., 1963). Approximately 75.6% of the samples collected showed airborne dust concentrations less than 5 mppcf, 19.3% in the range of 5–20 mppcf, 3.9% in the range of 20–50 mppcf, and 1.2% greater than 50 mppcf (Flinn et al., 1963). The investigations concluded that the majority of high dust measurements were attributable to insufficient engineering controls in several mines.

In the medical study, chest x-rays, medical exams, and medical and occupational histories of 14,076 metal miners revealed silicosis in 3.4% of the current worker population (Flinn et al., 1963). These rates were significantly lower than previous studies of miners, which had rarely reported a prevalence of silicosis less than 25%. In addition, it was observed in the follow-up study that the occurrence of silicosis was confined to workers with over 15 yr of mining experience, with no disease observed in miners younger than 35 yr or with less than 5 yr of employment.

Reevaluation of the Granite Industry Despite the continued occurrence of silicosis in some industries, follow-up investigations confirmed earlier findings among the Vermont granite workers that silicosis was not observed when exposures were maintained below 10 mppcf (Figure 7). In 1955, an environmental survey by the Industrial Hygiene Division of the Vermont Department of Health showed that dust concentrations were much lower than what was reported in the 1924–1926 and 1937–1938 surveys (Hosey et al., 1957). Average counts were well below 10 mppcf, with only 10% of the total measurements exceeding this level. Health surveys indicated that the overall rate of silicosis steadily decreased throughout the 1940s and 1950s, with 45% of surveyed workers being diagnosed with silicosis in 1937–1938, 20.3% in 1952, and 15.1% in 1956 (Hosey et al., 1957). Striking differences in silicosis rates were observed among men who had worked prior to the installation of engineering controls compared to those who had been hired after 1937. Nearly half of the 1112 men employed prior to 1937 had silicosis, whereas only one of 1134 men hired after the installation of dust-control measures exhibited symptoms of disease. Follow-up studies of these granite workers through the 1960s supported prior data indicating that exposures to dust concentrations of less than 5 mppcf did not result in disease (Ashe & Bergstrom, 1964).

Early Studies Involving Cristobalite and Tridymite It was not until the first half of this second era that researchers and industrial hygienists began to appreciate the varying fibrogenic potential of the different crystalline forms of silica. Occupational studies in the brick manufacturing and diatomaceous earth industries provided evidence that different polymorphs of crystalline silica, specifically cristobalite and tridymite, had greater fibrogenic potencies than quartz. The development of x-ray diffraction in the early 1940s provided a means for distinguishing and quantifying the polymorphs of crystalline silica in airborne dust samples, which facilitated characterizing the toxicity of each form in subsequent human and animal studies (Berkelhamer, 1941).

Some of the earliest studies of silicosis involving nonquartz forms of crystalline silica were those in the Pennsylvania brick industry (Figure 7). During brick manufacturing, rock containing an average of 97% quartz was heated to temperatures of 1482°C. Dust associated with the finished bricks was composed of approximately 90% cristobalite and tridymite, with only trace amounts of quartz. In a study of 4 brick manufacturing plants in Pennsylvania, Fulton et al. (1941) compared exposures and silicosis prevalence among workers in manufacturing departments where exposures were primarily to quartz versus those involving cristobalite and tridymite. Comparison of silicosis rates among workers in the green (primarily quartz exposure) and burned (primarily cristobalite and tridymite exposure) brick departments revealed similar rates (Fulton et al., 1941). It was observed, however, that silicosis in the burned brick department progressed faster than that observed among men who were primarily exposed to quartz-containing dust.

Cristobalite in the Diatomite Industry Diatomaceous earth consists of porous and friable sedimentary rock that is composed of silicate cell walls of diatoms, a type of single-celled algae. It has been mined since the end of the 19th century and used as a liquid filtering medium and as a filler material in a variety of products such as paper, paint, brick, tile, and ceramics. Cristobalite is formed when diatomaceous earth is heated during calcining and flux-calcining processes. During World War II, the volume of diatomaceous earth mining increased dramatically, resulting in an increased incidence of silicosis within this industry (Vigliani & Mottura, 1948; Cooper & Cralley, 1958).

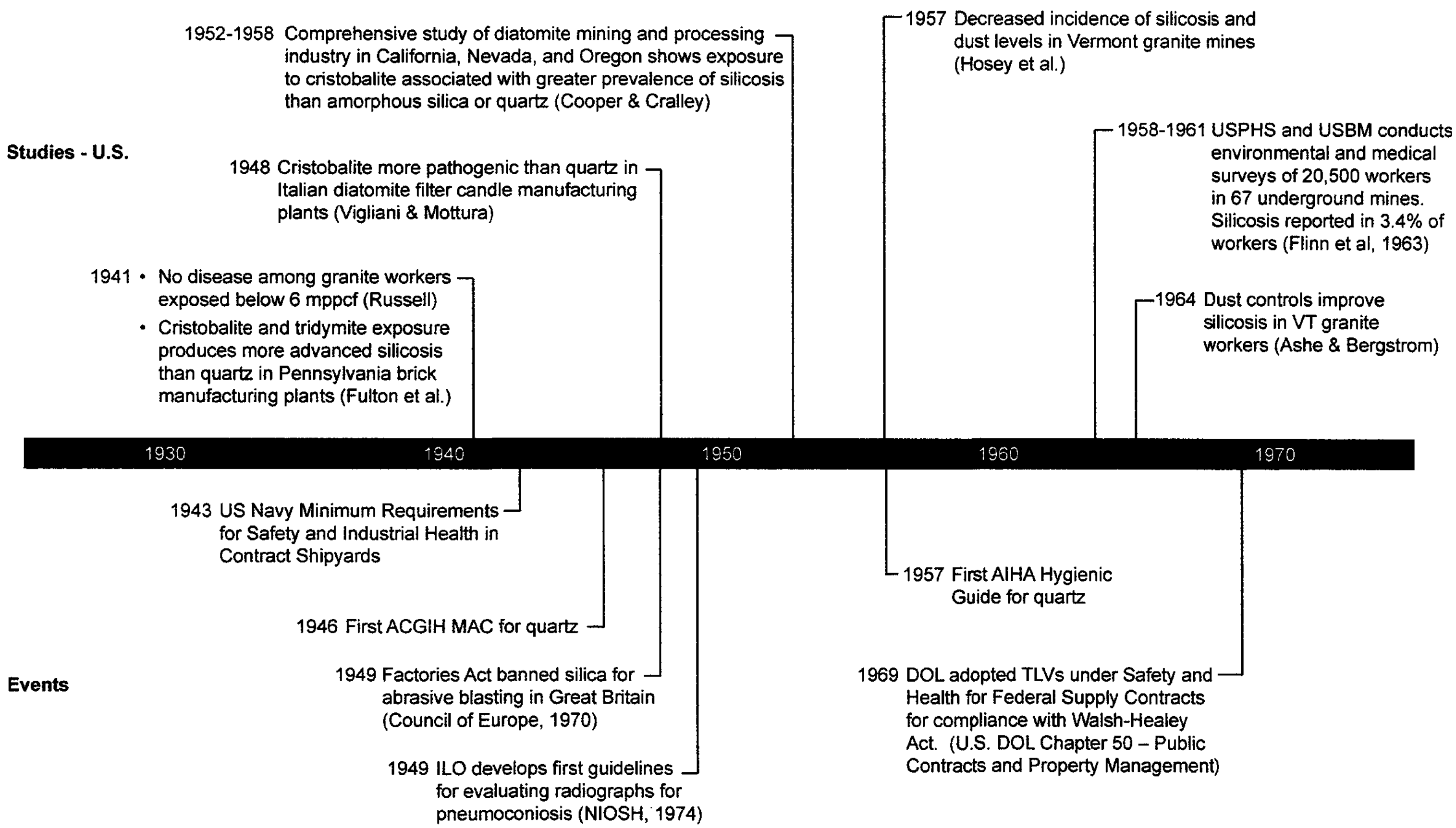


FIGURE 7. Timeline of key studies and events that led to the recognition of the hazards of silica (1940–1969).

Vigliani and Mottura (1948) studied two Italian factories that manufactured filter candles from crude diatomite mined in Tuscany and calcined, ultimately forming cristobalite (Figure 7). Although it was not always reported whether the measured dust concentrations reflected amorphous or crystalline forms of silica, or quartz versus cristobalite, a number of silicosis cases were identified, with illness developing relatively rapidly, often within a few years. The authors noted that this observation of disease was in contrast to prior studies which indicated diatomite did not produce silicosis. The authors compared the x-ray diffraction patterns of raw versus calcined diatomite and concluded that cristobalite formed by calcining at 1250°C contributed to the development of silicosis within these workers.

In 1952, the California State Department of Public Health and the USPHS conducted a comprehensive environmental and medical study of the diatomite industry, involving 5 plants in California, Nevada, and Oregon (Cooper & Cralley, 1958). Four of the plants produced natural, high-temperature (1800–2000ºF) straight-calcined and flux-calcined products, while the fifth produced only natural and low-temperature (approximately 1600ºF) straight-calcined products. In the medical survey, x-rays of 869 workers showed changes consistent with pneumoconiosis in 9% of the workers, with the highest rates observed among employees who worked in the mills for 5 yr or more (48 out of 101); mill dust contained a high percentage of cristobalite. In contrast, quarry workers, who were exposed primarily to amorphous silica, did not show abnormal x-rays. Taken together, studies of the diatomite industry provided evidence that exposure to cristobalite was associated with greater prevalence and faster progression of silicosis than exposure to quartz.

Experimental Animal Studies The expansion of the diatomite industry and the recognition of the silicosis hazards associated with worker exposure to cristobalite led to experimental studies involving different forms of silica, which showed that cristobalite and tridymite were more fibrogenic than quartz. A hallmark paper on this topic, published by King and colleagues (1953a), showed that, following intratracheal installation of different crystalline forms of silica with similar particle size ranges, tridymite produced the most rapid and severe fibrotic responses in the rat lung, followed by cristobalite and quartz. A later study conducted in the late 1960s attempted to model potential human exposures to cristobalite by exposing animals to airborne concentrations that were representative of potential working environments (Wagner et al., 1968). These experimental animal studies provided support for the development of OELs for the different crystalline forms of silica.

Additional studies in this era provided further evidence of the importance of particle size in determining fibrogenicity (Goldstein & Webster, 1966; Gardner, 1938a; King et al., 1953b). These studies were also conducted using more relevant routes of exposure (i.e., delivery by intratracheal installation or inhalation rather than intravenous injection) (Figure 4). In 1953, King demonstrated that intratracheal installation of silica particles ranging from less than 0.5 μm to 8 μm in diameter all produced fibrosis in the rat lung (King et al., 1953b). A dose-response relationship between particle size and the time required to produce each stage of fibrosis was also observed. Particles 1–2 μm in diameter produced the greatest extent of fibrosis within the shortest period of time following exposure. This observation was in contrast to a 1966 study, which reported a higher grade of fibrosis in rats that were exposed to large (4–5 μm) silica particles compared to those less than 1–3 μm in size (Goldstein & Webster, 1966). In the 1966 study, rats were exposed by intratracheal installation to doses of silica with varying particle size but equal total surface area. The authors noted that the results might be attributed to either higher silica exposures or the direct effect of the larger sized particles.

Occupational Exposure Limits for Silica

Prior to the 1940s, a number of governmental, industrial, and research-based organizations provided their views of a safe limit of exposure for airborne crystalline silica (Table 2) (Russell et al., 1929; Kuechle, 1934; Air Hygiene Foundation of America, Inc., 1937b; National Bureau of Standards, 1938). However, no formal scientific review process had been conducted in recommending an OEL until 1946, when the American Conference of Governmental Industrial Hygienists (ACGIH) developed its first maximum allowable concentration (MAC) for silica (ACGIH, 1964). Because it was well recognized that the percentage of crystalline silica in dust dramatically affects the risk of silica-related disease, three MACs were developed based on the content of quartz in airborne dust

(ACGIH, 1964).[5] These limits were embraced by other industrial hygiene organizations, such as the American Industrial Hygiene Association (AIHA) (AIHA, 1957, 1958). In 1962, ACGIH officially changed the MAC terminology to threshold limit values (TLVs), and developed separate OELs for the crystalline (cristobalite, quartz, trydimite) and noncrystalline (amorphous) forms of silica (ACGIH, 1962). These changes were prompted by animal studies and USPHS studies of the diatomite industry, which demonstrated that different forms of crystalline silica varied in their ability to induce fibrosis (Gardner, 1938c; King et al., 1953a; Cooper & Cralley, 1958).

Because the content of quartz in airborne dust varies significantly from one work setting to the next, and the health hazard is largely linked to the airborne concentration of crystalline silica, the ACGIH published a different approach to establishing an OEL for silica in 1966 (ACGIH, 1966). Although the concentration did not change, the revised TLV for quartz was based on a calculation of the amount of quartz (0–100%) present in the airborne dust rather than three categories of high (>50% free silica), medium (5–50% free silica) or low (<5% free silica) (Table 2). The 1955 follow-up study of the Barre, VT, granite workers formed the basis for the 1966 TLV. Comparable formulas for respirable mass and particle number concentration of airborne quartz dust was adopted by the DOL under the Safety and Health for Federal Supply Contracts for Compliance to the Walsh–Healey Public Contracts Act regulations, as well as the U.S. Department of the Interior under the Metal and Nonmetallic Health and Safety Act (OSHA, 1971b, 2007; Clayton and Clayton, 1978; U.S. Department of Labor, 1969). Additionally, under the Secretary of Health, Education and Welfare, the Federal Coal Mine Health and Safety Act adopted the same formula for a standard (U.S. Bureau of Mines, 1971).

Abrasive Blasting Studies and Developments in Industry

Abrasive Blasting in Foundries and Shipyards Foundry studies published in the 1940s and 1950s focused on the effectiveness of previously installed dust controls for reducing the incidence of silicosis. These studies were motivated by workers' compensation claims for silicosis that continued to appear through the 1940s and suggested that health risks from airborne dust were still a problem for foundry workers. In 1948, the USPHS and the Illinois State Department of Public Health conducted a 1-yr study of 18 representative ferrous foundries in Illinois to evaluate whether dust-control measures were adequately protecting workers against silicosis (U.S. Public Health Service and Illinois Department of Public Health, 1950). Abrasive blasting operations across the different foundries were performed using a variety of materials, including sand, synthetic abrasive, chilled grit, and shot. The authors concluded that foundry dust levels were generally lower than had been reported over the previous two decades, it was noted that further improvement was still necessary. Concurrent medical examinations of nearly 1937 male employees at 16 foundries revealed pulmonary fibrosis in 9.2% of foundry workers, with the highest incidence observed in workers performing cleaning and finishing operations (U.S. Public Health Service and Illinois Department of Public Health, 1950).

In addition to formal studies conducted by public health agencies, numerous articles published throughout this time period in the *National Safety News* (a monthly publication of the NSC) addressed issues related to abrasive blasting. One of the overarching themes was the need to ensure that blast rooms, cabinets, and rotating tumblers were sealed and properly maintained to prevent silica-containing dust from escaping into the general work area (Castrop, 1948; National Safety Council, 1945, 1956). It was also emphasized that employees working in the blast rooms should wear air-supplied hoods, and that helmets should be stored in a separate area to prevent

[5]Prior to the establishment of the 1946 ACGIH MAC for silica, quartz content in dust was typically determined using a colorimetric assay that measured the amount of silicon. This method was often inconsistent, because the test was based on a timed reaction that could differ significantly between operators. Berkelhamer (1941) reported that x-ray diffraction (XRD) could be used to quantify the amount of various pneumoconiosis-producing dusts. This method relied on the unique scattering of x-ray radiation produced by the crystalline lattice structure of each polymorph of silica and had several advantages over previous methods that used microscopy or colorimetric tests (i.e., analytical speed and sensitivity, minimal sample preparation time, ability to identify the different polymorphs of crystalline silica, capabilities for automation). The disadvantages of this technique were that very small amounts of silica were not detected efficiently, particularly when the sample contained a mixture of crystalline silica polymorphs (Berkelhamer, 1941)

contamination with silica dust. These recommendations were not limited to abrasive blasting using silica-containing sand; it was recognized that the use of steel grit as an abrasive could also generate significant dust levels, and the same safety measures were recommended (Castrop, 1948).

Abrasive blasting was also used widely in the maritime industry for surface preparation of hulls, tanks, and other components, as well as for removing marine growth from the bottom of ships, a process referred to as "sandblast fanning" (U.S. Bureau of Ships, 1955). In contrast to abrasive blasting in foundries, these operations were often conducted in the open air (e.g., hull preparation) or in tightly confined areas on a ship (e.g., surface preparation in a tank) (Figure 8). The engineering controls typically used in foundries were simply not feasible for many shipyard operations, necessitating that shipyards develop alternative means for protecting workers against the hazards associated with abrasive blasting. One common control involved attaching dust-removal apparatuses to blasting hoses to collect dust as it was generated. Some automation was implemented; for example, self-filling hoppers and remote-control systems were sometimes used for abrasive blasting (U.S. Bureau of Ships, 1959). Remote-control systems allowed the blaster to control the flow of compressed air and abrasive material from the handheld nozzle, negating the need for a pot tender. This method was particularly useful for blasting operations in tanks or on scaffolding during preparation of ship hulls where the blaster was not near the hopper.

Investigation of Alternative Abrasives In 1950, the use of silica sand was banned for abrasive blasting in Great Britain (Factories Act), followed by the Netherlands in 1956 and Belgium in 1964 (Council of Europe, 1970). The ban on silica as an abrasive material prompted research related to alternative materials that would provide comparable surface preparation without the toxicity of silica. The majority of this research was performed in Europe. Studies in Norway reported that olivine was satisfactory for cleaning foundry castings (Forbes et al., 1950). Around this same time period, animal studies were also conducted to evaluate the potential toxicity of these alternatives relative to silica sand; intratracheal installation of iron silicate did not produce fibrosis in rats, whereas exposure to silica did

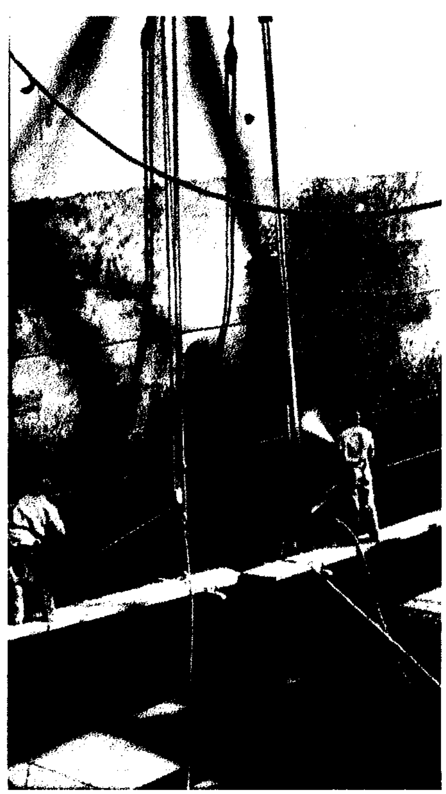


FIGURE 8. Abrasive blasting of a ship hull. From U.S. Bureau of Ships (1954), with permission.

(Holmqvist & Swensson, 1963). A 1970 report by the Council of Europe detailed a number of alternative abrasives, including cut steel wires, certain corunda (various aluminum oxides), certain metallic oxides or mixtures thereof, crushed slags from metal smelting or other metal working processes (copper, iron), glass (ground or pelleted), zirconium silicate, and crushed or granulated vegetable products (e.g., cherry pits, almond shells) (Council of Europe, 1970).

The use of alternative abrasives was also considered in the United States as an option to reduce the health risk associated with abrasive blasting operations (Brandt, 1943). The most frequently recommended alternative abrasive around this time was steel shot. However, it was generally recognized that sand had superior qualities as an abrasive and, in many cases, was less expensive than some of the common alternatives. Because of the large quantities of abrasive used in blasting operations, cost was a major factor for most industries. Furthermore, abrasives such as steel shot were known to create metallic dust, which required the same safety measures (supplied-air respirators and abrasive blasting helmets) as silica abrasives (Brandt, 1943). Therefore, because silica sand was viewed as an important industrial resource in the United States, rather than banning the material, the United States sought to control occupational exposures associated with abrasive blasting operations through engineering controls and respiratory protection.

Respiratory Protection Guidelines for Abrasive Blasting

Many of the recommendations for respiratory protection during abrasive blasting operations given by the USPHS, USBM, DOL, and AFA in the 1920s and 1930s were adopted and/or expanded upon by more specialized groups, specifically the maritime industry, in which abrasive blasting was performed frequently. Because of the unique nature of abrasive blasting operations in shipyards, special considerations regarding clean-air sources for airline respirators and falling or entanglement hazards were sometimes needed. In 1943, the U.S. Navy and U.S. Maritime Commission jointly published Minimum Requirements for Safety and Industrial Health in Contract Shipyards. While the requirements for respiratory equipment during abrasive blasting were not specific, they stated that adequate respiratory protective devices should include "abrasive blasting helmets" and "dust respirators" (U.S. Navy and Maritime Commission, 1943). In 1960, the DOL published Safety and Health Regulations for Ship Repairing. In a section devoted to mechanical paint removal, the regulations stated that abrasive blasters were required to be protected by hoods and air-line respirators or helmets with positive-pressure air flow (U.S. Department of Labor, 1960). Employees in the vicinity of blasters, including the pot tenders and recovery men, were to be provided with both eye and respiratory protective equipment. Both the Navy and DOL documents recommended that all respiratory equipment be approved by the USBM (U.S. Department of Labor, 1960; U.S. Navy and Maritime Commission, 1943).

In addition to the maritime industry, independent standard-setting organizations also began publishing safety and health standards related to silica exposure and abrasive blasting. The American Standards Association (now the American National Standards Institute, or ANSI) published the American Standard Safety Code for Heads, Eyes, and Respiratory Protection in 1959 and later published the American National Standard Practices for Respiratory Protection in 1969. These two documents not only recommended respiratory protection for abrasive blasting, but were the first to identify the limitations of different types of respiratory protection (ASA, 1959; ANSI, 1969). It was acknowledged that, in some circumstances, there may be physical limitations to wearing a hose mask or air-line respirator, such as when the operation requires the worker to maneuver or work around obstructions not amenable to the proper use of such a device (ASA, 1959; ANSI, 1969). In these situations, the respirator itself may create additional entanglements or falling hazards. ANSI clarified its position on mechanical filter respirators in a 1968 standard titled "Ventilation and Safe Practices of Abrasive Blasting Operations." This standard stated that, according to the recommendation of a proper authority having jurisdiction over the work site (i.e., an employer), particulate-filter respirators were acceptable only for occasional or short-term dust exposures when nonsilica abrasives were used, and such respirators were not to be used as a continuous form of protection when silica was used as the abrasive. ANSI further indicated that only USBM-approved abrasive blasting respirators should be worn by workers performing abrasive blasting (ANSI, 1968).

Government and industry-based professional industrial hygiene associations, such as the AIHA and ACGIH, also followed suit in providing recommendations for respiratory protective equipment for abrasive blasting operations. In 1963, the AIHA and ACGIH jointly published the first manual devoted solely to the selection and use of respirators, which became widely used throughout industry. In this manual, abrasive blasting respirators were defined as one of two general designs: (1) a mask or tight-fitting face piece with a connection to a source of supplied air, and including a hood for rebound protection; or (2) a helmet that covers the neck, with a connection to an air supply through a hose line (AIHA-ACGIH, 1963).

THE LATER YEARS (1970–1989): ERA OF FEDERAL REGULATIONS AND REASSESSMENT OF WORKPLACE EXPOSURES TO SILICA

Studies of Health Effects

Exposure and Health Surveillance by the Government Following the passage of the Occupational Safety and Health Act by Congress in 1970, the Occupational Safety and Health Administration (OSHA), in the DOL, was formed to enforce occupational safety and health laws while the National Institute for Occupational Safety and Health (NIOSH), now part of the Centers for Disease Control and Prevention in the Department of Health and Human Services, was to be responsible for research and recommendations related to occupational safety and health. NIOSH and OSHA initiated surveys in several different industries to characterize the extent of silica exposure and disease rates among the U.S. workforce. One of the first efforts led by NIOSH was the National Occupational Health Survey (NOHS), in which approximately 5,000 establishments were surveyed and over 9,000 potential occupational hazards were identified (NIOSH, 2006a). Based on this initial survey, NIOSH estimated that over 3 million workers in 238,000 plants were potentially exposed to silica (NIOSH, 1983). In the early 1980s, a second survey, the National Occupational Exposure Survey (NOES), included approximately 4500 establishments (NIOSH, 2006b, 2006d). Both surveys involved site visits and interviews with management to collect information about each facility and occupational health and safety policies. The details of each site visit were entered into a large database, which provided records describing potential workplace exposures by industry, occupation, and chemical. In addition to the industry-wide surveys, NIOSH conducted health hazard evaluations (HHEs) of individual workplaces at the request of employers or employees (NIOSH, 2006a). Over the past 30 yr, there have been more than 200 HHE evaluations pertaining to silica, which are available to the public.

Silica was also identified as one of five key industrial hazards when OSHA initiated its "Target Health Hazards Program" in 1972. By 1976, more than 5000 inspections were conducted under the auspices of this program. Approximately 60,000 air samples were collected by OSHA, including over 8000 samples of airborne silica. Many of the silica samples were collected at foundries, with 37% of the samples collected in all industries showing concentrations in excess of the OEL (Ryer, 1978). A follow-up analysis of the OSHA inspection data collected from 1972 to 1982 revealed that 20% of samples across all industries evaluated exceeded the TLV by a factor greater than two (NIOSH, 1983). OSHA's findings were also supported by independent research studies involving foundries (Oudiz, 1986). In total, exposure studies and OSHA sampling data indicated that, despite continued efforts, dust levels were not always sufficiently controlled (NIOSH, 1985, 2006a; Froines et al., 1986; NIOSH, 1976a).

Incidence of Silicosis Declines During the 1980s, exposure data compiled by OSHA and NIOSH were coupled with health statistics to specifically track the incidence of silicosis within various industries across the United States. These efforts involved collaboration between NIOSH and the National Center for Health Statistics (NCHS) to develop the National Occupational Mortality System (NOMS), which facilitated surveillance of cause-specific mortality by the decedent's industry code or occupation (NIOSH, 2006d). In addition to this program, NIOSH established the National Surveillance System of Pneumoconiosis Mortality (NSSPM) in the late 1980s, which provided annual updates of the total number of deaths in the United States for which pneumoconiosis was listed as the underlying cause (NIOSH, 2006d). Despite evidence that silica exposure levels continued to exceed regulatory standards in many industries, the overall number of deaths due to silicosis (as an underlying or contributing cause) decreased steadily throughout this era (Figure 9). Age-adjusted mortality rates in the United States, where silicosis was identified as the underlying cause of death, were at least twofold lower by 1990 compared to 1970 (NIOSH, 2003). A greater than fivefold reduction over the same time period was noted for deaths where silicosis was identified as a contributing cause of death.

This favorable trend of silicosis reduction was seen not only in industries involving quartz, but also in those primarily associated with cristobalite exposure. A large-scale reevaluation of diatomaceous earth workers found, for example, that lung changes associated with occupational exposure were observed in 2.8% of workers, compared to 9% in the original 1953–1954 USPHS survey. This reduction was attributed to dust-control practices and use of respirators (Cooper & Cralley, 1958; Cooper & Jacobson, 1977). Similarly, in 1970–1971, periodic chest x-rays taken of Canadian brick and tile workers since 1958 showed no cases of silicosis among 1166 production workers (Rajhans & Budlovsky, 1972).

Retrospective Analysis of Silica Cohorts Up until this era, cohort studies typically reported rates of silicosis among the current worker population and did not follow employees who had left the work force. For chronic silicosis, there is at least a 10-yr latency period for the development of disease. Thus, a potentially large number of workers could have been misclassified as nondiseased, because they were evaluated before any clinical symptoms developed. Consequently, epidemiological studies published in the 1970s and 1980s focused on disease rates among those who had remained in the work force long enough to potentially develop silicosis. Many of the studies conducted at this time evaluated large occupational cohorts, some of which included people who had worked in the 1940s. The availability of environmental and medical data for a subset of workers who had been exposed to varying concentrations of airborne silica for decades allowed researchers to provide quantitative estimates of the exposure-response relationship for silica. This type of analysis represented an important advancement from earlier studies in the granite industry, which could

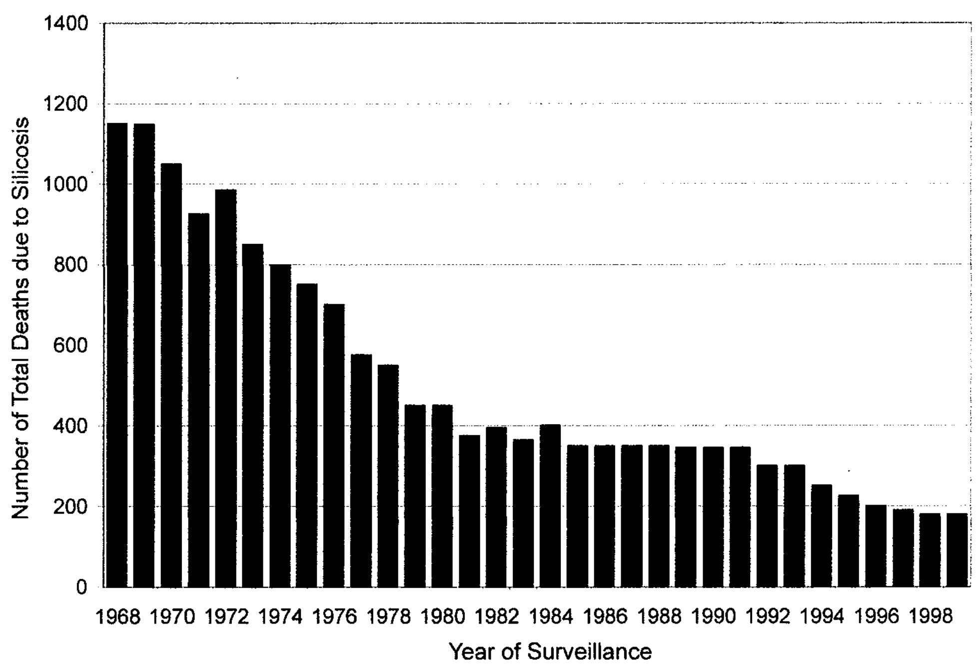


FIGURE 9. Number of deaths due to silicosis (underlying or contributing cause) among U.S. residents age 15 yr and over (1968–1999) (NIOSH, 2005).

establish only that workers in areas where airborne silica concentrations were kept below a certain level did not appear to develop disease.

Despite the longer follow-up periods, researchers still faced methodological challenges. A major source of uncertainty was the lack of complete and quantitative historical industrial hygiene data. This lack of information was due, in part, to the fact that air samples were often taken sporadically and under a variety of conditions. Changes in sampling technology also presented a major hurdle in estimating exposure over time, especially when older sampling data were collected using the impinger method and data regarding the silica content of the dust were not available. For example, in the late 1960s and early 1970s, researchers and industrial hygienists began moving away from the impinger method (e.g., particle number) to the gravimetric method to assess airborne silica concentrations in the work environment.[6] Later, size-selective sampling devices were developed that separated out larger dust particles and measured only those that were capable of penetrating the lungs (Ayer et al., 1968; NIOSH, 1974). Gravimetric sampling allowed measurements to be taken over a full shift and also provided enough sample volume to allow for analysis of free-silica content. However, with this shift in air-sampling methodology, it was necessary to determine how the results of one method correlated with the other, because historical measurements had been derived from impinger or particle-count measurements.

To address the discrepancy between impinger and gravimetric data, a factor to convert particle count into particle mass concentrations was developed (Ayer, 1969; Ayer et al., 1973). Specifically, Ayer et al. (1973) simulated 1920 conditions in granite sheds and measured free silica by dust count, using both the Greenburg–Smith impinger and the gravimetric method. A comparison of the two types of measurements suggested that 10 mppcf was roughly equivalent to 0.2 mg/m^3. Subsequent studies aimed at correlating the two types of measurements did not always find a relationship, which generated some controversy at the time, because nearly all of the studies conducted through the 1960s had relied on particle counts (NIOSH, 1983; Rice et al., 1984). Despite this controversy, the original conversion factor developed by Ayer (1973) was the one most frequently used in epidemiological studies and by standard-setting groups to convert older particle count values to particle mass measurements.

In addition to the uncertainties associated with interpreting older exposure data, the criteria for identifying and diagnosing silicosis in worker populations varied over time and by industry, making it difficult to retrospectively estimate the true disease rate in a given population. This discrepancy in diagnosing silicosis has hampered direct comparisons of studies. While many studies relied on International Labor Office (ILO) criteria for interpreting chest radiographs for pneumoconiosis, the cutoff point (e.g., 1/0 vs. 1/1) used to determine whether a person was classified as "silicotic" often varied. International studies occasionally used criteria other than the ILO classification system for reading chest radiographs for silicosis (Chen et al., 2001, 2005). In addition to variations based on diagnostic criteria, the choice of the comparison population used to generate standard mortality ratios (SMRs) in many studies contributed an additional level of uncertainty. The strength of the association could vary considerably depending on whether local or national death rates were used to generate risk estimates.

Exposure-Response Studies Studies of the granite industry conducted in the late 1960s by the Harvard School of Public Health and the Vermont Industrial Hygiene Division were among the first to address the relationship between lifetime exposure to quartz and lung disease (Theriault et al., 1974a, 1974b, 1974c). In these studies, personal lapel samples, collected using the gravimetric method, were used to estimate worker exposures to respirable dust. Lifetime dust exposure was calculated, and a factor of 10 was applied for all exposures prior to 1940, based on the assumption that airborne dust concentrations prior to the installation of dust controls were likely higher than what had been reported in more recent samples. A study by Ayer et al. (1968) reported that the respirable fraction of

[6]Gravimetric sampling provided a solution for many of the problems associated with the particle count method, such as agglomeration of dust particles, which could affect the proportion of particles of respirable size that were actually counted by the method. Particle count results could be highly variable, and because of the short sampling time of the impinger, multiple samples were often required to estimate exposure levels.

the dust in the 1960s contained 7.2% quartz, whereas dust measurements from the first studies of the granite industry reportedly contained between 25 and 35% quartz (Theriault et al., 1974a).[7] Workers were divided into different exposure groups, similar to the four categories evaluated in 1929 by the USPHS (Russell et al., 1929). Again, no respiratory disease, defined by abnormal chest X-rays, was reported in workers in the lowest exposure group (9 mppcf), with average cumulative granite dust exposures of 19 dust-yr (equivalent to an exposure of 0.5 mg/m^3 for 19 yr) and thus provided further support for the protectiveness of the OSHA PEL (Theriault et al., 1974c).

The dose-response relationship for silicosis was also evaluated in workers in the dusty trades in North Carolina. These data were collected as part of a formal state program that had been in place since 1935 and included information related to worker pre-employment health status, occupational history, annual physical exams, and air measurements from workplace inspections (Baucom, 1986). The dusty trades included in the program have expanded over time. While early operations around 1900 were limited to mica mining, industries such as hard-rock mining, quarrying, mineral processing, and foundries were incorporated into the program as they developed in the state. Similar to historical surveys of the Vermont granite sheds and quarries, the incidence of silicosis in the North Carolina worker cohort correlated with changes in workplace practices and dust-control measures over time. Because the study period covered a long time span (1935–1980), a cumulative exposure model was selected to evaluate the threshold at which no silicosis was observed (Rice et al., 1986). Cumulative exposure estimates were calculated by adjusting the total dust concentrations by the average quartz content within each industry (estimated from historical settled dust samples). The cumulative exposure at which no increased risk for silicosis was observed was roughly equivalent to a mean exposure of 1 mppcf over a 40-yr working lifetime. Moderately elevated odds ratios (ORs) (ranging from 1.03 to 3.04) were observed among workers with a mean exposure of 2.5 mppcf over a 40-yr working lifetime. Conversion of the 1-mppcf estimate to respirable mass unit yielded a value of approximately 0.1 mg/m^3, which was equivalent to the OSHA PEL and consistent with what had been reported in the Vermont studies. The exposure and health experience of the Vermont granite workers and the tradesmen of North Carolina provided additional support that the OSHA PEL was sufficiently protective against silicosis.

Understanding Early Studies of Silica and Lung Cancer As the incidence of silicosis continued to decrease throughout this era, the focus of many of the health studies shifted to the potential relationship between silica exposure and lung cancer. Several autopsy studies conducted in the 1950s and 1960s suggested that there might be an increased risk of lung cancer in mineral-dust workers, but these were not considered persuasive evidence of a causal association (Gloyne, 1951; Heuper, 1966). By the mid-1970s, the observation of higher rates of lung cancer among metal miners prompted researchers to consider silica as a potentially carcinogenic component of mining dust. Although the presence of other known carcinogens (such as radium ore decay products or amosite asbestos) in the mining industry was well known, several studies reported mixed associations between silica exposure and lung cancer (Gillam et al., 1976; McDonald et al., 1978; Brown et al., 1986; Higgins et al., 1983; Finkelstein et al., 1986). However many of these studies did not control for confounding exposures, and accurate information regarding smoking history was generally unavailable or not properly gathered. As a result of these shortcomings, these investigations were not widely supported within the scientific community.

It was not until the early 1980s that more robust studies of lung cancer in silicotics appeared in the scientific literature (Figure 10). Analyses of data from the Swedish pneumoconiosis register (which contains all silicosis cases, compensated or uncompensated, after 1931) indicated that workers employed in the mining and iron and steel industries had higher rates of lung cancer (Westerholm, 1980). The authors noted, however, because of the presence of co-carcinogens in these industries

[7]Initially, dust samples were analyzed for silica content using chemical and petrographic methods. Samples were first treated with a series of acids to remove soluble compounds and break down silicates (Drinker, 1954). The petrographic analysis involved the evaluation of certain physical properties, including specific gravity, hardness, color, crystal structure, and others, using the same light-field method of counting impinger samples (Drinker & Hatch, 1954). Based on this type of analysis, it was estimated that Vermont granite dust contained between 25% and 35% quartz (Russell et al., 1929). The colorimetric method, using hydrofluoric acid, was later used to analyze quartz, but it could not distinguish between the polymorphs.

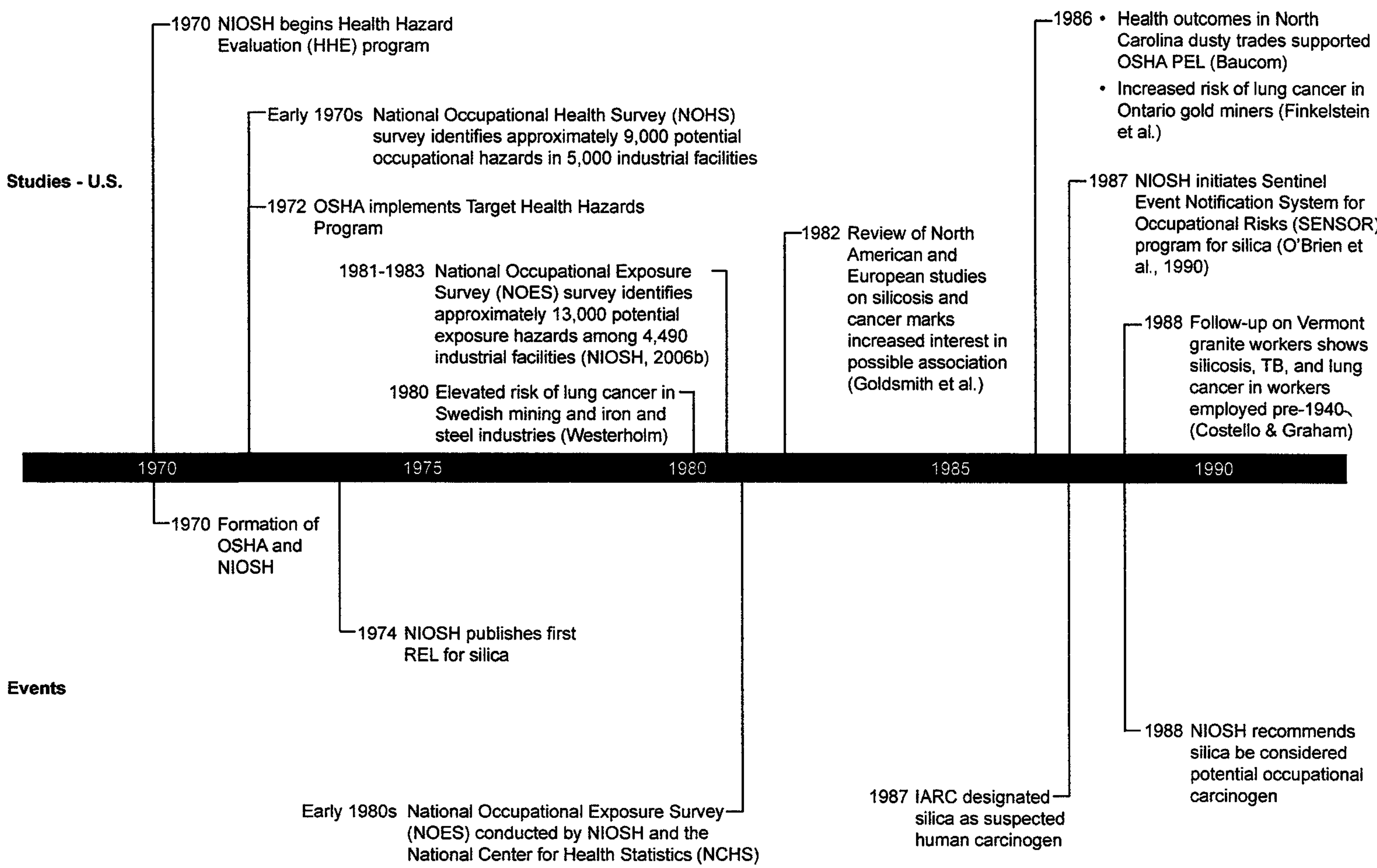


FIGURE 10. Timeline of key studies and events that led to the recognition of the hazards of silica (1970–1989).

and the lack of smoking information, this association did not necessarily indicate a causal relationship. Similarly, Ontario gold miners receiving compensation for silicosis were found to have elevated rates of cancer, as well as mortality from all causes (Finkelstein et al., 1986). Although these early mortality studies reported increased cancer rates (as measured by proportionate mortality ratio [PMR] and SMR, respectively) among silicotics, a major limitation of these studies was that they did not account for smoking history.

In the early 1980s, Goldsmith et al. (1982) brought the issue to the attention of the scientific community (Figure 10). In their study, Goldsmith et al. (1982) indicated that excess mortality rates of respiratory cancer had been reported in North American and European studies in iron and steel foundry workers, steel casting workers, abrasive blasters, metal molders, miners (nonuranium), and ceramic workers, all of which had historically experienced excessive exposures to silica. The reports from the Swedish Pneumoconiosis Register and the Ontario Ministry of Labor were also cited by Goldsmith as evidence that silica exposure was associated with an increased risk of lung cancer (Finkelstein et al., 1982; Westerholm, 1980). Although nearly 20 studies were considered by Goldsmith et al. (1982), the results did not allow for easy inference of a direct causal relationship between silica and lung cancer. This difference was largely due to the fact that the observed associations were as likely to be due to other factors, such as smoking or concurrent exposure to other known occupational carcinogens (i.e., polycyclic aromatic hydrocarbons (PAHs) among foundry workers, radioactive radon daughters and asbestos among mine workers) (Ng, 1994). Other limitations included selection and information bias, as well as a lack of dose-response patterns. Nonetheless, several hypotheses regarding the carcinogenic effects of silica were proposed by Goldsmith et al. (1982): (1) Silica directly produces lung cancer; (2) silicosis may serve as an intermediate pathologic state leading to lung cancer; and (3) silica, linked with PAHs either from smoking or from the ambient working environment, impairs lung clearance and increases the effective dose and/or duration of exposure, inducing neoplasia in the adjacent pulmonary tissue.

Experimental Animal Studies The primary focus of animal studies conducted in the 1980s was to evaluate the carcinogenic potential of crystalline silica (Figure 4). The incidence of lung tumors was measured in rats, hamsters, and mice following exposure by multiple routes (e.g., inhalation, intratracheal installation, intrapleural, intrathoracic, and intraperitoneal injection, and intravenous administration) (Wagner, 1976; Wagner et al., 1968, 1980; IARC Working Group, 1987; Wagner & Wagner, 1972). Positive results were limited to rats, in which lung tumors were observed following inhalation and intratracheal instillation, and thoracic malignant histiocytomas developed following intrapleural and intrathoracic administration (Holland et al., 1983, 1986; Dagle et al., 1986; IARC Working Group, 1987). Although rat inhalation studies reported tumor incidence ranging from 20 to 30% (Dagle et al., 1986; Muhle et al., 1995; Holland et al., 1986), a consistent dose-response pattern was not documented. In addition, tumors were not observed in hamsters, mice, or guinea pigs (Holland et al., 1983; Holland, 1995; Stenback et al., 1986; Niemeier et al., 1986). Based on the animal studies, in 1986, International Agency for Reasarch on Cancer (IARC) classified crystalline silica as a group 2A carcinogen, a designation indicating that there was sufficient evidence available to classify silica as a carcinogen to animals, but only "limited evidence" that silica was carcinogenic in humans (IARC Working Group, 1987).

The fact that evidence of carcinogenicity was limited to the rat has raised several questions about whether silica (alone) is a lung carcinogen. It has been suggested that chronic inflammation, which is not observed in mice or hamsters, may play a role in the carcinogenesis of silica in the rat (Holland, 1995). It has also been proposed that lung fibrosis produced by silicotic lesions in rats may have contributed to the development of lung tumors. These questions have stemmed from (1) observations of the inconsistent latency of tumor incidence (e.g., tumors observed after acute and chronic exposures), (2) co-occurrence of fibrosis and tumors in the rats (i.e., fibrosis is required for the development of carcinogenic tumors), (3) lack of dose-response patterns, and (4) inconsistencies among studies (Holland, 1995; NIOSH, 2002a). Given that malignant tumors were not observed in other animal species (even in a mouse strain with a high background incidence of lung adenoma), it was suggested that rats may have some specific, unique susceptibility to the adverse effects of silica (ILSI, 2000). In addition, silica was not mutagenic in *Salmonella typhimurium* or *Escherichia coli* assays, and in vitro studies in mammalian cells were positive only for micronuclei induction (IARC Working Group, 1987). In short, typical tests for mutagenicity have not indicated that silica is likely to be an initiator for cancer.

Occupational Exposure Limits for Silica

The introduction of the respirable mass method as a sampling technique and its validation in the granite worker cohorts paved the way for proposing a new TLV for quartz in 1971 (Table 2). Like the previous standards, the formula used based the TLV on % of crystalline silica. The new TLV did not replace the previously existing particle-count approaches, but provided industrial hygienists with an option to use either method (i.e., both methods or formulas were considered equivalent). In addition to the new respirable-mass TLV for quartz, ACGIH recommended that TLVs for cristobalite and tridymite be limited to one-half the value calculated for quartz (this approach was applied to both respirable mass and particle-count formulas). The ACGIH subsequently decided to drop the mppcf formula entirely from future TLVs (ACGIH, 1966, 1971).

In 1971, OSHA adopted the ACGIH TLVs as a PEL, which was a federally enforceable limit. Although OELs for silica had been in place for nearly 40 yr, this was the first time in history that employers across the nation were required by federal law to maintain airborne contaminants in the workplace below airborne concentrations specified by the government. The PEL was also based on the gravimetric approach, as well as the option for the particle-count approach. In 1983, the ACGIH opted to simplify the guideline by replacing the formulas for calculating TLVs with recommended limits for respirable and total dust for specific concentrations: 0.1 mg/m^3 for respirable dust and 0.3 mg/m^3 for total dust (ACGIH, 1983). Similarly, the TLVs for cristobalite and tridymite were changed to an explicit and single value of 0.05 mg/m^3 (ACGIH, 1983). Because measurements of respirable dust were easily obtained and were considered the most relevant in terms of health risk, the TLVs for total dust were eliminated by ACGIH in 1986.

In 1974, NIOSH published its "Recommended Standard for Occupational Exposure to Crystalline Silica," in which it proposed a respirable quartz dust limit of 0.05 mg/m^3 in the workplace environment as a time-weighted average, in combination with a program of work practices and medical examinations. This recommendation was based, in part, on the studies in the granite industry by Theriault et al. (1974a, 1974b, 1974c), in which pulmonary function tests and chest x-rays were correlated with dust measurements using the new size-selective respirable mass sampling and gravimetric method. NIOSH acknowledged that these studies did not identify a "safe" level of exposure (that is, one that presents no risk but, rather, tolerable risk) and noted that the exposure-response model used in the study predicted a significant incidence of silicosis when zero dust exposure was used as the input. Nonetheless, NIOSH recommended that the limit of exposure to quartz, cristobalite, and tridymite in workplace environments should be no greater than 0.05 mg/m^3 (Theriault et al., 1974a, 1974b, 1974c; NIOSH, 1974).

The 1974 NIOSH document was fairly controversial at the time. Not only did NIOSH equate all three crystalline forms of silica (despite the decades of research showing that the hazards of quartz, cristobalite, and tridymite were not the same), but their findings were based on Theriault et al. (1974a, 1974b, 1974c), which NIOSH had acknowledged was not a source suitable for deriving an OEL. OSHA and ACGIH did not adopt NIOSH's recommendation, due in part, to a study performed by Graham et al. (1981), which evaluated the same group of workers as Theriault et al. and found an increase, rather than a decrease, in pulmonary function (OSHA, 1989). When OSHA updated its standard in 1989, the PEL was changed to 0.1 mg/m^3 for respirable dust containing quartz (regardless of percentage) and to 0.05 mg/m^3 for cristobalite and tridymite, although these values were later rescinded by the U.S. Court of Appeals based on administrative procedural grounds (OSHA, 1989). A respirable quartz OEL of 0.1 mg/m^3 was also recommended by the American Society for Testing and Materials (ASTM) in 1986 (ASTM, 1986). ASTM commented that the Theriault et al. (1974a, 1974b, 1974c) studies did not demonstrate that an OEL higher than 0.05 mg/m^3 would be unsafe and criticized the extrapolation of particle-count standards to particle mass concentrations based on concerns that the granite-shed studies (10 mppcf, or approximately 0.1 mg/m^3) may not be representative for all types of quartz-containing dusts.

Abrasive Blasting Studies and Developments in Industry

The hazards of abrasive blasting were well known when OSHA was promulgated in 1970. Nonetheless, cases of acute silicosis among abrasive blasters continued to be reported in the literature (Suratt et al., 1977; Owens et al., 1988; Giles et al., 1978). In general, these reports documented silica exposures far in excess of the TLV, with rapid onset of disease (usually within a few years). In addition, exposure studies during abrasive blasting operations were conducted in the Louisiana Gulf area throughout the 1970s (Samimi et al., 1974, 1975, 1978a; Ziskind et al., 1976). With no mining or quarrying industry, silicosis was a relatively rare disease in Louisiana until around 1950, when the offshore drilling, shipbuilding, and ship repair industries developed. Abrasive blasting was commonly used for surface preparation in all of these industries (Hughes, 1982).

In 1972, a longitudinal study of silicotics was initiated in the Louisiana Gulf area. Study participants were identified through personal consultations and local hospitals; by 1982, 83 men with silicosis were enrolled (Hughes et al., 1982). Disease progression was monitored by x-ray examinations and lung function tests. Follow-up ranged from 1 to 7 yr. Air samples for various job titles obtained from Samimi et al. (1978b) were combined with work histories to estimate cumulative silica dust exposures; impairment of lung function was greater among men in the higher exposure categories. Most of the study participants had worked as abrasive blasters in the 1950s and 1960s, and the average length of exposure to abrasive blasting operations was 11.3 yr. These observations were consistent with what had been published previously regarding acute silicosis in abrasive blasters (Merewether, 1936; Jones et al., 1975).

Exposure studies that were also conducted during this period focused specifically on abrasive blasting in Louisiana steel fabrication yards during slow (up to 2.5 h per day), moderate (2.5–5 h), and busy (5 h and above) conditions (Samimi et al., 1974, 1975, 1978a). Air samples were collected for a variety of job types, including the abrasive blaster, pot tender, helper, and other nearby workers (Figure 11). Samples were also collected from inside and outside abrasive blasting hoods (both air-fed and non-air-fed). It was noted by Samimi et al. (1974) that, with the exception of the abrasive blaster, workers rarely wore respiratory protection during abrasive blasting. Airborne

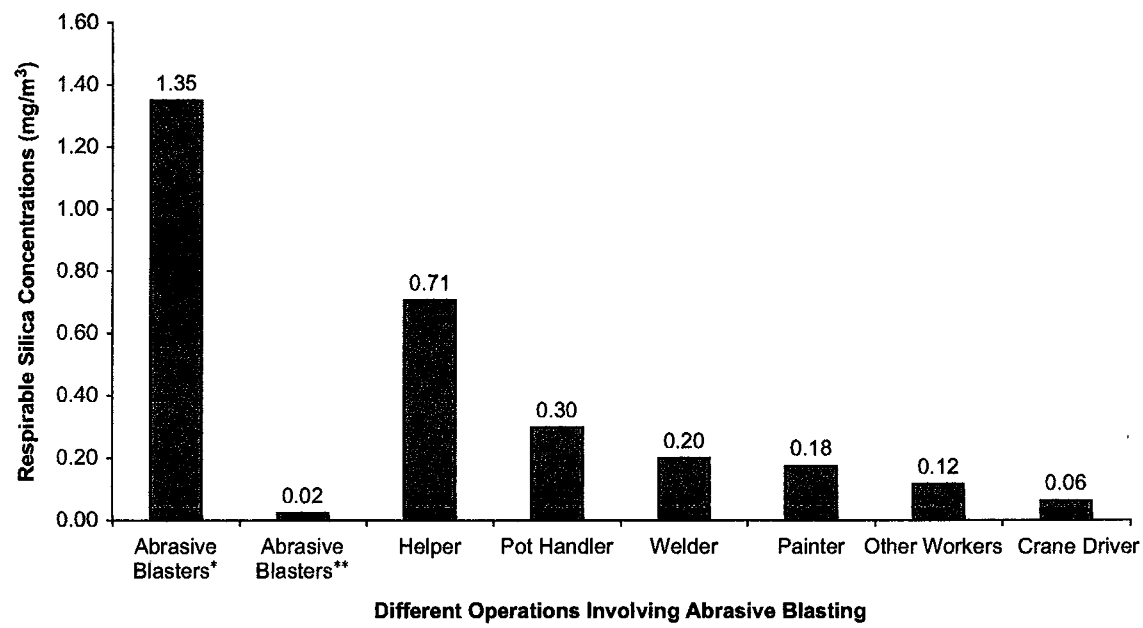


FIGURE 11. Respirable silica exposures for different abrasive blasting jobs preformed with and without appropriate respiratory protection (Samimi et al., 1974, 1975).

*workers did not wear respiratory protection.

**workers wore air-supplied hood.

concentrations, reported as the ratio of respirable dust to the TLV at that time, were noted to be 0.3 (inside air-supplied hoods) and 14.1 (outside the hood) during abrasive blasting. Ratios for other types of workers (e.g., helpers, pot tenders, painters, etc.) ranged from 0.7 to 7.4. A 1975 publication of the same data indicated that the respirable dust concentrations were taken "continuously" during the workday and represented the potential time-weighted average concentration during blasting and nonblasting intervals (Samimi et al., 1975). As such, they included time when the hood was off the worker and did not represent exposures when the hood was properly used. For blasters who did not continuously wear air-supplied hoods during abrasive blasting operations, the ratio of respirable silica dust to the contemporaneous TLV ranged from 2.7 to 33.7 (Samimi et al., 1974). Samples collected inside the air-fed hood only during blasting averaged respirable silica concentrations 1/3 the TLV value at that time, indicating that when worn continuously, continuously air-fed hoods could significantly reduce exposures to the abrasive blaster.

The studies conducted by Samimi et al. (1974, 1975) consistently demonstrated that concentrations of respirable dust during abrasive blasting were considerably above the TLV, despite the fact that many of these activities occurred outside. In the late 1970s, OSHA also conducted surveys during abrasive blasting in foundries. Data compiled from inspections indicated a median value of 13% silica in the dust, and nearly 50% of air samples of silica exceeded a level of 1.2 times the PEL (Oudiz, 1986). In addition, some of the health hazard evaluations and walk-through surveys conducted by NIOSH documented misuse of respiratory equipment or other problems with work practices or control equipment.

In response, NIOSH conducted a large-scale survey to determine the number of workers that who performed abrasive blasting and characterized practices across different industries (Blair, 1974). Six target locations were chosen, and selection was focused to give a large representation to shipyards (five of the six target locations contained seaports). Other industries surveyed (172 companies in total) included the monument industry, auto body repair shops, painting and construction, and foundries. Questionnaire responses indicated that a high proportion of the abrasive blasting work was performed in unconfined areas (outdoors and in large work areas) or in enclosed areas (i.e., tank with the worker on the outside). Silica sand was used in 44.7% of abrasive blasting operations. Other abrasives that were reportedly used included steel shot (16.7%), steel grit (9.7%), alumina (9.3%), flint/garnet (7%), glass beads (4.6%), carbides (3.5%), slag (3.1%), and organics such as cobs or pecan shells (1.1%) (Blair, 1974). With respect to typical abrasive blasting practices, the majority of industries surveyed used hand-held hoses for the dry-blast processes. The authors noted that the only other process reported in significant numbers was the centrifugal or "airless" process; workers generally did not use respirators when performing airless blasting. In addition, some job sites reported that workers did not wear respiratory protection during outdoor abrasive blasting or other abrasive blasting operations on stone.

In 1974, NIOSH published its "Industrial Health and Safety Criteria for Abrasive Blast Cleaning Operations," which described typical practices based on a survey of 92 manufacturers known to perform abrasive blasting (Goodier et al., 1974). Airborne dust concentrations at participating plants were measured, and it was reported that when silica sand was used as an abrasive, airborne silica measurements usually exceeded OSHA and ACGIH OELs, which was not observed with metallic shot or slag abrasives (Goodier et al., 1974). Soon thereafter, in 1976, NIOSH published several documents pertaining to safe abrasive blasting operations. These generally focused on engineering controls and work practices and also provided an overview of the various types of blasting equipment and dust control methods, as well as recommended ventilation guidelines for abrasive blasting operations (NIOSH, 1976a, 1976b). In addition, it was also suggested that blasters use some of the newer abrasives available at the time, such as wet-bottom boiler slag ("Black Beauty") or copper slag, both of which contained less than 1% silica (NIOSH, 1976a).

Respiratory Protection Guidelines for Abrasive Blasting

The creation of OSHA and the institution of federal regulations in the early 1970s also affected guidelines for the use of respiratory protective equipment. In 1971, OSHA published its first respiratory protection standard based on the 1969 ANSI standard on respiratory protection and ANSI's standard on identification of gas mask canisters. The OSHA standard required that employers provide proper respiratory protection to their employees when necessary to protect their health and refers the reader to ANSI Z88.2 for guidance as to how to choose the proper respiratory protection. It should be noted that OSHA did not allow that respiratory protection be a primary means of control, rather substitution, isolation, and ventilation should be the principle means of controlling exposure (OSHA, 1971a).

Although the OSHA respiratory protection standard did not specifically address abrasive blasting, the Department of Labor adopted the Bureau of Labor Standards, Safety and Health Regulations for Ship Repairing outlined requirements for abrasive blasting hoses, hose couplings, nozzles, "dead man control," and personal protective equipment (PPE), which included protective clothing and either (1) hoods and air-fed respirators, or (2) air-fed helmets with positive-pressure air flow. Abrasive blasters working in open spaces were also required to wear air-fed respirators or helmets, unless the abrasive contained less than 1% free silica. For low-silica (<1%) situations, a Bureau of Mines USBM-approved filter respirator appropriate for lead dusts was permitted. Eye and respiratory protection, in addition to protection against impact, were also required for workers in proximity to abrasive blasters (e.g., pot tenders, recovery men) (U.S. Department of Labor, 1964).

NIOSH became involved in respiratory protection when it began approving respirators in 1972. NIOSH jointly approved respirators with USBM until 1973, when the Mining Enforcement Safety Administration (MESA) was created from the regulatory division of the USBM and assumed safety and health enforcement functions. In 1974, MESA assumed the former USBM role of jointly approving respirators with NIOSH, until 1977, when the Federal Mine Safety and Health Act was passed. The passage of this act created the Mine Safety and Health Administration (MSHA) by moving MESA from the Department of the Interior to DOL (U.S. Department of Labor, 1977; OSHA, 1998b). NIOSH and MSHA jointly approved respirators until 1995, when NIOSH became the sole approval agency for all respiratory protection equipment, with the exception of selected mining-specific respirators (NIOSH, 1995; OSHA, 1998b).

In the 1970s, NIOSH contracted the Los Alamos Scientific Laboratory (LASL) to provide advice on how to improve the respirator approval process. In 1976, LASL acknowledged the need for the respirator certification program to include fit testing. This recommendation was based on human studies that evaluated how respirators fit on differently sized and proportioned faces (Douglas et al., 1976; Hack et al., 1974). One of the major outcomes was the development of a "fit test panel," which incorporated dimensions of the face and lips of the various participants in the studies. This information was used during respirator testing to ensure that each respirator would provide adequate protection to a heterogeneous worker population (Douglas et al., 1976). Quantitative respirator fit testing was incorporated into the ANSI 1980 update of the American National Standard Practices for Respiratory Protection (Z88.2). This document also introduced a method for assigning respirator establishing protection factors based on the respirator, work area, and wearer, which provided a more conservative approach to the selection and classification of respirators (ANSI, 1980).

As described previously, NIOSH was actively involved in investigations of abrasive blasting practices throughout the 1970s. The resulting reports often discussed what respiratory protection measures were necessary to adequately protect workers against silica exposures. The use of a separate air supply (either as a supplied-air respirator or an air-supplied hood) was always recommended, which was consistent with the scientific literature and previously published guidelines in existence at the time (Figure 6) (U.S. Department of Labor, 1964). Specifically, NIOSH recommended a Type C continuous-flow, supplied-air respirator (in combination with a hood or helmet) during abrasive blasting using silica sand (NIOSH, 1974). These recommendations were adopted by OSHA in a 1978 directive, which served as an internal document for OSHA to evaluate compliance with the standard and determine whether there were grounds for citing an employer (OSHA, 1978). Furthermore, a 1976 NIOSH report on engineering controls and work practices for abrasive blasting operations recommended wearing an abrasive blasting respirator that was MESA/NIOSH approved (NIOSH, 1976a).

THE MODERN YEARS (1990–2008)—REFINING RESEARCH AND REEXAMINING THE OCCUPATIONAL EXPOSURE LIMITS FOR SILICA

Studies of Health Effects

Silicosis Exposure-Response Models A major focus of health studies in the 1990s was to further characterize the exposure-response relationship between crystalline silica and silicosis. Improvements in exposure assessment and dose reconstruction methods, as well as continued follow-up of established occupational cohorts, allowed researchers to generate quantitative estimates of disease risk at different levels of silica exposure over a working lifetime. These new studies, which attempted to account for well-established confounders (e.g., diagnostic criteria, length of follow-up), suggested that the OSHA PEL for silica did not provide sufficient protection against the development of disease. Most of these studies offered a quantitative estimate of risk for silicosis mortality, and at least one developed a model to estimate a "no-observed-adverse-effect level" (NOAEL), which would define a threshold dose below which illness would not be expected (Rice & Stayner, 1995).

A cohort morbidity study of Ontario hardrock miners was among the first to develop quantitative risk estimates for silicosis associated with different respirable silica exposures for a working lifetime (Muir et al., 1989a, 1989b; Verma et al., 1989). This study was a joint effort between the management of the gold mines, Canadian government, and Workers' Compensation board, and involved collecting of data from 2,109 miners at two gold and uranium mines. The highest risks were observed among workers employed in dusty areas, rather than those who had worked the longest in the industry. Although workers were not followed after leaving the mines, there were a total of 32 (1.5%) cases of silicosis identified by a panel of B-readers in this cohort.[8] The authors estimated a cumulative risk estimate (%) of silicosis incidence of 1.2 (0.7–2.1) based on 40 yr of exposure at a mean respirable concentration of the current OSHA PEL of 0.1 mg/m^3 (Muir et al., 1989a, 1989b; Verma et al., 1989).

While the analysis of the hardrock miners was one of the more thorough exposure-response studies conducted during this time period,[9] the small number of silicosis cases and the lack of follow-up of workers after they left the work force were considered significant shortcomings, in that the true prevalence of silicosis could have been substantially underestimated. Later cohort studies conducted in the early 1990s included longer follow-up periods and attempted to determine the health status of workers who had left the work place. In a cohort study by Hnizdo and Sluis-Cremer (1993), the health status of white South African gold miners who had worked at least 10 years between 1940 and the early 1970s was followed through 1991. Of these miners, 14% were silicotic, and of these silicotics, 57% displayed radiological signs of silicosis an average of 7.4 yr after leaving the mines (Hnizdo & Sluis-Cremer, 1993). The reported silicosis rates were considerably higher than in previous studies, which the authors attributed to the longer follow-up period. It was also suggested at the time, however, that the average dust exposures (which had been based on samples collected from 20 gold mines in the 1960s) might have been underestimated (Gibbs & Du Toit, 2002), or that South African quartz produced more toxicity than Canadian quartz. Based on these data, the cumulative risk of silicosis incidence at 9 mg/m^3-yr (roughly equivalent to 28 yr at the current PEL) of respirable dust was estimated to be 25%.

The South African study was among the first to question the protectiveness of the OSHA PEL and to indicate that exposures at 0.1 mg/m^3 for a 40- or 45-yr working lifetime might not protect against silicosis (Figure 12) (Hnizdo & Sluis-Cremer, 1993). Since then, a number of other epidemiological studies reported varying estimates of silicosis risk associated with a lifetime of work at the current occupational standard (Table 4) (Rosenman et al., 1996; Steenland & Brown, 1995b; Kreiss & Zhen, 1996; Chen

[8] To address reader variability in classification of x-rays, NIOSH instituted the B-Reader Certification Program in 1974 to standardize the interpretation of pneumoconiosis for workers' compensation programs. To receive certification, a physician must pass a test to demonstrate competence in classifying radiographs according to ILO criteria (NIOSH, 2005a).

[9] In addition to reviewing annual chest x-rays for all miners from 1927 to 1982 (the end of the follow-up period), a side-by-side study of konimeter and gravimetric sampling was undertaken to allow for conversion of older konimeter data to gravimentric concentrations of respirable silica. This sampling was done separately for 29 tasks, because it was believed that the conversion could vary based on the type of dust produced by each task. Historical practices (i.e., dry drilling) were also simulated for purposes of converting older konimeter data.

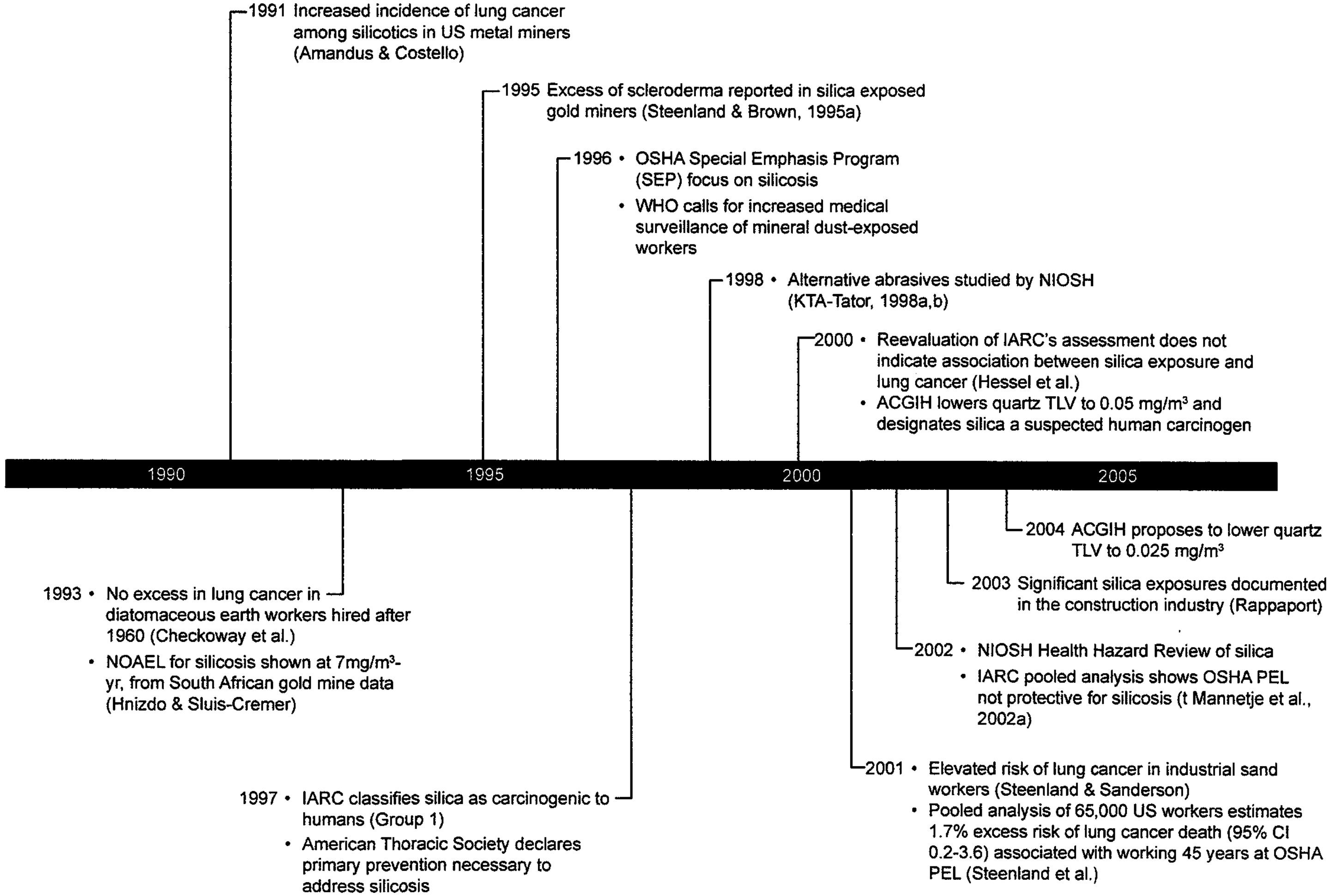


FIGURE 12. Timeline of key studies and events that led to the recognition of the hazards of silica (1990–2008).

et al., 2001; ASA, 1959; Churchyard et al., 2004; Park et al., 2002; Checkoway et al., 1997; t Mannetje et al., 2002a, 2005t Mannetje & Pearce, 2005). Risk estimates reported in some of the larger studies have ranged from 1 to 80%, but generally were consistent in that the estimated risk of silicosis incidence exceeded OSHA's acceptable risk level of 1 in 1,000. Few studies provide an estimate of a "safe" exposure level, although in the Rice and Stayner (1995) study, data from 6 epidemiological studies were reviewed, and the NOAEL was estimated to be between 7 and 100 μg/m^3. The authors noted that such a wide range indicates a high degree of uncertainty and demonstrates the difficulty in drawing conclusions about safe exposure levels. Possible reasons for the differences in risk include the large variation in follow-up time, lack of information regarding peak exposures, or differences in exposure patterns (Finkelstein, 2000; NIOSH, 2002a). It has also been suggested that the dose-response curve for silicosis is nonlinear, with risk increasing more rapidly at higher exposure levels (Hnizdo & Sluis-Cremer, 1993).

To address the variability among the studies, IARC conducted a pooled exposure-response analysis of six occupational cohorts (t Mannetje et al., 2002a, 2002b). Original exposure data were obtained from the principal investigators, converted to a common exposure metric (mg/m^3), and organized into job-exposure matrices (t Mannetje et al., 2002b). The analysis focused on mortality from

TABLE 4. Summary of Exposure-Response Studies and Lifetime Estimates of Silicosis Risk for Silica Exposures at the OSHA PEL (0.1 mg/m^3)

Industry	Study	Outcome	Lifetime Silicosis Risk at OSHA PEL 0.1 mg/m^3 [(a)]
Granite			
Mining	Ng and Chan, 1994		15–20%[b]
Gold and uranium	Muir et al, 1989a	Incidence	0.4 (0.2-1.1)[c]
Gold	Hnizdo and Sluis-Cremer, 1993	Incidence	77% [d]
Gold	Steenland and Brown, 1995b	Incidence	35–47% [e]
Hardrock	Kreiss and Zhen, 1996	Incidence	68–80%
Tin	Chen et al, 2001	Incidence	55%
Gold	Churchyard et al, 2004	Incidence	Average prevalence, 19.1%; long term workers, 32%[f]
Tin	Chen et al, 2001	Incidence	55%
Tungsten	Chen et al, 2005	Incidence	7%[k]
Diatomite			
	Checkoway et al, 1997	Mortality	RR 3.17 (1.25-8.05)[g]
	Hughes et al, 1998	Incidence	1.1%[h]
	Park et al, 2002	Mortality	100-140/1000
Foundry			
	Rosenman et al, 1996	Incidence	OR 2.1 (1.56–2.82)[c]
Pottery workers			
	Chen et al, 2005	Incidence	13%[l]
Dusty trades			
	Rice et al, 1986	Incidence	Significant risk[i] at 2.5 mppcf [c]
Pooled analyses			
Data from six cohorts [j]	t Mannetje et al, 2002a	Mortality	13/1000

[a]*45 year work history unless otherwise noted.*

[b]*Reported in Chen 2001.*

[c]*40 year work history.*

[d]*~4.5 mg/m^3 -yr cumulative respirable silica dust (assuming 30% quartz content at a respirable dust concentration of 0.4 mg/m^3 for 37 yr).*

[e]*calculated using 0.09 mg/m^3 -yr PEL.*

[f]*87–93% samples <0.1 mg/m^3.*

[g]*cumulative exposure (2.1-5 mg/m^3 -yr); risk of non-malignant respiratory disease.*

[h]*2 mg/m^3 -yr crystalline silica exposure; risk of opacities.*

[i]*no risk calculation.*

[j]*Pooled analysis included: Checkoway et al. 1997, Koskela et al. 1994, Costello et al. 1988, Steenland and Sanderson 2001, Steenland and Brown 1995a, DeKlerk et al. 1998. These studies were designed to detect lung cancer exposure-response relationships; the data was pooled and re-analyzed to measure silicosis risk.*

[k]*Based on Chinese Method for total dust of 4.6 mg/m^3 for 45 yr.*

[l]*Based on Chinese Method for total dust of 2.0 mg/m^3 for 45 yr.*

silicosis, which the authors noted was seldom studied because of the relatively small number of deaths where silicosis was reported on the death certificate as the underlying cause. Quantitative exposure data were derived from studies of U.S. diatomaceous earth workers, Finnish granite workers, U.S. (Vermont) granite workers, U.S. industrial sand workers, U.S. gold mine workers, and Australian gold miners (Checkoway et al., 1997; Koskela et al., 1994; Costello & Graham, 1988; Steenland & Sanderson, 2001; Steenland & Brown, 1995a; de Klerk & Musk, 1998). Together, the pooled cohort contained 18,364 workers, of whom 170 died from silicosis or an unspecified pneumoconiosis. The silicosis mortality rate for the entire cohort was 28.8 per 100,000 person years, while the estimated cumulative risk of death from silicosis was 13/1000 for exposure to 0.1 mg/m^3 from age 20 to 65. Although the authors did not provide an estimate of an occupational exposure limit that would result in less than a 1-in-1000 risk of silicosis mortality, it was emphasized that the current OSHA PEL of 0.1 mg/m^3 was not sufficiently protective (t Mannetje et al., 2002a).

Silica, Silicosis, and Lung Cancer In the two decades following the IARC 1986 designation of silica as a 2A probable carcinogen, numerous epidemiological studies have been conducted to address the relationship between silica exposure, silicosis, and lung cancer (Figure 12). Similar to the exposure-response studies, there was considerable potential for exposure misclassification and other possible biases (Hessel et al., 2000). The extent to which these factors played a role has varied by industry. Some of the earlier studies during this era were conducted in the pottery and stone workers, but many of the positive associations were attributed to other exposures (e.g., cigarette smoke, PAHs), which confounded the exposure response patterns of silica (Costello and Graham, 1988; McDonald, 1995; McLaughlin et al., 1992). Studies in the pottery and ceramic industries at the time showed conflicting results, which were explained, in part, by exposures to other substances (Meijers et al., 1990; Thomas, 1982, 1990), as well as the selection of the referent populations used to calculate mortality ratios. Although the presence of other carcinogens was less of an issue in the granite industry, there were mixed findings of increased lung cancer mortality among granite workers compared to the general population (Davis et al., 1983; Steenland & Beaumont, 1986; Costello & Graham, 1988; Koskela et al., 1987a, 1987b). A more recent follow-up study of the Vermont granite worker cohort found increased lung cancer mortality among silica-exposed workers (SMR = 1.17, $p < .05$), although a dose-response trend was not seen across all the exposure groups (Attfield & Costello, 2004). Excess lung cancer risk was documented among diatomaceous earth and refractory brick workers, who were exposed primarily to cristobalite (Checkoway et al., 1993; Rice et al., 2001).

Increased lung cancer risk has been reported in studies throughout the 1990s and 2000s. In many cases, however, these associations were not statistically significant, or significant findings were limited to workers with silicosis (Figure 13). The issue of whether silicosis is a necessary step in the development of lung cancer has been a controversial issue for many years (Checkoway & Franzblau, 2000). Beginning in the mid-1990s, several meta-analyses were conducted using studies of silicotics. In these studies, the estimates of relative risk for lung cancer mortality ranged from 1.3 (95% CI 1.2–1.4) to 2.2 (95% CI 2.1–2.4) (Smith et al., 1995; Steenland & Stayner, 1997). While the individual studies included in each meta-analysis varied, many of the original studies contained incomplete (or nonexistent) smoking data.

In 1997, IARC reevaluated the carcinogenicity of crystalline silica (IARC Working Group, 1997) relying upon the "least confounded" epidemiological studies, which included those of the South Dakota gold miners (McDonald et al., 1978; Brown et al., 1986; Steenland & Brown, 1995a), Danish stone-industry workers (Guenel et al., 1989), Vermont granite-shed and quarry workers (Costello & Graham, 1988), U.S. crushed-stone-industry workers (Costello et al., 1995), U.S. diatomaceous-earth workers (Checkoway et al., 1993, 1996), Chinese and Italian refractory-brick workers (Dong et al., 1995; Merlo, 1991), and Chinese and United Kingdom pottery workers (McDonald et al., 1995; Chen et al., 1992; McLaughlin et al., 1992) (Table 5). Cohorts of registered silicotics in North Carolina and Finland were also considered (Amandus et al., 1991; Partanen et al., 1994). IARC concluded in its assessment that "the epidemiological findings support increased lung cancer risks from inhaled crystalline silica (quartz and cristobalite) resulting from occupational exposure" that could not be explained by confounding or other biases. IARC also noted, however, that "carcinogenicity in humans was not detected in all industrial circumstances studied" (IARC Working

Group, 1997). Although IARC designated crystalline silica as a Group 1 carcinogen ("sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the form of quartz or cristobalite"), this decision provoked controversy within the scientific community (Hessel et al., 2000; Soutar et al., 2000; Pelucchi et al., 2006; Checkoway & Franzblau, 2000; Wong, 2002; Vallyathan et al., 1998). Some of the primary arguments against the IARC designation were inconsistencies amongst the studies and weakly significant findings. The lack of smoking information in many of the studies and the unreliability of older exposure data were also noted. Hessel et al. (2000) published a response to the IARC working group, in which an alternative analysis was conducted (Table 5). The authors included nearly 20 of the studies upon which IARC relied, as well as some that had been published since the 1997 evaluation. Studies of compensated silicotics were excluded (Hessel et al., 2000). The analysis did not find an association between lung cancer and exposure to silica dust.

In 2002, NIOSH published a health hazard review for silica, in which the lung cancer studies were considered (NIOSH, 2002a). The review focused on the same industries as the 1997 IARC

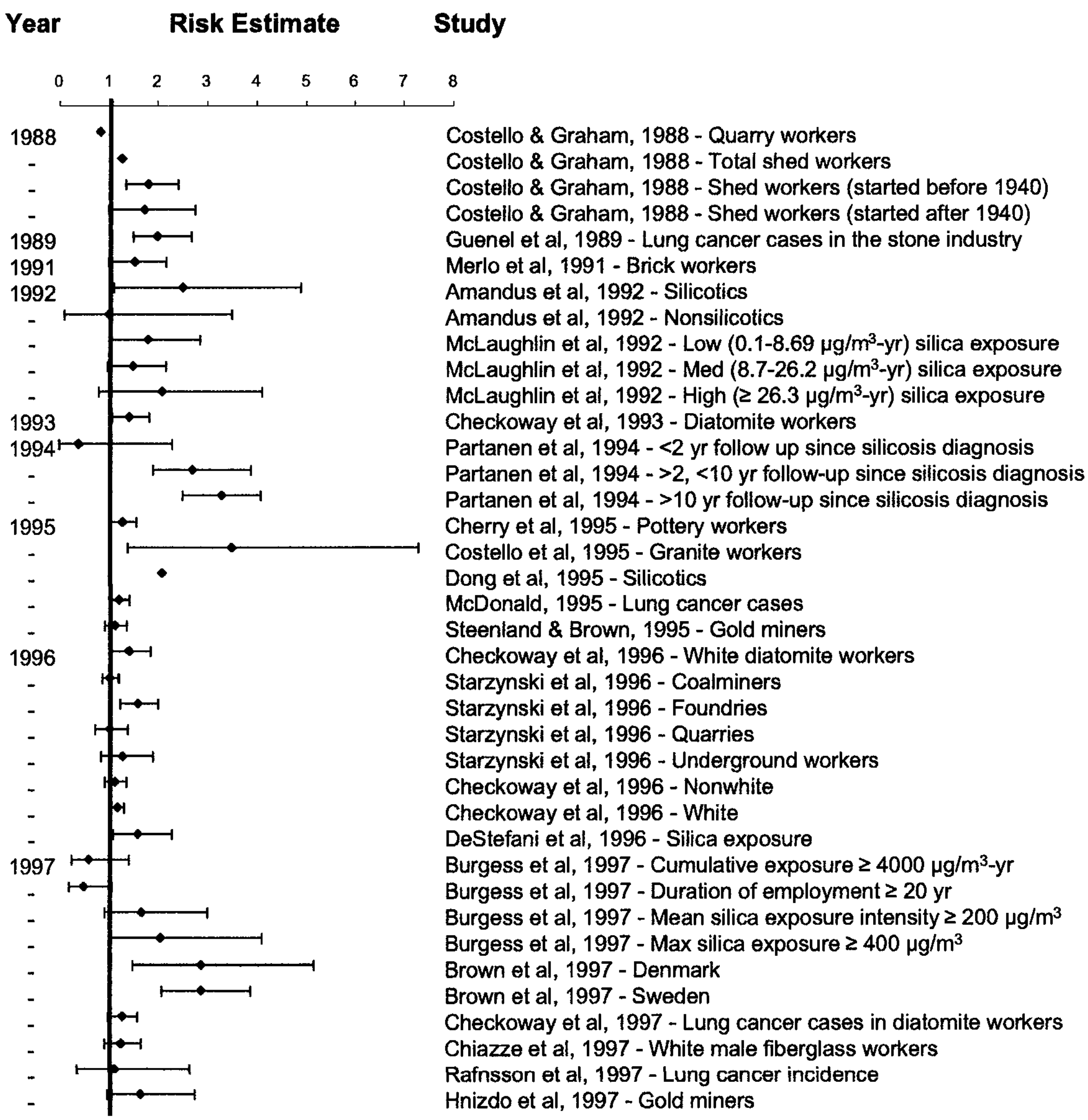
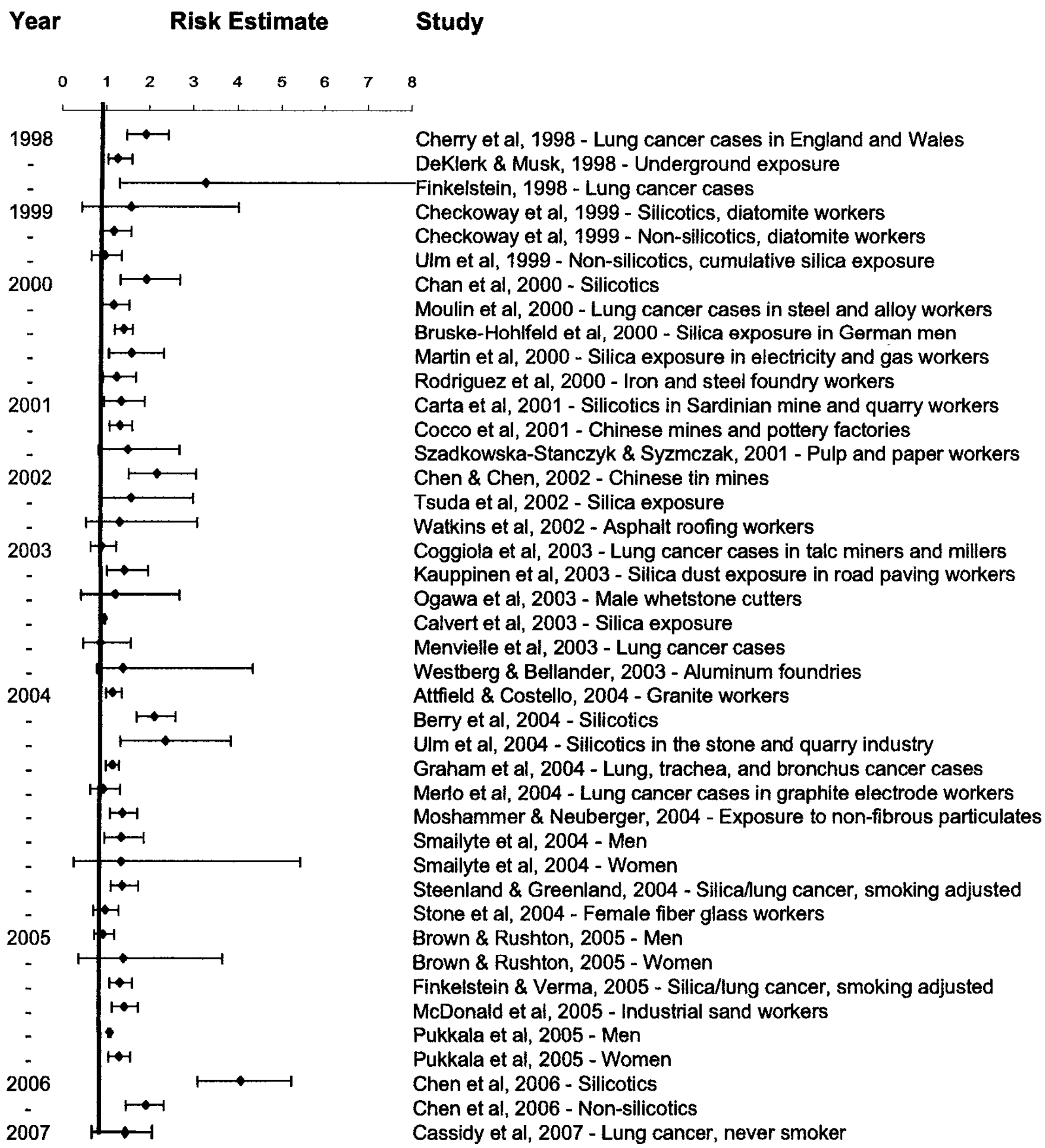


FIGURE 13. Estimates of risk of lung cancer from epidemiological studies of silica-exposed workers.



Adapted in part from Pelucci et al., 2006

FIGURE 13. (*Continued*).

assessment, with the exception of studies involving silicotics found in local or national registries or those that were considered to be confounded due to inadequate exposure assessment, selection and/or confounding bias, inadequate controlling for smoking or exposure to other carcinogens, lack of evidence of an exposure-response relationship, or the inability to distinguish differences in the fibrogenic and carcinogenic potencies of the various silica polymorphs (Table 5). NIOSH also discussed several studies that had been published subsequent to the IARC assessment and noted that, overall, their review supported IARC's conclusion that there was an association between lung cancer risk and silicosis. A review of the literature by ACGIH (2006) noted that, while a number of U.S. and international agencies agreed that a positive association exists between silica exposures and

TABLE 5. Summary of Key Analyses and Studies Relied Upon for the Evaluation of the Carcinogenicty of Silica

Cohorts	IARC 1997	Hessel, 2000	NIOSH 2002	2002 IARC*
Miners				
U.S. gold	Steenland and Brown, 1995a Brown et al, 1986 McDonald et al, 1978	Steenland and Brown, 1995a	Steenland and Brown, 1995a	Steenland and Brown, 1995a Steenland et al., 2001
South African gold	–	Hessel et al, 1986 Hessel et al, 1990 Hnizdo and Sluis-Cremer, 1991 Reid and Sluis-Cremer, 1996 Hnizdo et al, 1997	–	Hnizdo et al, 1997 Steenland et al., 2001
Chinese tin, tungston, iron-copper	–	McLaughlin et al, 1992	–	Chen et al, 1992
Australian gold		de Klerk and Musk, 1998		de Klerk and Musk, 1998 Steenland et al., 2001
Granite and stone workers				
Danish stone	Guenel et al, 1989	–	Guenel et al, 1989	–
Finnish granite				Koskela et al, 1994 Steenland et al., 2001
Vermont granite shed and quarry	Costello and Graham, 1988	–	Costello and Graham, 1988	Costello and Graham, 1988 Steenland et al., 2001
U.S. crushed stone	Costello et al, 1995	–	Costello et al, 1995	
U.S. diatomaceous earth	Checkoway et al, 1993, 1996	Checkoway et al. 1993, 1996	Checkoway et al. 1993, 1996	Checkoway et al, 1997 Steenland et al., 2001
German stone, quarrying, ceramics industry	–	Ulm et al, 1999	–	
U.S. industrial sand				Steenland et al, 2001
Refractory brick workers				
Chinese	Dong et al, 1995	–	Dong et al, 1995	–
Italian	Merlo et al, 1991	–	Merlo et al, 1991 Puntoni et al, 1988	–
Pottery workers				
U.K.	Cherry et al, 1995, 1997 McDonald et al, 1995 Burgess et al, 1997 Winter et al, 1990	Cherry et al, 1998	Cherry et al, 1995, 1997 McDonald et al, 1995, 1997 Burgess et al, 1997	–
Chinese	McLaughlin et al, 1992 Chen et al, 1992	McLaughlin et al, 1992	McLaughlin et al, 1992	Chen et al, 1992 Steenland et al., 2001
Registries				
Silicotics	Amandus et al, 1992 Partanen et al, 1994	–	Amandus et al, 1991, 1992 Partanen et al, 1994 Kurppa et al, 1986	–
Result/Conclusion	Overall, "carcinogenic to humans," support for carcinogenicity of silica varies by industry	Lack of causal relationship between silica and lung cancer	"NIOSH concurs with the conclusions of the IARC (1997) and the ATS"	Estimated excess lifetime risk was 1.7% (95% CI 0.2% –3.6%)

*Steenland et al., 2001.

lung cancer, there was no consensus on the issue of whether silica is actually a confirmed human carcinogen (ACGIH, 2006).

To address some of the issues posed by the scientific community, Steenland et al. (2001) conducted a pooled analysis using the cohorts that were developed for the exposure-response studies described previously (Steenland et al., 2001). This pooled analysis included 65,000 workers in 10 cohorts and over 1000 lung cancer deaths. Pooling the number of lung cancer deaths across multiple occupational cohorts allowed researchers to increase the statistical confidence in their comparisons over other studies that individually may not have had the statistical power to detect a statistical difference. Data from foundries were excluded to prevent confounding from co-carcinogens, such as PAHs. Results from studies of coal miners were also excluded because of the relatively low silica content of the dust. Smoking information was available for 4 of the 10 cohorts. In this analysis, odds ratios for lung cancer increased by quintiles of cumulative exposure, and similar results were observed when average exposure was considered. The Steenland study reported that the log of cumulative exposure, with a 15-yr lag, was predictive of lung cancer ($p = .0001$), with consistency across studies (test for heterogeneity, $p = .34$). They reported that the results were consistent between underground mines and other facilities (Steenland et al., 2001).

The role of silicosis in the development of lung cancer remains an unresolved matter today. In a review published by Checkoway and Franzblau (2000), 10 studies that presented lung cancer risk estimates separately for silicotics and nonsilicotics were assembled and analyzed (Checkoway & Franzblau, 2000). While the authors noted that epidemiologic and experimental evidence supports the IARC 1997 classification of crystalline silica as a human lung carcinogen, they also concluded that there remains uncertainty about whether excessive lung cancer occurs exclusively among workers with silicosis. A more recent review of studies conducted between 1996 and 2005 (excluding those previously reviewed in the IARC monograph) used random effects models to estimate pooled relative risks (RRs) for lung cancer separately among studies of silicotics, nonsilicotics, and those in which the status of silicosis was unknown (Pelucchi et al., 2006). In total, 45 studies were considered. The pooled RRs for the cohort studies ($n = 28$) were 1.69 (95% CI 1.32–2.16) for silicotics, 1.25 (95% CI 1.18–1.33) when silicosis status was unknown, and 1.19 (95% CI 0.87–1.57) for nonsilicotics. For case-control studies ($n = 15$), pooled RRs were 3.27 (95% CI 1.32–8.2) for silicotics, 1.41 (95% CI 1.18–1.7) when silicosis status was unknown, and 0.97 (95% CI 0.68–1.38) for nonsilicotics. The pooled RR for the two PMR studies considered was 1.24 (95% CI 1.05–1.47).

Based on the current literature, it is uncertain whether the increased risk of lung cancer among silicotics is actually due to the fibrotic nature of the lung or if silicosis is merely a marker for high silica exposures. Only a handful of studies specifically addressed lung cancer risk in the absence of silicosis; these have shown conflicting results (Ulm et al., 1999; Checkoway & Franzblau, 2000). The quality of data regarding smoking, which is known to produce pulmonary fibrosis and lung cancer, must also be considered when evaluating the literature related to this topic. Estimates of an association between silica exposure and lung cancer are weaker than many, if not most, other carcinogens (Steenland et al., 2001). Taken together, the true relationship between silica exposure, silicosis, and lung cancer may never be entirely clear.

Relationship Between Silica Exposure and Nonpulmonary Disease Over the last 10–15 yr, a number of studies addressing the potential association between silica exposure and autoimmune and kidney diseases have appeared in the scientific literature. While case reports in silica-exposed workers were published in the early 1900s, it was not until the mid 1980s that epidemiological studies were conducted to evaluate the relationship between silica and autoimmune diseases such as scleroderma, rheumatoid arthritis (RA), and systemic lupus erythematosus (SLE) (Bramwell, 1914; Calvert et al., 2003; Rosenman et al., 1999; Sluis-Cremer et al., 1985; Rafnsson et al., 1998; Burns et al., 1996). It has been difficult to characterize the risk of autoimmune disease among workers exposed to silica because environmental and genetic factors (e.g., gender, family history) can greatly influence the development and progression of these illnesses, yet they cannot be readily controlled for in occupational studies (Arnett, 2000; Silman & Newman, 1996; Steen, 1999). In addition, women are more susceptible to many autoimmune diseases, but occupational cohorts are predominantly male;

thus, the relative rarity of these diseases among men makes it difficult to achieve the statistical power necessary for epidemiology studies (Jacobson et al., 1997; Parks et al., 1999).

Scleroderma has been the most commonly studied autoimmune disorder in occupational studies involving silica. Scleroderma, which literally means "hardening of the skin," is a disorder of the connective tissue characterized by increased collagen production (Industrial Disease Standards Panel, 1992). Prior to 1990, the majority of the literature that connected scleroderma to silica exposure included case reports, prevalence surveys, and ecological studies with few case-control studies (Rodnan et al., 1967; Sluis-Cremer et al., 1986; Steen, 1999). More recent studies have evaluated scleroderma mortality rates among workers exposed to silica. Excess rates were reported in some, but not all, of the cohorts (NIOSH, 2002a). The use of mortality data to study scleroderma in occupational settings has been problematic, because in general, scleroderma is not a fatal disease. These studies also failed to account for family history or possible confounding exposures.[10] While the causes of scleroderma are unknown, a family history of scleroderma and other autoimmune disease, and gender (scleroderma is 3–8 times more common in women than in men) are considered the strongest risk factors (Industrial Disease Standards Panel, 1992; Jacobson et al., 1997; Arnett, 2000). Nonetheless, the American Thoracic Society (ATS) has recently concluded that the evidence relating silica exposure to scleroderma is persuasive where there is an appreciable silicosis risk; although NIOSH did not find sufficient evidence to reach the same conclusion, it referenced the literature that has found statistically significant numbers of excess deaths (American Thoracic Society Committee of the Scientific Assembly on Environmental and Occupational Health, 1997; NIOSH, 2002a).

Similar issues must be considered when evaluating the relationship between silica exposure and the development of rheumatoid arthritis (RA). RA, which is characterized by painful joint inflammation, also has a strong genetic component and has been associated with a number of environmental and lifestyle risk factors (e.g., female hormonal changes, cigarette smoking, diet, and infections) (Oliver & Silman, 2006; Klockars et al., 1987; Caplan, 1953). In recent epidemiological studies, positive associations between silica exposure and RA have been reported (Calvert et al., 2003; Rosenman & Zhu, 1995; Rosenman et al., 1999; Sluis-Cremer et al., 1986). However, these studies either did not adjust for confounders (e.g., family history, cigarette smoking) or did not report a concurrent association with other autoimmune diseases such as scleroderma, systemic lupus erythematosus, or sarcoidosis. In 2000, Turner and Cherry reported that cases of RA among pottery, sandstone, and refractory material workers had silica exposures of significantly shorter duration compared to the referents (Turner & Cherry, 2000). An ATS review committee indicated that the association between RA and silica exposure or silicosis is not clear, particularly when RA, silicosis, and most other pulmonary fibrotic diseases may not produce positive serum tests for antinuclear antibodies and rheumatoid factor (American Thoracic Society Committee of the Scientific Assembly on Environmental and Occupational Health, 1997).

A possible association between silica exposure and systemic lupus erythmatosus (SLE) has also been investigated. SLE is an autoimmune disease that affects multiple organ systems and is characterized by immunological abnormalities, such as hyperactive B cells. SLE is generally believed to develop from the combination of a genetic predisposition and an environmental trigger. Family members of autoimmune disease patients are at a greater risk of developing disease, and endogenous hormone levels have been shown to be important in disease development. Environmental triggers that have been identified include numerous pharmaceuticals containing aromatic amines; other suspected triggers include sex hormones, traumatic life events, cigarette smoking, and hair dyes (Bengtsson et al., 2002). Much of the literature related to silica exposure and SLE consists of case reports (Koeger et al., 1995; Costallat et al., 2002; Bolton et al., 1981). More recently, occupational cohort studies have suggested an association between SLE and high occupational exposures to silica, although the results have not always been statistically significant (Calvert et al., 2003; Sanchez-Roman et al., 1993;

[10]A number of chemicals present in occupational settings, including vinyl chloride, organic solvents such as trichloroethylene, and epoxy resins, have been investigated for a possible association with scleroderma incidence. While a convincing association has not been shown (Steen, 1999), scleroderma has been a compensable occupational disease in South Africa, the former German Democratic Republic, and Ontario, Canada (Industrial Disease Standards Panel, 1992). The majority of claims have been related to silica.

Conrad et al., 1996). NIOSH has concluded that more research is necessary to characterize the relationship between silica exposure and SLE; likewise, the ATS has concluded that a causal association should be suspected only in cases of acute or accelerated silicosis (American Thoracic Society Committee of the Scientific Assembly on Environmental and Occupational Health, 1997; NIOSH, 2002a).

While recent studies have postulated an association between occupational exposure to silica and autoimmune disease, the complex nature of these disorders and the inability to control for important risk factors in epidemiology studies preclude drawing any firm conclusions. In vitro studies have demonstrated that exposing cell cultures to silica can exert an adjuvant effect on antibody production, which could lead to a chronic process of immune stimulation (Parks, 1999). Several mechanisms by which silica could generate an autoimmune response through this pathway have been proposed, but robust animal and experimental studies are lacking. Markers of autoimmune dysfunction have also been documented in abrasive blasters with silicosis, including increased levels of antinuclear autoantibodies, rheumatoid factor, immunoglobins, and immune complexes, although serum levels did not correlate with the severity or progression of lung disease (Doll et al., 1981). Overall, the body of evidence remains unclear, and both NIOSH and ATS have concluded that further research is required before any definitive conclusions can be drawn regarding the association between silica exposure and autoimmune disease (American Thoracic Society Committee of the Scientific Assembly on Environmental and Occupational Health, 1997; NIOSH, 2002a).

In addition, an increased incidence of renal disease has been suggested among silica-exposed workers in a number of published case reports over the last 25 yr (Giles et al., 1978; Haughlustaine et al., 1980; Osorio et al., 1987). However, as was the case with autoimmune disease, it was not until the 1990s that epidemiological studies on this health endpoint were conducted. Small sample sizes and very low incidence have made it difficult to detect associations. There has also been considerable variation in the renal health endpoints included in occupational studies, which has made comparison difficult. Endpoints have ranged from biomarkers of renal function (proteinuria) to specific kidney diseases (glomerulonephritis, hypertensive kidney disease, interstitial kidney disease, Wegener granulomatosis, SLE nephritis, and kidney cancer) to generalized kidney disease (end-stage renal disease, renal disease, and kidney failure) to the physical accumulation of silica in the kidney (Steenland, 2005; Ng et al., 1993; El-Safty et al., 2003a, 2003b; Ng et al., 1992; Boujemaa et al., 1994; Hotz et al., 1995; Nuyts et al., 1995; Steenland et al., 1990; Rapiti et al., 1999; Hogan et al., 2001; Chiazze et al., 1999; Calvert et al., 2003; Attfield & Costello, 2004). The most compelling study, Steenland (2005), found an excess risk of end-stage renal disease of 1.8% (0.8% to 9.7%) in a pooled analysis of 3 cohorts. In their review of the health effects of crystalline silica, NIOSH noted that multiple studies have reported statistically significant relationships between silica exposure and renal disease (NIOSH, 2002a).

Experimental Animal Studies With a clear understanding of the histopathological and clinical aspects of silicosis, researchers in the 1990s focused their efforts on characterizing the mechanisms by which silicosis occurs and its apparent role in the development of lung cancer. Many of these studies have evaluated how particle surface chemistry, intercellular signaling pathways, and oxidant stress may induce inflammation and stimulate the immune system, ultimately leading to cell proliferation and tissue fibrosis following exposure to crystalline silica (Blackford et al., 1997; Huffman et al., 1998; Kim et al., 1999; Kang et al., 2000; Zeidler et al., 2004; Hamilton et al., 2008). Some of these studies have led to investigation for potential biomarkers of exposure, effect, and susceptibility for silicosis (Gulumian et al., 2006). Overall, the intercellular interactions and cell signaling pathways are complex, numerous cross-talk and feedback mechanisms exist, and species responses and forms of silica differ. Although the use of biomarkers for human populations exposed to silica are far from being validated or feasible, the studies have revealed some of the underlying mechanisms involved in the development of silica-induced lung injury.

The mechanisms underlying silica-induced carcinogenesis in animals, and perhaps in humans, are not well understood. IARC described the experimental evidence for a direct genotoxic action of crystalline silica as "weak" (IARC Working Group, 1997). However, many of the pathways that are believed to be involved in the inflammatory and fibrogenic processes may also be important in the carcinogenic process. For example, the development of lung tumors in the rat appears to be dependent on coexistent chronic inflammation and cell proliferation (ILSI, 2000). ROS produced as a result of silica exposure can interact with DNA in vitro to form potentially promutagenic lesions (Daniel et al., 1993; Saffiotti et al., 1994; Shi et al., 1994, 1998; Albrecht et al., 2005), and increased cell proliferation can lead to the development of cancer by increasing the likelihood that such lesions will become fixed before they can be repaired by the cell. It has been suggested that the formation of lung tumors in rats exposed to silica appears to be consistent with a nonspecific response to persistent inflammation and increased cell proliferation, and that it may therefore be appropriate to apply a threshold model of carcinogenesis to inhaled silica if silicosis is required for the development of silica-related lung cancer (Mossman et al., 1995).

Occupational Exposure Limits for Silica

The TLV for quartz remained at 0.1 mg/m^3 throughout the 1990s. In 1999, ACGIH reevaluated the TLV for quartz and, in 2000, lowered the TLV to 0.05 mg/m^3 based on studies suggesting that the risk of silicosis associated with exposure to 0.1 mg/m^3 over a working lifetime was well above of OSHA's acceptable risk level of 1 in 1,000 (Table 2) (Muir et al., 1989a; Graham et al., 1991; Hnizdo & Sluis-Cremer, 1993; Steenland & Brown, 1995a; Kreiss & Zhen, 1996; ACGIH, 2000). ACGIH also cited the study by Hnizdo et al. (1993), in which autopsies were conducted to validate previous diagnoses of silicosis based on x-rays, and it was estimated that over half of silicotics would not have been diagnosed as positive using x-ray analysis alone (Hnizdo et al., 1993). ACGIH also designated quartz as a suspected human carcinogen (A2) and noted that, while it did not appear that silica was a direct-acting initiator, there was "compelling evidence that many forms of pulmonary fibrosis constitute major risks for lung cancer" (ACGIH, 2000). Thus, lowering the TLV to a level that was protective against silicosis was considered sufficient to prevent the development of lung cancer. However, ACGIH also acknowledged that cancer studies in rats were lacking in strength, due to the recognition that rats are a poor predictor of human response to the effects of dust (ACGIH, 2000). A significant departure from previous silica TLVs occurred in 2006, when the TLVs for quartz and cristobalite were combined, and lowered to 0.025 mg/m^3 (ACGIH, 2006). The primary basis for the combined TLV for quartz and cristobalite was that human studies in the diatomaceous earth industry in the late 1990s/early 2000s indicated that the exposure-response risks for radiologically diagnosed silicosis in this cohort were similar to those for quartz, which was a departure from historical animal studies that showed differential toxicity for the two crystalline forms of silica (ACGIH, 1962, 2006; Hughes et al., 1998; Park et al., 2002).

The current OSHA PEL of 10/(% quartz + 2) mg/m^3 for respirable dusts and 30/(% quartz + 2) mg/m^3 for total dusts (Table 2) remains unchanged since 1971[11]; however, OSHA has been working toward a revision.[12] A major concern has been the issue of noncompliance with the current standard, and as such, a new standard would have an economic impact on those already in compliance. To address this situation, it has been suggested that OSHA consider improved enforcement and outreach for the existing rule. A timetable for OSHA's final decision to move forward with rulemaking has not been issued.[13] In addition, MSHA has also given an advanced Notice of Proposed Rulemaking on crystalline silica. Designation of a new occupational health standard for respirable crystalline silica has been listed as a long-term action as recently as April 2006.

Abrasive Blasting Studies and Industry Developments

Because of the very high exposures that can occur during abrasive blasting, NIOSH has continued to evaluate these operations in industries (e.g., shipyards, foundries) long recognized as having excessive

[11]The current OSHA PEL is commonly cited as 0.1 mg/m^3, which assumes that the percentage of quartz is equal to 100%.

[12]Under the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), one of the first steps that OSHA is required to take when revising a PEL is to issue a proposal (element of a draft rule) to a panel to demonstrate how a rulemaking might affect small business (U.S. Small Business Administration, 1996). In October 2003, the submitted draft evaluated three PELs under consideration by the Agency: 50, 75, and 100 μg/m^3, measured as an 8-hr time-weighted average (TWA) (U.S. Small Business Administration, 2003). In December 2003, OSHA received comments from small-entity representatives (SERs), and the consensus of the majority of SERs was that a new silica rule was not needed.

[13]According to the Unified Regulatory Agenda, the Peer Review of Health Effects and Risk Assessment for silica, which is also required as a part of the rulemaking, has an undetermined completion date (OSHA, 2007).

silica exposures and a high incidence of silicosis. The development of surveillance programs, such as NIOSH's Sentinel Event Notification System for Occupational Risks (SENSOR) and OSHA's Special Emphasis Program (SEP), during this time period have also been important in identifying and investigating high risk industries (NIOSH, 2006d; Galster, 1997). Much of the silicosis and silica exposure experience among abrasive blasters in the 1990s through today were identified and reported through these types of programs (Centers for Disease Control [CDC], 1990, 1998, 2004; Sevinc et al., 2003; Galster, 1997; O'Brien et al., 1990; Irwin, 2003; Jennison & Cocalis, 1995; Short, 1993; Yassin et al., 2005). For silicosis cases, the majority of workers with symptoms and diagnoses reported not using recommended respiratory protection, and workplaces were found to have insufficient engineering controls.

During the 1990s, OSHA remained active in training and educating abrasive blasters and other workers exposed to high levels of silica. In 1996, OSHA started a SEP focused on silicosis, which provided employers and state officials with educational materials about the risks of silica exposure. There was also an inspection component of the program. Of the 332 SEP inspections performed by OSHA, 30% of the air samples were found to be over the OSHA PEL (OSHA, 1996; Linch et al., 1998). This program included recommendations for medical monitoring. In addition, workers, unions, state health departments, and NIOSH all prepared public educational materials about the risks of silicosis and ways to prevent the disease. Most of these publications were aimed at construction and foundry workers, although at least one mock case study was prepared for high school students (NIOSH, 2002b).

Silicosis Among Construction Workers During the 1990s, construction workers were increasingly identified as an occupational group at high risk for silica-related disease. Many construction workers perform abrasive blasting as part of their work, and may also be exposed during other activities such as drilling, cutting, and grinding concrete. In a 1996 report titled "Preventing Silicosis and Deaths in Construction Workers," NIOSH described a number of silicosis case reports among construction workers, including abrasive blasters, in which respiratory protection was either inadequate or completely absent (NIOSH, 1996a). This observation is consistent with reports in other exposure studies of the construction industry (Flanagan et al., 2003; Rappaport et al., 2003).

Flanagan et al. (2006) published a study of silica exposures at construction sites in which three task areas had higher quartz exposures from abrasive blasting. In all, samples from the majority of trade, task and tool categories exceeded the TLV of 0.05 mg/m^3. By trade, abrasive blasters had the highest quartz exposure, although exposures classified by task and tool categories showed that silica concentrations during tuck-point grinding and surface grinding exceeded that observed with abrasive blasting (Flanagan et al., 2006). Both engineering and PPE controls were recommended for the workers with the highest exposures; however, it was noted that the nature of construction work makes implementing these controls difficult. The composition of the rock and sand used in cement varies widely, and the portable nature of the work limits the use of engineering controls.

In a recent study of the construction industry, researchers compared the airborne silica concentrations across four different construction trades (i.e., bricklayers, operating engineers, painters, and laborers). Painters, who used abrasive blasting in surface preparation, experienced the highest median silica exposures of 1.28 mg/m^3 (Rappaport et al., 2003). The remaining groups of construction workers were shown to have median silica exposures in excess of the TLV at 0.32, 0.08, and 0.35 mg/m^3 for bricklayers, operating engineers, and laborers, respectively. Of particular concern were exposures of bricklayers and laborers, who did not wear any respiratory protection in spite of the high exposure levels. Dust suppression was recommended as the most inexpensive way to reduce silica exposures for blasters and other construction workers until the construction industry investigates silica exposures at thousands of sites (Rappaport et al., 2003).

The use of alternative abrasives was often recommended as an additional control method to reduce worker exposures to airborne silica. Abrasive material other than silica sand was already commonly used in many industries, although few exposure and toxicity studies of the dust generated from these abrasive materials had been conducted in the United States. In 1998, NIOSH published a comprehensive study on the effectiveness, operating costs, and airborne concentrations associated with the use of a number of substitute abrasive materials (KTA-Tator, 1998a, 1998b, 1999). The study examined 13 different types of abrasives, including silica sand, and analyzed 30 different chemicals and metals in the airborne abrasive dust for potential health risks. In addition, the study compared the operating costs of the different abrasive materials. While it was concluded that the alternative abrasives were comparable to silica sand from an economic standpoint and substantially reduced respirable quartz concentrations, it was also found that the alternative abrasives had higher levels of potentially toxic agents, including heavy metals. The study suggested that a broader "vertical health standard" encompassing all health hazards associated with abrasive blasting should be considered (KTA-Tator, 1998a, 1999).

Respiratory Protection Guidelines for Abrasive Blasting

Although respirators have never been considered the principle method for controlling exposures in abrasive blasting and the basis for respiratory protection recommendations during abrasive blasting have not changed significantly over the past 15 yr, respirator recommendations during abrasive blasting have become more prescriptive than in the past. For example, in 1992, ANSI again updated the American National Standard Practices for Respiratory Protection (Z88.2) to reflect the current state of the science on qualitative and quantitative fit testing, breathing-air supplies, respirator selection, and assigned protection factors (ANSI, 1992). Specifically, the respirator decision-making process was clarified, oxygen deficiency was redefined, and a requirement for the fit testing of positive-pressure respirators was added. The standard clearly states that respirators specifically approved for abrasive blasting should be used for these operations. Furthermore, the standard mentions that abrasive blasting in confined spaces may generate contaminant levels exceeding the protective capability of any respirator, and such situations require implementation of engineering controls.

In the 1980s, the language regarding recommended respiratory protection for abrasive blasting shifted from air-supplied respirators/hoods/helmets or abrasive blasting respirators to, specifically, Type CE respirators. The first official document to single out Type CE as the only respirator type suitable for abrasive blasting was ASTM 1986 standard, Health Requirements Relating to Occupational Exposure to Quartz Dust. Specifically, it stated that a Type CE supplied-air respirator, including a full face piece, hood, or helmet, operated with positive pressure should be used during abrasive blasting (ASTM, 1986). Later, NIOSH published a pamphlet that stated that abrasive blasting operations involving silica sand demand the highest level of protection available, defined as the Type CE abrasive blasting respirator. The pamphlet states clearly, "If you must sandblast, use type CE positive pressure abrasive blasting respirators" (NIOSH, 1997a). In 1995, NIOSH stated that they had not approved any Type AE or BE respirators, indicating that they had become obsolete (NIOSH, 1995). In the NIOSH Respiratory Protective Devices guidance, which was published in the Federal Register in 1995 (42 CFR 84), the definition of a Type CE respirator is as follows (NIOSH, 1995):

> A type "C" supplied-air respirator equipped with additional devices designed to protect the wearer's head and neck against impact and abrasion from rebounding abrasive material, and with shielding material such as plastic, glass, woven wire, sheet metal, or other suitable material to protect the windows of face pieces, hoods, and helmets which do not unduly interfere with the wearer's vision and permit easy access to the external surface of such window(s) for cleaning.

NIOSH further clarified this definition in May 1996, when it published a Respirator User Notice to all abrasive blasters. This document clearly defined Type CE abrasive blasting respirators four ways: (1) continuous flow with loose-fitting hood and assigned protection factor (APF) of 25, (2) continuous flow with tight-fitting face piece and APF of 50, (3) positive-pressure respirator with tight-fitting half-mask face piece and APF of 1000, and (4) pressure demand or positive-pressure respirator containing a tight-fitting full face piece and APF of 2000 (NIOSH, 1996b).

The NIOSH User Notice further stated that "air purifying and powered-air purifying respirators are not recommended for abrasive blasting operations, but may be suitable for auxiliary work such as outside clean-up operations." It also emphasized that silica sand should not be used as an abrasive medium. If silica sand is used, the notice stated that only NIOSH-certified pressure-demand or positive-pressure respirators with a NIOSH-recommended APF of 1000 or 2000 should be used (NIOSH, 1996b).

Similar to respiratory protection recommendations, the respiratory standards developed by OSHA have not changed significantly in recent years. OSHA's maritime standard still states, "Abrasive blasters working in enclosed spaces shall be protected by hoods and air line respirators, or by air helmets of a positive pressure type in accordance with the requirements of subpart I of this part" (OSHA, 2004). Subpart I refers to OSHA's respiratory protection standard updated in 1998, stating that employers must select NIOSH-approved respirators after evaluating the hazard and determining the proper type of respirator to be worn as part of a required respiratory protection program (OSHA, 1998a). The use of NIOSH-approved respirators is also a requirement stated in OSHA's ventilation standard, which addresses respiratory protection for abrasive blasting (OSHA, 1999). It should be once again noted that under OSHA, it is illegal to rely upon respiratory protection as the principle means of controlling exposure (OSHA, 1998b).

DISCUSSION

Crystalline silica has been one of the most widely studied chemicals in the history of occupational disease, and was among the first industrial chemicals for which exposure standards and work practice guidelines were developed. Our understanding of the health hazards associated with exposure to airborne silica continues to evolve to this day. The silica TLV has been updated several times over the last 5–10 yr and, in 2003, OSHA initiated the process of reevaluating the protectiveness of the PEL for crystalline silica. In all likelihood, the possible lung cancer hazard associated with silica will receive the most attention from scientists and regulators. IARC, ACGIH, ATS, and the World Health Organization (WHO) have designated crystalline silica a human carcinogen; however, many questions remain and continue to be heavily debated by the scientific community. These questions, particularly the exact nature of the relationship between silicosis and lung cancer, will be critical as OSHA considers the scientific basis of the current PEL.

By and large, there has been significant success in reducing silica exposures across the various industries, and the incidence of disease today is a fraction of that observed in prior decades. However, historical and current studies have consistently identified abrasive blasting as one of the more hazardous operations involving silica, and cases of silicosis among abrasive blasters continue to be reported today. Efforts to reduce exposure among this occupational group have included implementating of engineering controls, developing of OELs, and establishing guidelines for the use of respiratory protection. Most of the techniques that formed the basis for the dust-control measures (including respiratory protection) for abrasive blasting operations in the early 20th century are still used today, albeit with a number of improvements. Exposure studies in a variety of industries demonstrated that engineering controls were not always effective at reducing airborne silica concentrations to a level believed to be safe, and consequently, respiratory protection has always been (and continues to be) an important component for protecting abrasive blasters against the respiratory hazards of airborne crystalline silica.

Because abrasive blasting is commonly performed in many industries, the number of people potentially exposed to silica is relatively large. Silica sand is still used as an abrasive in the United States, and abrasive blasting of surfaces such as concrete can also produce airborne silica exposures even when nonsilica abrasives are used. As discussed in this review, exposure surveys conducted over the years have documented failures to maintain airborne concentrations of silica below the PEL, as well as a lack of appropriate respiratory protection programs within many industries. Abrasive blasting operations were often noted to be particularly problematic, and consequently, NIOSH and OSHA have continued to closely monitor abrasive blasters. Guidelines and requirements pertaining to respiratory protection have been updated in recent years to reemphasize the importance of a positive-pressure respirator during abrasive blasting operations. In addition, there has been considerable focus in recent years on the construction industry, where the portable nature of the work makes implementation of traditional engineering controls difficult. The importance of proper respiratory protection has been a consistent theme for abrasive blasters in this industry, and in fact, improper or a complete lack of respiratory protection in the work place has been noted in many of the silicosis cases identified by NIOSH. As such, it should be recognized that, while the scientific community will undoubtedly continue to debate whether health risks exist at the current PEL or whether silica is a carcinogen, significant attention will undoubtedly be directed at educating employers and enforcing current occupational exposure and respiratory protection standards.

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AIR QUALITY, GREENHOUSE GAS AND DISPERSION MODELING REPORT

ARGENT MATERIALS
OAKLAND, CALIFORNIA

RAMBOLL

ATTACHMENT C

CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

AB	Aggregate Base
AERMOD	American Meteorological Society/Environmental Protection Agency regulatory air dispersion model
AQ	Air Quality
ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
Cal/EPA	California Environmental Protection Agency
CAP	Criteria Air Pollutant
CEQA	California Environmental Quality Act
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
DEIR	Draft Environmental Impact Report
DPM	Diesel Particulate Matter
EDR	Environmental Data Resources
EI	Emissions Inventory
GHG	Greenhouse Gas
HI	Hazard Index
HRA	Health Risk Assessment
MEISR	Maximally Exposed Individual Sensitive Receptor
N_2O	Nitrogen Dioxide
NOx	Nitrous Oxide
OEHHA	Office of Environmental Health Hazard Assessment
PM	Particulate Matter
$PM_{2.5}$	Fine Particulate Matter Less than 2.5 Micrometers in Aerodynamic Diameter
PM_{10}	Respirable Particulate Matter Less than 10 Micrometers in Aerodynamic Diameter
ROG	Reactive Organic Gas
TAC	Toxic Air Contaminant
TCEQ	Texas Commission on Environmental Quality
USEPA	United States Environmental Protection Agency

USGS	United States Geological Survey

Units

g	Gram
MT	Metric Ton
s	Second
tpy	Ton per Year
yr	Year

EXECUTIVE SUMMARY

Argent Materials has an aggregate recycling operation in West Oakland located at 8300 Baldwin Street. The facility currently recycles construction material debris and converts it to recycled concrete, sand, gravel, and other building materials. Currently, operations take place inside a large warehouse and we understand that the City would like to understand the environmental impacts of these processing operations. The indoor rock crushing operations are referred to in this report as "the Project". The primary purpose of this report is to evaluate the Project's emissions against regional air district standards. To this end, analysis shows that Project operations are approximately 90% lower than BAAQMD significance thresholds for Particulate Matter (PM) and Greenhouse Gas (GHG) Emissions. Operational mass emissions of other Criteria Air Pollutant (CAP) emissions are zero from Project Operations. Emissions are relatively low because the Project's warehouse operations are electrified, and do not use diesel fuel.

For illustrative purposes, and to provide a practical understanding of the scale of air quality emissions the Project generates, Ramboll has compared emissions from the Project's indoor warehouse operations with emissions from a Lowe's Home Improvement Warehouse facility located in Santa Rosa, CA ("Lowe's Store") as if the existing warehouse at the Project site were being replaced with a building materials sales store. A Lowe's Store was selected because its retail operations appear to qualify as a permitted-by-right use in zoning district in which Project parcel sits, that being a Commercial-Industrial Mix 2 (CIX-2)[1] zoning district. The CIX-2 zone accommodates commercial and industrial establishments, including General Whole Sales, General Retail Sales, and Building Material Sales (Oakland Planning Code section 17.73.020.) This comparison is deemed to be conservative because CIX-2 zones also permit, by right, industrial activities that tend to have more significant emissions, including glass factories, metal foundries, and other General Manufacturing uses. Ultimately, analysis shows that annual emissions from the Lowe's Store are higher than Project emissions by 85% for PM_{10}, 30% for $PM_{2.5}$ and 83% for GHG.

At the request of Argent Materials, Ramboll US Corporation (Ramboll) conducted a quantitative assessment of the concentration of particulate matter (PM) resulting from the Project operations. Ramboll also evaluated the Criterial Air Pollutant (CAP) and Greenhouse Gas (GHG) emissions from small crushing operations taking place indoors and compared emissions against the Lowe's Store and against operational emissions thresholds as specified by the Bay Area Air Quality Management (BAAQMD). Diesel Particulate Matter (DPM) was not evaluated in this report as diesel fuel is not used in the operation of heavy machinery inside the warehouse. All equipment operating indoors are electric.

This report evaluates the air quality (AQ) and GHG impacts, together with the concentration of PM at the nearest residential and sensitive locations. The local air agency, BAAQMD, has published California Environmental Quality Act (CEQA) Guidelines for use in determining significance, which will apply here for AQ and GHG (BAAQMD 2011). The relevant thresholds for the Project are:

- Operational CAP and precursor emissions

[1] City of Oakland. Planning and Zoning Map. Available online at: http://gisapps1.mapoakland.com/planmap/planmap.html?apn=042%20431804300

- Operational GHG emissions

Since there are no Toxic Air Contaminants (TACs) from the warehouse operations, Ramboll did not conduct a Health Risk Assessment (HRA) to evaluate Excess Lifetime Cancer Risk, Chronic Hazard Index (HI) and Acute HI. Instead, the concentration of PM was determined at the nearest residential receptors. In order to confirm the impact on the residences closest to the Project, Ramboll modeled the closest residential receptors located at roughly 1,600 ft. as discrete receptors and evaluated the concentration resulting from Project PM emissions.

Emissions of PM from indoor operations were estimated using EPA's AP-42, Fifth Edition Compilation of Air Pollutant Emission Factors (EPA 1995) consistent with guidance in BAAQMD's 2011 CEQA guidelines (BAAQMD 2011) and the 2015 California Environmental Protection Agency (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) Hot Spots Guidance (2015). Concentrations of PM were estimated using American Meteorological Society/Environmental Protection Agency regulatory air dispersion model (AERMOD), a Gaussian air dispersion model recommended by United States Environmental Protection Agency (USEPA), California Air Resources Board (ARB), and BAAQMD for use in preparing environmental documentation for stationary sources.

Results showed that the operational mass emissions of both particulate matter (PM_{10} and $PM_{2.5}$) and greenhouse gas emissions from the Project operations are approximately 90% lower than BAAQMD significance thresholds. Operational mass emissions of other CAP emissions are zero from Project Operations. Annual emissions from the Lowe's Store are higher than Project emissions by 85% for PM_{10}, 30% for $PM_{2.5}$ and 83% for GHG.

Dispersion modeling of $PM_{2.5}$ also showed that the concentration of $PM_{2.5}$ at the closest residential receptors are well below the BAAQMD CEQA threshold for $PM_{2.5}$. Our analysis indicates that the impacts due to the Project are expected to be minimal on nearest sensitive receptors.

1. INTRODUCTION

At the request of Argent Materials, Ramboll US Corporation (Ramboll) has prepared this technical report documenting air quality (AQ), and greenhouse gas (GHG) analyses for the indoor rock crushing operations taking place at the Project site located at 8300 Baldwin Street, Oakland, CA. "The Project", as defined in this report, is the crushing of rocks and separation of materials into finished products taking place inside the warehouse facility. The primary purpose of this report is to compare Project-related emissions to standards set forth by the Bay Area Air Quality Management District (BAAQMD) and the air district's California Environmental Quality Act (CEQA) Guidelines, released in 2011 (BAAQMD 2011).[2] The City of Oakland's CEQA Thresholds of Significance Guidelines reference these air district standards. Second, in order to provide a reference point for better understanding the operations and for illustrative purposes, air emissions from the Project operations are compared with the air emissions from a Lowe's Store. The Lowe's Store was chosen as the point of comparison since it is use that is permitted by right in the Project site's CIX-2 zone, and facilitates a conservative approach given that higher emitting uses, such as glass factories and metal foundries, are also permitted by right in CIX-2 zones.

1.1 Project Description

The Project site located at 8300 Baldwin Street is bounded by Baldwin Street to the South West, rail tracks to the North East, and a few industrial developments to the North and South in Oakland, California. The Project is located on an approximately 4.97-acre lot. The Project location and property boundary are shown in **Figure 1**. Currently, the Project processes an average of 2,183 tons of construction debris per day and converts it to finished products including Class 2 Aggregate Base (AB) Mixed, Class 2 Concrete, Class 2 Perm, Backfill material, and Sand, among other things inside the warehouse. The separated feed then undergoes further crushing and separation in an indoor facility where the finished products are produced and stored in stockpiles. Few of the finished products are stored in outdoor stockpiles that are transferred outside either through conveyors or loaders that carry the material. The rest of the stockpiles are currently stored inside the warehouse itself. **Figure 2** shows the location of the different sources for the Project operations.

1.2 Objective and Methodology

This report evaluates the criteria air pollutants and GHG emissions as well as concentrations of particulate matter (PM) from the Project. CAP and GHG emissions from the Project operations are compared with the emissions from a Lowe's Store. The impacts from Project operation are also compared with the BAAQMD 2017 CEQA thresholds. The BAAQMD 2017 CEQA Guidelines contain recommended thresholds for operational criteria air pollutant (CAP) and precursor emissions, and GHG emissions from an individual project (BAAQMD 2017). In addition, the BAAQMD 2017 CEQA thresholds include incremental ambient air concentrations for $PM_{2.5}$. The incremental ambient air concentrations for $PM_{2.5}$ from the Project operations are also evaluated at nearby residential receptors and sensitive receptors. DPM was not

[2] A March 2012 Alameda County Superior Court judgment determined that the BAAQMD had failed to evaluate the environmental impacts of the land use development patterns that would result from adoption of the thresholds and ordered the thresholds set aside. The Court of Appeal reversed that judgment and the California Supreme Court decided the limited issue that CEQA does not require an analysis of the environment's impact on a project, with the exception of schools.

evaluated in this report as diesel fuel is not used in the operation of heavy machinery at the Project. All equipment operating at the Project is electric.

1.3 Thresholds Evaluated

The AQ analysis of this report evaluates the daily and annual regional emissions of criteria pollutants and precursors from both the Project operations and evaluates these emissions against BAAQMD's May 2011 significance thresholds for emissions (BAAQMD 2011). These thresholds are as follows:

Operational CAP Emissions:

- Average daily emissions of Reactive Organic Gas (ROG) greater than 54 lb/day, or maximum annual emissions of 10 tons per year (tpy);
- Average daily emissions of Nitrous Oxide (NOx) greater than 54 lb/day, or maximum annual emissions of 10 tpy;
- Average daily emissions of respirable particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}) greater than 82 lb/day, or maximum annual emissions of 15 tpy; and
- Average daily emissions of fine particulate matter less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) greater than 54 lb/day, or maximum annual emissions of 10 tpy.

The GHG analysis of this report evaluates the GHG emissions from the Project operations and evaluates these emissions against BAAQMD's May 2017 significance thresholds for emissions. These thresholds are as follows:

- Stationary source direct GHG emissions of 10,000 metric tonnes per year (MT/yr)

Ramboll conducted a sensitive receptor search within the 1,000-foot zone of influence and determined that there are no sensitive receptors around the Project site. For completeness, Ramboll estimated the $PM_{2.5}$ concentration as a result of Project operation at nearby residences located roughly 1,600 feet from the Project.

To meet the above stated objectives, this dispersion modeling was conducted consistent with the following guidance:

- May 2017 BAAQMD CEQA Guidelines (BAAQMD 2017); and
- BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (BAAQMD 2012a).

Ramboll did not conduct an HRA to evaluate the Excess Lifetime Cancer Risk, Chronic HI and Acute HI since there are no DPM or other TAC emissions associated with the warehouse operations. In addition, all sensitive receptors were more than 1,000 feet from the Project site, which is the distance within the BAAQMD CEQA Guidance calls for a risk assessment.

1.4 Report Organization

This technical report is divided into eight sections as follows:

Section 1.0 – Introduction: describes the purpose and scope of this technical report, the objectives and methodology used in this technical report, and the report organization.

Section 2.0 – Emission Estimates: describes the methods used to estimate the emissions of CAPs and GHGs from the Project.

Section 3.0 – Estimated Air Concentrations: discusses the air dispersion modeling, the selection of the dispersion models, the data used in the dispersion models (e.g., terrain, meteorology, source characterization), and the identification of residential locations evaluated in this technical report.

Section 4.0 – Emissions and Dispersion Modeling Results: presents the estimated emissions of CAPs and GHGs, and concentrations of PM emissions for the Project.

Section 5.0 – References: includes a listing of all references cited in this report.

2. EMISSION ESTIMATES

Ramboll estimated CAP and GHG emissions from the Project. The CAPs that have BAAQMD thresholds include ROG, NOx, $PM_{2.5}$ and PM_{10}. There are no NOx or ROG emissions from the Project. Therefore, this report discusses only PM_{10} and $PM_{2.5}$. The GHGs emitted include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), which are commonly combined by global warming potential-weighted average into carbon dioxide equivalents (CO_2e). TAC emissions including DPM were not evaluated in this report since the Project equipment is all electric and diesel fuel is not used in the Project operation. These CAP and GHG emissions estimates were compared with emissions from the Lowe's Store in Santa Rosa, CA, BAAQMD thresholds and were used as inputs to the air dispersion modeling. The methodologies used by Ramboll are summarized below.

Table 1 and Table 2 presents the emissions associated with the operational activities for the Project and Lowe's Store operations, respectively.

2.1 Calculation Methodologies for Operational Emissions

The Emissions Inventory (EI) includes emissions from the Project operation. Emissions from crushing operations were estimated using EPA's AP-42, Fifth Edition Compilation of Air Pollutant Emission Factors (EPA 1995). The stationary sources associated with the operational emissions are listed below. Emissions from the Lowe's Store were obtained from the Draft Environmental Impact Report (DEIR) published in the City of Santa Rosa website (Lowe's DEIR, 2017)

2.1.1 Stationary Sources

Stationary sources associated with Project operational emissions would include

- Processing Facility crushers;
- Screens;
- Conveyors;
- Material handling points.

Uncontrolled and controlled emissions for all stationary sources were calculated using emission factors from EPA's AP-42, Fifth Edition Compilation of Air Pollutant Emission Factors (EPA 1995). Controls on sources such as screens, conveyors and crushers including baghouse filters and water spray systems obtained from BAAQMD's permit applications for each source. For warehouse operations, any source located indoors are assumed to be in a fully-enclosed space with a control efficiency of 70% consistent with the Texas Commission on Environmental Quality (TCEQ) guidance (TCEQ 2018).

All the Project processing equipment are electric and have no other CAP emissions associated with them.

2.1.2 Sources of Emissions at the Lowe's Store

The primary sources of operational emissions occurring at the Lowe's Store includes operational vehicular emissions and area source emissions. Area source emissions are from consumer products, heaters that consume natural gas, gasoline-powered landscape equipment, and architectural coatings (paintings). Mobile emissions are primarily from motor vehicles traveling to and from the area. Emissions reported in the DEIR are for a full buildout year of 2010. With the improvement in emissions standards for vehicles, current mobile exhaust emissions from the Lowe's Store are likely to be lower than the numbers reported for operational year 2010. However, exhaust emissions typically contribute to less than 5% of PM_{10} and $PM_{2.5}$ emissions[3], with the majority being roadway dust, brake wear and tire wear, which have remained largely constant over time[4]. Therefore, current PM_{10} and $PM_{2.5}$ emissions are expected to be similar to emission reported in 2010.

Overall, CAP emissions including ROG and NO_X for the Project operations are zero and are lower than the CAP emissions from the Lowe's Store and the BAAQMD thresholds. Annual PM_{10} from Project Operations are lower than the Lowe's Store by at least 85% and annual $PM_{2.5}$ emissions are lower by at least 30%.

2.1.3 Summary of Project Operational GHG Emissions

The only source of GHG emissions associated with the Project is from the electricity consumed by the stationary sources and equipment. GHG emission associated with the electricity consumed by the stationary sources and equipment are estimated based on the equipment horsepower, annual operating hours and GHG intensity factor. GHG emissions for the stationary sources are shown in **Table 1**. GHG emissions associated with the Lowe's Store were obtained from the Draft EIR (Lowe's DEIR, 2017) for the year 2010 are shown in **Table 2**.

GHG emissions from the stationary sources are subject to the BAAQMD CEQA threshold for stationary sources. Based on the maximum allowable hours of operation annually, the stationary sources are estimated to emit 1,016 MT CO_2e/yr for the Project operations and well below the BAAQMD stationary source threshold of 10,000 MT CO_2e/yr. For comparison, GHG emissions are 5,965 MT/year for the Lowe's Store.

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[3] Estimates are from a recent project involving a 1 MM square feet of new mix-use developments in the Bay Area.

[4] Contributions of Tire Wear and Brake Wear to Particulate Matter Emissions Inventories for On-Road Mobile Sources. Available online at: https://www.epa.gov/sites/production/files/2015-09/documents/sbai_pres.pdf

3. DISPERSION MODELING METHODOLOGIES AND PROCEDURES

The model and methods used to evaluate the dispersion of PM are discussed below.

3.1 Model Selection

Modeling was conducted with the latest version of the American Meteorological Society/ Environmental Protection Agency Regulatory Model (AERMOD) (Version 19191). AERMOD is the preferred dispersion model recommended by EPA (i.e., Appendix W) for source to receptor distances less than 50 km, equivalent to 31 miles. AERMOD is capable of handling complex source configurations, deposition processes, emission units subject to plume downwash, and situations where plumes interact with complex terrain.

For each receptor location, the model generates air concentrations that result from emissions from multiple sources. If unit emissions (i.e., 1 gram/second [g/s]) are modelled, the resultant value for each receptor location is called the air dispersion factor. If actual emissions are modelled, the resultant value for each receptor location is the concentration itself. Air dispersion models such as AERMOD require a variety of inputs such as source parameters, meteorological conditions, topographical information, and receptor parameters as described in the sections below. Modeling parameters for different sources used in this report are shown in **Table 3.**

3.2 Source Parameters

Emission sources associated with the Project operations were modeled using volume source representations. **Figure 2** shows the location of all the sources for Project operations. **Table 3** shows the source characterization and the modelling parameters associated with each source along with the different emissions rate for each source.

3.2.1 Volume Source Parameters

Volume source parameters were assigned based on the size of the initial plume or the physical dimensions of the source. The methods follow the recommendation of the AERMOD User's Guide (EPA 2018a). Single volume sources were used to represent doors and openings located on the warehouse building. Dimensions of the doors and openings were obtained from site layout diagrams provided by Argent Materials.

3.3 Meteorological Data

Air dispersion modeling requires the use of meteorological data that ideally are spatially and temporally representative of conditions in the immediate vicinity of the site under consideration. For this analysis, meteorological data from the Oakland International Airport and upper air data from Oakland for the years 2014 through 2018 were used. Data were processed using AERMINUTE (15272) and AERMET (18081). The meteorological data was processed using the ADJ_U* option that reduces overprediction of modeled concentrations that occur in stable conditions with low wind speeds due to underprediction of the surface friction velocity (u*). Underprediction of u* results in an underestimation of the mechanical mixing height and thus overprediction of ambient concentrations. The ADJ_U* option is now considered a regulatory default option with the recent update per Guideline on Air Quality Models 40 CFR 51, Appendix W (EPA 2017).

3.4 Terrain

Elevation data were imported from the National Elevation Dataset maintained by the United States Geological Survey (USGS 2017). Average source and receptor elevations were calculated using AERMAP (18081).

3.5 Receptor Grid Setup

In-order to evaluate the impacts nearby sensitive receptor populations were identified. Sensitive receptors include areas with residents, schools, daycare centers, parks and other recreational areas, hospitals, and senior care facilities. Sensitive receptor locations were identified using a search performed by Environmental Data Resources (EDR), as shown in **Appendix A**. The EDR report mis-identified one sensitive receptor just outside the 1,000-ft buffer around the site as a hospital; this receptor location is a medical office building instead of an hospital. Since there were no residential areas within 1,000 feet of the Project property, Ramboll modeled discrete receptors located in the residential areas roughly 1,600 feet from the site. **Figure 3** shows the location of receptors modeled in this report.

4. EMISSIONS AND DISPERSION MODELING RESULTS

In this section, the dispersion modeling results are presented for the Project operations. As discussed in Section 1.3, Ramboll did not conduct a health risk assessment to evaluate the Excess Lifetime Cancer Risk, Chronic HI and Acute HI resulting from the Project, since there are no DPM or other TAC emissions associated with the Project operations. In addition, there was no residential or sensitive receptor within 1,000 feet of the site.

Table 4 shows the operational mass emissions of criteria air pollutants and greenhouse gas emissions for the Project and for Lowe's Store. As shown in the Table, CAP emissions for the Project Operations are below the BAAQMD threshold of significance for average daily emissions and annual emissions by 90 percent. There are no ROG and NO_X emissions associated with the Project operations. Annual emissions from the Lowe's Store are higher than Project emissions by 85% for PM_{10}, 30% for $PM_{2.5}$ and 83% for GHG. Project GHG emissions are also significantly lower than the BAAQMD CEQA thresholds for stationary sources.

Table 5 shows the concentrations of PM_{10} and $PM_{2.5}$ for the Project operations at Maximally Exposed Individual Sensitive Receptor (MEISR). As shown in the Table, incremental ambient air concentrations for $PM_{2.5}$ from the Project operations are less than the BAAQMD CEQA threshold of 0.3 μg/m^3 at all residential receptors. As a result, impacts from the warehouse operations are expected to be minimal at the sensitive receptor locations.

5. REFERENCES

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TABLES

Table 1
Emissions from Project Operations
Argent Materials
Oakland, CA

Equipment Identifier	Equipment Name[1]	Average process rate (tpd)[2]	Average process rate (tph)	Annual Operating Hours (hours)	Actual (usage) horsepower	Accompanying abatement device	Location of Equipment as Indoor/Outdoor	Control Efficiency for Indoor vs Outdoor Sources[3]	AP-42 Emission Factor Category	Uncontrolled PM_{10} Emission Factor - AP-42[4]	Controlled PM_{10} Emission Factor - AP-42[4]	Uncontrolled $PM_{2.5}$ Emission Factor - AP-42[5]	Controlled $PM_{2.5}$ Emission Factor - AP-42[5]	Total Emissions - PM_{10}	Modeled Emission Rate - PM_{10}[6]	Total Emissions - $PM_{2.5}$	Modeled Emission Rate - $PM_{2.5}$[6]	CO_2e Emissions[7]
										(lb/ton)	(lb/ton)	(lb/ton)	(lb/ton)	(tpy)	(g/s)	(tpy)	(g/s)	MT/yr
Secondary Processing																		
CV4s	Building entry conveyor	3,056	170	5,040	30	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.14	0.0071	0.14	0.0071	33
CV5S	Scalper feed conveyor	3,056	170	5,040	40	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.14	0.0071	0.14	0.0071	44
S_1 - Scalping Screen																		
SC1s	Screen 1 (incoming feed)	3,056	170	5,040	40	A-5 Water Spray	Indoor	0.70	Screening (SCC 3-05-020-02, 03)	0.0087	7.4E-04	0.0087	5.0E-05	0.095	0.0047	0.0064	3.2E-04	44
CV6s	Overcross conveyor	573	32	5,040	15	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.026	0.0013	0.026	0.0013	16
CV7s	Mids cross conveyor	300	17	5,040	15	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.014	0.0007	0.014	6.9E-04	16
CV8s	Underscreen conveyor	2,183	121	5,040	20	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.10	0.0050	0.10	0.0050	22
CV9s	Finish feed conveyor	2,183	121	5,040	30	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.10	0.0050	0.10	0.0050	33
S_2 - Finish Screen																		
SC2s	Screen 2	546	30	5,040	40	A-6 Water Spray	Indoor	0.70	Screening (SCC 3-05-020-02, 03)	0.0087	7.4E-04	0.0087	5.0E-05	0.017	0.0008	0.0011	5.7E-05	44
CV10s	Over cross conveyor	546	30	5,040	15	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.025	0.0013	0.025	0.0013	16
CV11s	Mid cross conveyor	400	22	5,040	15	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.018	0.0009	0.018	9.2E-04	16
CV12s	Bott cross conveyor	100	5.6	5,040	15	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.0046	0.0002	0.0046	2.3E-04	16
CV13s	Underscreen conveyor	46	2.6	5,040	20	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.0021	0.0001	0.0021	1.1E-04	22
	Product Conveyor	100	5.6	5,040	15	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.0046	0.0002	0.0046	2.3E-04	16
	Product Conveyor	400	22	5,040	25	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.018	0.0009	0.018	9.2E-04	27
	Product Conveyor	46	2.6	5,040	15	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.0021	0.0001	0.0021	1.1E-04	16
Secondary Crushing Station																		
CR2s	Cone crusher[8]	873	49	5,040	400	A-4 water spray and baghouse filter	Indoor	0.70	Tertiary Crushing (SCC 3-050030-	0.0024	5.4E-04	0.0024	1.0E-04	0.020	0.0010	0.0037	1.8E-04	439
CV15s	Undercrusher conveyor	873	49	5,040	25	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.040	0.0020	0.040	0.0020	27
M2	Magnetic separator (rectifier)	873	49	5,040	11	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	--	0.0011	1.3E-05	0.040	0.0020	0.040	0.0020	12
CV20f_1	Transfer Cross Conveyor 1	1,637	91	5,040	25	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.076	0.0038	0.076	0.0038	27
CV20f_2	Transfer Cross Conveyor 2	1,637	91	5,040	25	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.076	0.0038	0.076	0.0038	27
CV20f_3	Transfer Cross Conveyor 3	1,637	91	5,040	25	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	4.6E-05	0.0011	1.3E-05	0.076	0.0038	0.076	0.0038	27
CV16s	Radial Stacker	1,637	91	5,040	25	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	--	0.0011	1.3E-05	0.076	0.0038	0.076	0.0038	27
CV17s	Radial Stacker	1,637	91	5,040	25	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	--	0.0011	1.3E-05	0.076	0.0038	0.076	0.0038	27
CV18s	Radial Stacker Hydraulics	1,637	91	5,040	10	--	Indoor	0.70	Conveyor Transfer Point (SCC 3-05-020-06)	0.0011	--	0.0011	1.3E-05	0.076	0.0038	0.076	0.0038	11

Table 1
Emissions from Project Operations
Argent Materials
Oakland, CA

Notes:

1. Operational emissions are estimated for warehouse operations.
2. Average process rates were provided by Argent Materials. Average process rate for equipment CV29f was based on the total throughput of Class 2 Aggregate Base (AB) material.
3. Control efficiencies were applied as follows - any source located indoors are assumed to be located in a fully-enclosed space with a control efficiency of 70% consistent with the TCEQ guidance.
4. Controlled emission factors for PM_{10} were obtained from AP-42 Chapter 11.19.2 for Crushed Stone Processing and Pulverized Mineral Processing. Controlled sources (with wet suppression) are those that are part of the processing plant that employs current wet suppression technology similar to the study group. As per the study, the moisture content of the study group without wet suppression systems operating (uncontrolled) ranged from 0.21 to 1.3 percent, and the same facilities operating wet suppression systems (controlled) ranged from 0.55 to 2.88 percent.
5. Controlled emission factors for $PM_{2.5}$ were obtained from AP-42 Chapter 11.19.2 for Crushed Stone Processing and Pulverized Mineral Processing. PM_{10} emission factors were conservatively used for sources with no data on $PM_{2.5}$ emission factors.
6. Modeled emission rate shown reflects emission rate in g/s for each piece of equipment based on the total operating hours of 280 days per year and 18 hours per day.
7. GHG emissions for the different pieces of equipment were estimated based on the equipment horsepower, operating schedule and electricity intensity factor from Pacific Gas and Electric. An emission factor of 641.34 lb/MWh, 0.029 lb/MWh and 0.00617 lb/MWh were used for CO_2, CH_4 and N_2O, respectively.
8. Emission factors for tertiary crushing operations from AP-42 was used for the Cone Crusher.

Abbreviations:

CO_2e - Carbon dioxide equivalent	MT - Metric tons	ton - short tons
g - grams	PM_{10} - Particulate Matter less than 10 microns in diameter	tpd - tons per day
hr - hour	$PM_{2.5}$ - Particulate Matter less than 2.5 microns in diameter	tph - tons per hour
lb - pounds	s - second	

References

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Table 2
Emissions from Lowe's Store in Santa Rosa, CA
Argent Materials
Oakland, CA

Emissions Source Category[1]	Average Daily Emissions[2]				Annual Emissions				
	ROG	NO_x	PM_{10}	$PM_{2.5}$	ROG	NO_x	PM_{10}	$PM_{2.5}$	CO_2e
	(lbs/day)				(tons/year)				(MT/year)
Area Emissions	1.33	1.63	0.01	0.01	0.22	0.29	0.00	0.00	0.5
Mobile Emissions	33.13	33.47	46.52	8.92	6.55	7.08	8.49	1.63	4,452
Natural Gas	--	--	--	--	--	--	--	--	1,068
Water Transport	--	--	--	--	--	--	--	--	315
Refrigerants[3]	--	--	--	--	--	--	--	--	130
Total	34.5	35.1	46.53	8.93	6.8	7.4	8.49	1.63	5,965

Notes:

1. Operational emissions for the Lowe's Store in Santa Rosa, CA were obtained from the Draft EIR. Emissions are reported for the full-buildout year of 2010.
2. Average Daily Emissions are reported in the Draft EIR for both summer and winter months. To conservatively assess the comparison with Lowe's Store, maximum daily emissions for summer months are reported here, as these are the lower of the two.
3. The Draft EIR reports Hydrofluorocarbon emissions from refrigerators and air conditioning units.

Abbreviations:

CO_2e - Carbon dioxide equivalent
lbs - pounds
NO_x - Nitrogen Oxides
PM_{10} - Particulate Matter less than 10 microns in diameter
$PM_{2.5}$ - Particulate Matter less than 2.5 microns in diameter
ROG - Reactive Organic Gases

References:

Lowe's Home Store in Santa Rosa, CA. Draft EIR. Available online at: https://srcity.org/DocumentCenter/View/3620/-Lowes-DEIR-Air-

Table 3
Modeling Parameters for Project
Argent Materials
Oakland, CA

Source Locations[1]	Source Type[1]	Number of Sources	Release Height (m)[2]	Initial Lateral Dimension (m)[3]	Initial Vertical Dimension (m)[3]	Modeled Emissions Rate (g/s)[4]	
						PM_{10}	$PM_{2.5}$
Main Building Doorway	Volume	1	1.52	0.71	0.71	0.046	0.042
Building Opening 1	Volume	1	1.52	0.71	0.71	0.009	0.008
Building Opening 2	Volume	1	2.29	2.55	1.06	0.009	0.008

Notes

1. Doors and openings in the warehouse building were modeled as single volume sources.
2. Release height for volume sources is based on drawings provided by Argent Materials.
3. Initial Vertical Dimension and Initial Lateral Dimension for volume sources are set to [release height]/2.15 per the AERMOD User's Guide.
4. Modeled emissions rates for PM_{10} and $PM_{2.5}$ were obtained from Table 1. Emissions rate for the warehouse building were split into emissions rate for doorways and building openings based on the area of doors and openings.

Abbreviations:

g - grams

m - meters

s - seconds

References:

USEPA. 2019. User's Guide for the AMS/EPA Regulatory Model (AERMOD). August. Available at: https://www3.epa.gov/ttn/scram/models/aermod/aermod_userguide.pdf

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Table 4
Operational Mass Emissions of Criteria Air Pollutants and Greenhouse Gas
Argent Materials
Oakland, CA

Scenario	ROG	NO_X	PM_{10}	$PM_{2.5}$	ROG	NO_X	PM_{10}	$PM_{2.5}$	CO_2e
	Average Daily Emissions				Annual Emissions				
	lbs/day				tons/yr				MT/yr
Project Operations[1]	0	0	6.9	6.3	0	0	1.3	1.1	1,016
Lowe's Store in Santa Rosa, CA[2]	34.5	35.1	46.5	8.9	6.8	7.4	8.5	1.6	5,965
BAAQMD Thresholds	**54**	**54**	**82**	**54**	**10**	**10**	**15**	**10**	**10,000**

Notes

1. Operational emissions for the Project are estimated based on the warehouse operations.
2. Operational emissions for the Lowe's Store in Santa Rosa, CA were obtained from the Draft EIR. Emissions are reported for the full-buildout year of 2010.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
EIR - Environmental Impact Report
lbs - pounds
MT - metric ton
NO_x - Nitrogen Oxides
PM_{10} - Particulate Matter less than 10 microns in diameter
$PM_{2.5}$ - Particulate Matter less than 2.5 microns in diameter
ROG - Reactive Organic Gases

References:

Lowe's Home Store in Santa Rosa, CA. Draft EIR. Available online at: https://srcity.org/DocumentCenter/View/3620/-Lowes-DEIR-Air-Quality-

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Table 5
Concentrations at Residential Receptors
Argent Materials
Oakland, CA

Scenario	Receptor Type and Location	Annual Average PM_{10}		Maximum 24-hour PM_{10}		Annual Average $PM_{2.5}$		Maximum 24-hour $PM_{2.5}$	
		(ug/m^3)							
Project Operations	MEISR[1]	0.22		2.9		0.20		2.6	
	UTMx and UTMy	571663.28	4178214.39	571663.28	4178214.39	571663.28	4178214.39	571663.28	4178214.39
BAAQMD CEQA Thresholds		**None**		**None**		**0.3**		**None**	

Notes:

1. The Maximally Exposed Individual Sensitive Receptor (MEISR) is identified as the residential receptor with the maximum concentration for each scenario and averaging time.

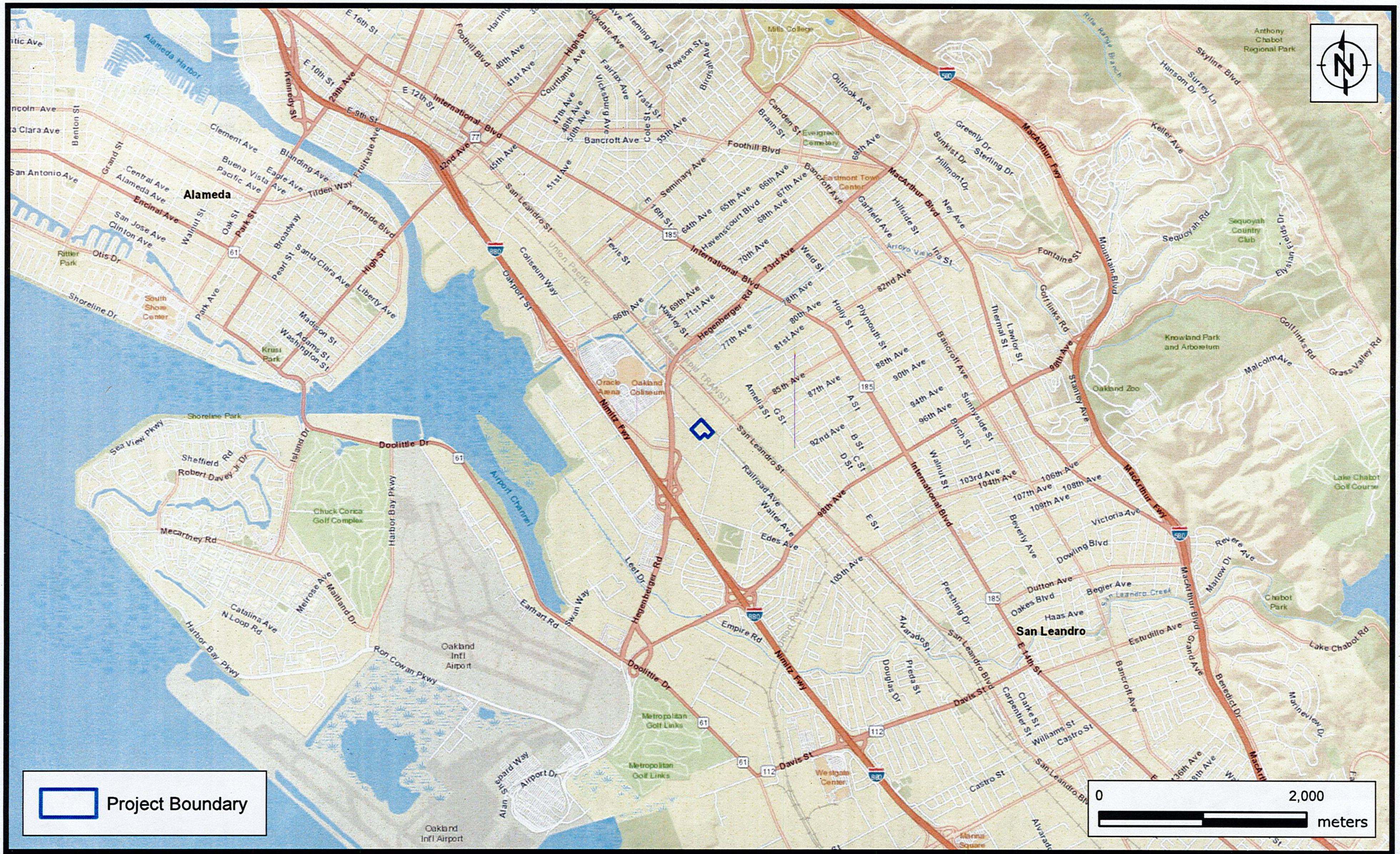
Abbreviations:

ug/m^3 - micrograms per meter cubed
BAAQMD - Bay Area Air Quality Management District
CEQA - California Environmental Quality Act
MEISR - Maximally Exposed Individual Sensitive Receptor
PM_{10} - Particulate Matter less than 10 microns in diameter
$PM_{2.5}$ - Particulate Matter less than 2.5 microns in diameter
UTM: Universal Transverse Mercator

References:

California Air Resources Board (ARB). Inhalable Particulate Matter and Health ($PM_{2.5}$ and PM_{10}). Available online at: https://ww3.arb.ca.gov/research/aaqs/common-pollutants/pm/pm.htm

FIGURES



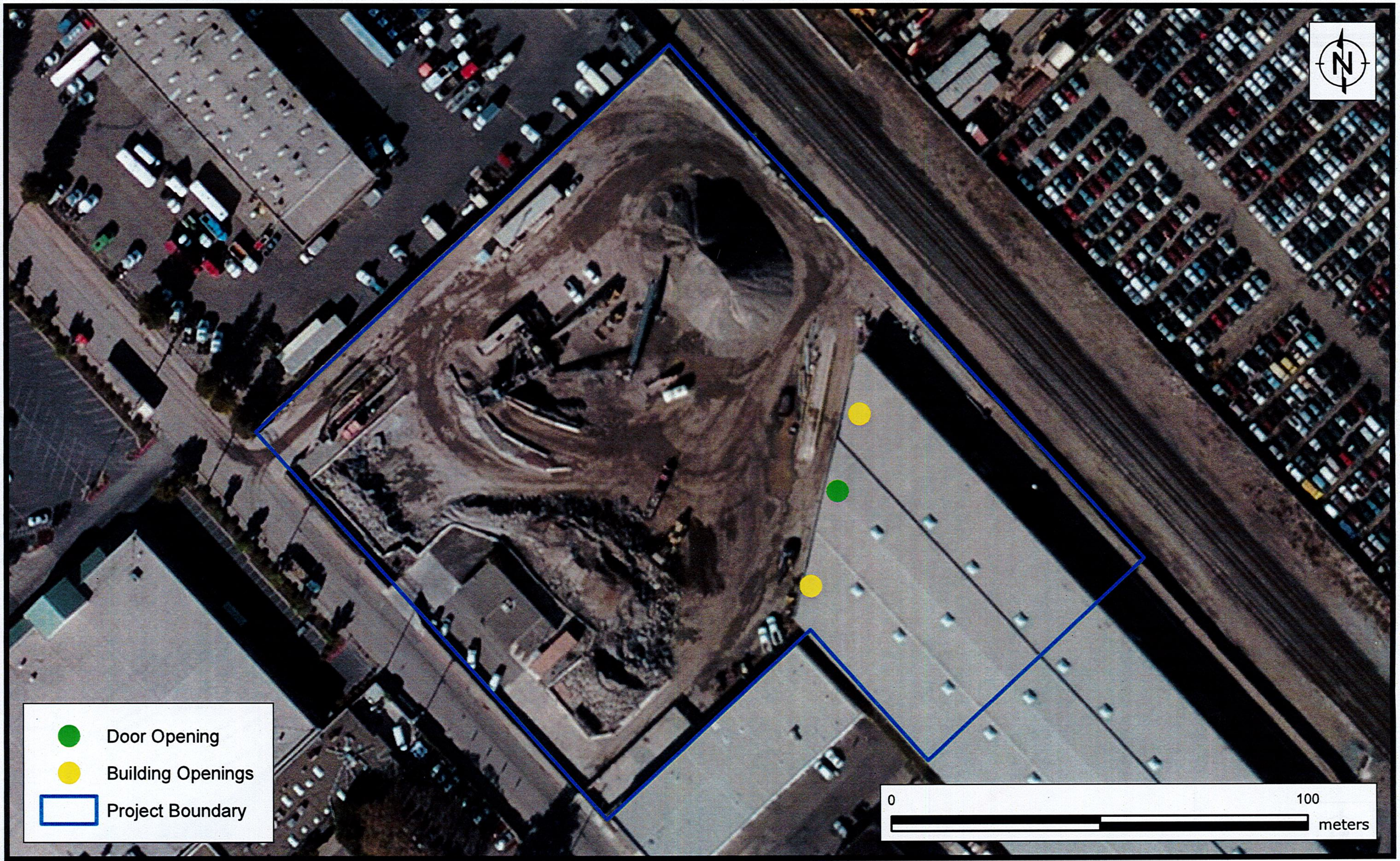
Project Location and Boundary
Argent Materials
Oakland, CA

FIGURE 1

RAMBOLL

DRAFTED BY: DCW | DATE: 12/10/2019

1690015117

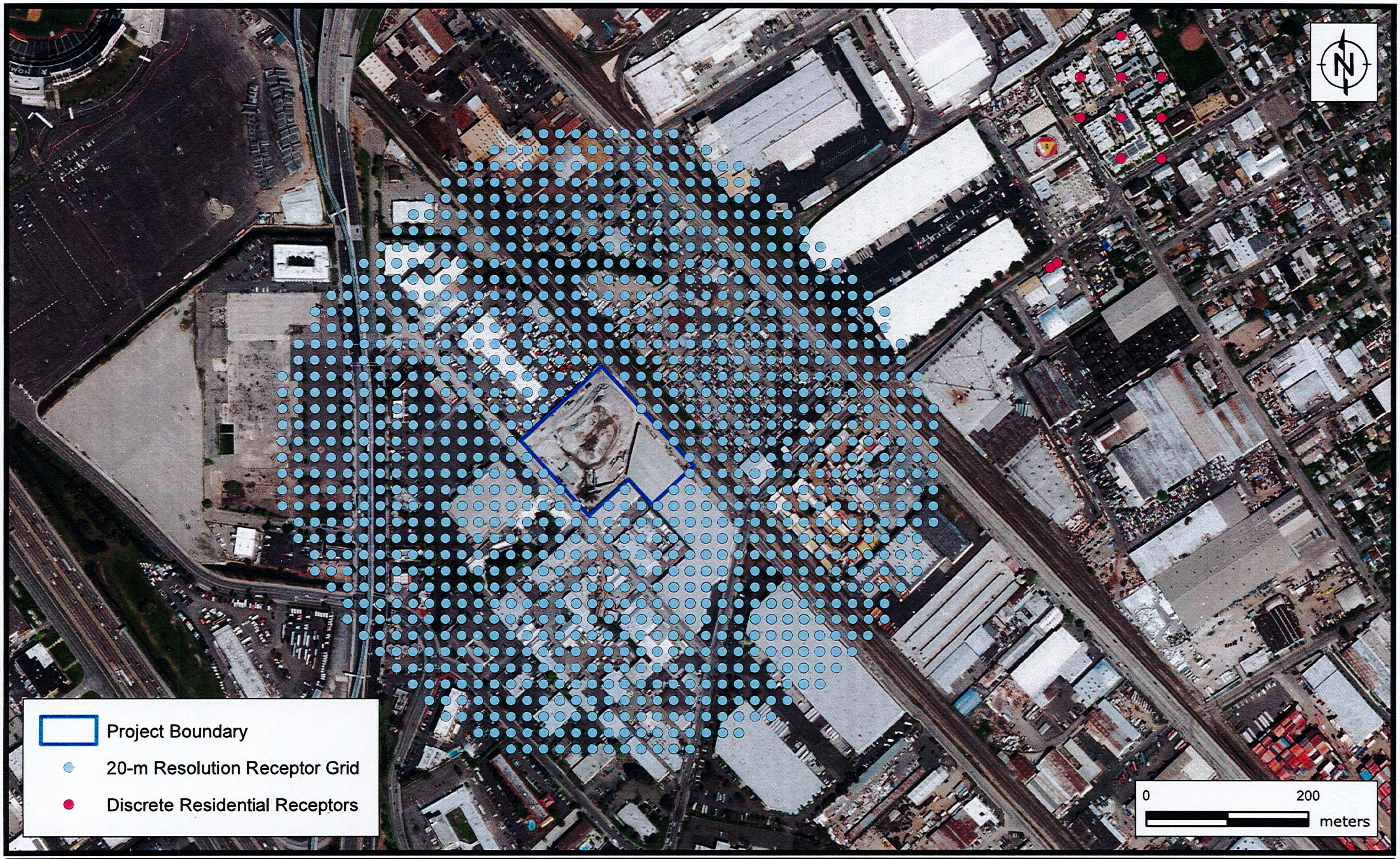


RAMBOLL

DRAFTED BY: DCW | DATE: 1/6/2020

Source Locations for Project Operations
Argent Materials
Oakland, CA

FIGURE
2
1690015117



RAMBOLL

DRAFTED BY: DCW | DATE: 12/10/2019

Modeled Receptor Grid
Argent Materials
Oakland, CA

FIGURE
3

1690015117

APPENDIX A

8300 Baldwin Street
8300 Baldwin Street
Oakland, CA 94621

Inquiry Number: 5838289.1s
October 22, 2019

EDR Offsite Receptor Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

FORM-GON

TABLE OF CONTENTS

Thank you for your business
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available records was conducted by Environmental Data Resources, Inc. (EDR). The EDR Offsite Receptor Report provides information which may be used to comply with the Clean Air Act Risk Management Program 112-R. *"The rule requires that you estimate in the RMP residential populations within the circle defined by the endpoint for your worst-case and alternative release scenarios (i.e., the center of the circle is the point of release and the radius is the distance to the endpoint). In addition, you must report in the RMP whether certain types of public receptors and environmental receptors are within the circles."*

The address of the subject property, for which the search was intended, is:

8300 BALDWIN STREET
8300 BALDWIN STREET
OAKLAND, CA 94621

Distance Searched: 1.000 miles from subject property

RECEPTOR SUMMARY
An X indicates the presence of the receptor within the search radius.

Residential Population
Estimated population within search radius: 15720 persons.

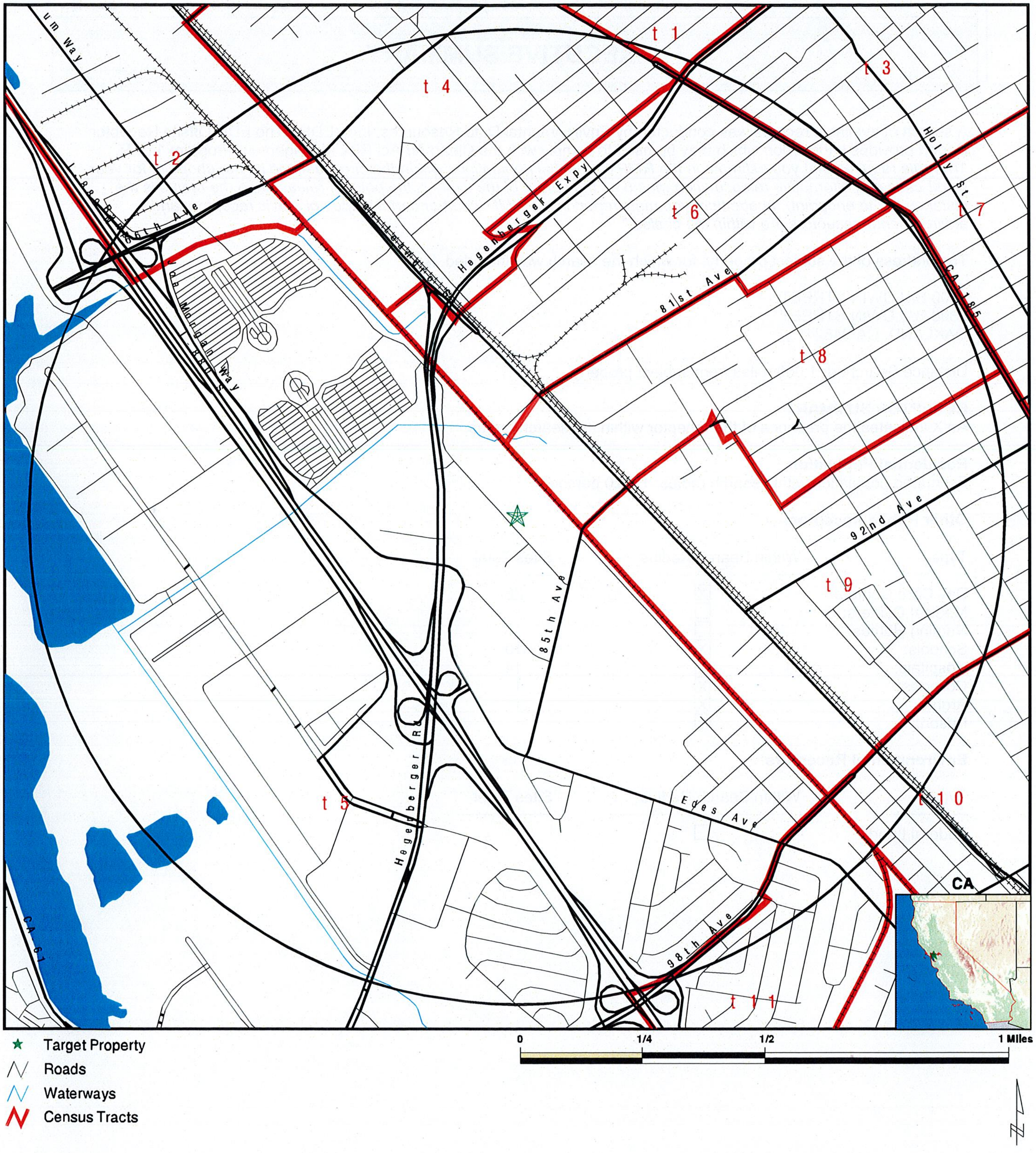
Other Public Receptors

Type	Within Search Radius	Sites Total
Day Care Centers:	☒	26
Medical Centers:	☐	
Nursing Homes:	☐	
Schools:	☒	10
Hospitals:	☒	14
Colleges:	☒	1
Arena:	☒	1
Prison:	☐	

Environmental Receptors

Type	Within Search Radius	Sites Total
Federal Land:	☐	

CENSUS MAP - 5838289.1s

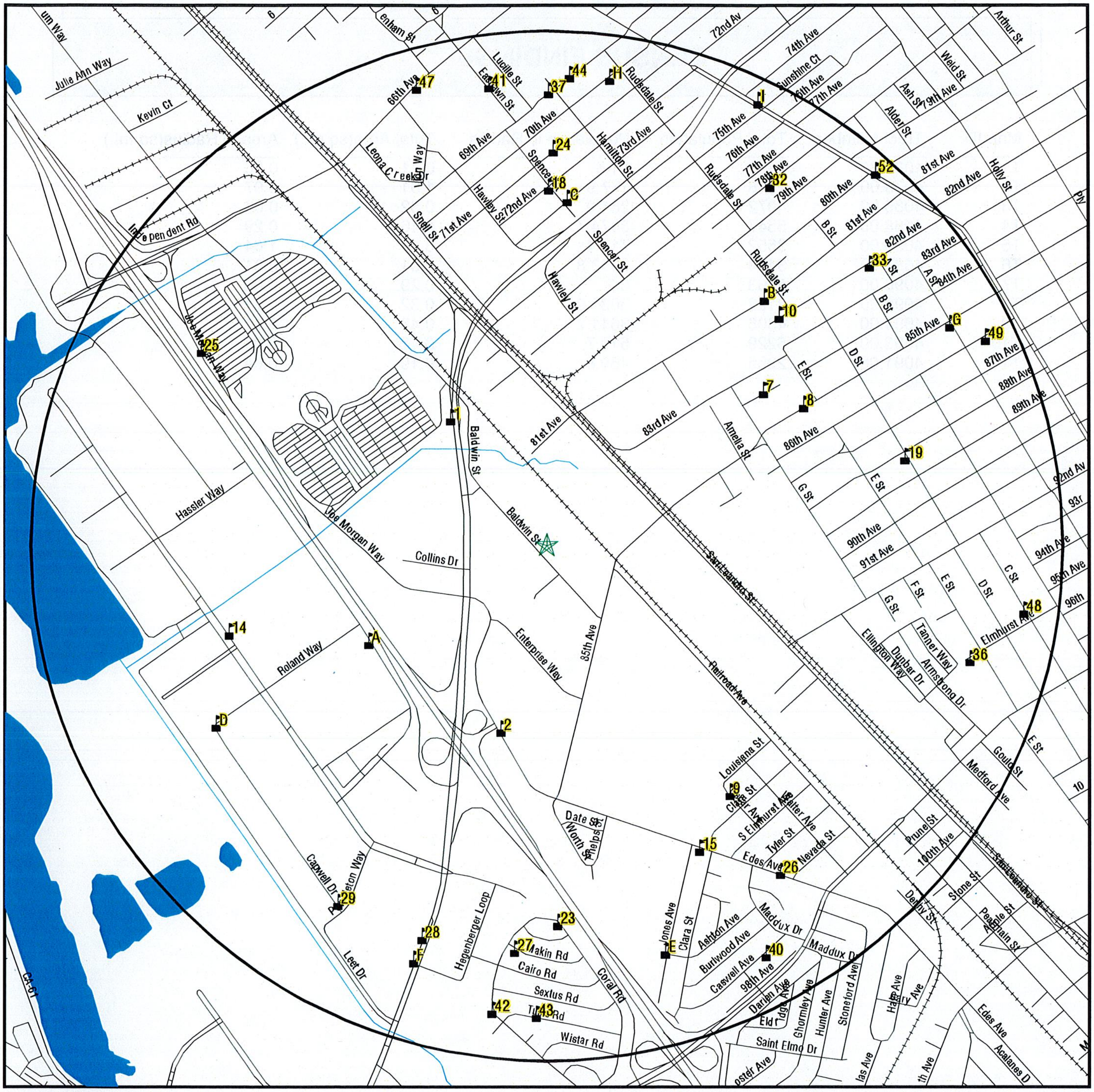


TARGET PROPERTY:	8300 Baldwin Street	CUSTOMER:	Ramboll
ADDRESS:	8300 Baldwin Street	CONTACT:	Lewis Kunik
CITY/STATE/ZIP:	Oakland CA 94621	INQUIRY #:	5838289.1s
LAT/LONG:	37.7462 / 122.1932	DATE:	October 22, 2019 9:21 am

CENSUS FINDINGS

Map ID	Tract Number	Total Population	Population in Radius	Total Area(sq.mi.)	Area in Radius(sq.mi.)
T1	4086.00	5492	31.6	0.41	0.00
T2	4073.00	2598	177.9	1.01	0.07
T3	4085.00	4972	281.9	0.32	0.02
T4	4088.00	5547	3474.7	0.46	0.29
T5	4090.00	3552	715.4	8.12	1.64
T6	4089.00	3414	3413.8	0.31	0.31
T7	4096.00	5063	0.2	0.29	0.00
T8	4095.00	3122	3031.9	0.32	0.31
T9	4094.00	4306	3611.7	0.48	0.41
T10	4093.00	5229	510.7	0.42	0.04
T11	4091.00	2255	469.8	0.19	0.04

RECEPTOR MAP - 5838289.1s



0 | 1/4 | 1/2 | 1 Miles

★ Target Property
Roads
Waterways
Environmental or Public Receptor
Federal Lands Linear Features
Federal Lands Area

TARGET PROPERTY:	8300 Baldwin Street	CUSTOMER:	Ramboll
ADDRESS:	8300 Baldwin Street	CONTACT:	Lewis Kunik
CITY/STATE/ZIP:	Oakland CA 94621	INQUIRY #:	5838289.1s
LAT/LONG:	37.7462 / 122.1932	DATE:	October 22, 2019 9:21 am

MAP FINDINGS

Map ID / Direction / Distance / Distance (ft.) / Elevation	Site		EDR ID / Database
1			SRHO20070154407
NW	Hospital type:	01	AHA Hospitals
1/4-1/2 mi	Num of times COO:	00	
1631	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	
	Medicare/Medicaid:	Not Reported	
	Facility name:	OAKCARE MEDICAL GROUP, INC	
	Intermediary/Carrier:	Not Reported	
	Medicaid number:	Not Reported	
	Partcipation date:	19971229	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	05D0937961	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Y	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	LAB	
	street address:	675 HEGENBERGER ROAD SUITE 123	
	Phone num:	5106325514	
	Termination reason:	08	
	Term Date:	20031228	
	Purpose of action:	Not Reported	
	Provider control:	04	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	Not Reported	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSCLIA	
	Edr id:	SRHO20070154407	
2			SRHO20070134795
SSW	Hospital type:	01	AHA Hospitals
1/4-1/2 mi	Num of times COO:	00	
1949	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	

MAP FINDINGS

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Medicare/Medicaid:	Not Reported	
	Facility name:	NAVCARE 2	
	Intermediary/Carrier:	Not Reported	
	Medicaid number:	Not Reported	
	Partcipation date:	19930504	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	05D0602903	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Not Reported	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	LAB	
	street address:	8450 EDES AVENUE	
	Phone num:	5106325514	
	Termination reason:	01	
	Term Date:	19950930	
	Purpose of action:	Not Reported	
	Provider control:	04	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	Not Reported	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSCLIA	
	Edr id:	SRHO20070134795	

A3			SRHO20070133688
WSW	Hospital type:	01	AHA Hospitals
1/4-1/2 mi	Num of times COO:	00	
2076	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	
	Medicare/Medicaid:	Not Reported	
	Facility name:	MIDPENINSULA HOSPICE	
	Intermediary/Carrier:	Not Reported	
	Medicaid number:	Not Reported	
	Partcipation date:	19950404	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	05D0600670	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Y	

state abbrev:	CA	
ssa state:	05	
state region cd:	LAB	
street address:	7901 OAKPORT STREET SUITE 3500	
Phone num:	5106324390	
Termination reason:	08	
Term Date:	20000831	
Purpose of action:	Not Reported	
Provider control:	02	
Zip:	94621	
Fips state:	06	
Fips cnty:	001	
SSA MSA:	418	
SSA MSA size code:	B	
Date accredited:	Not Reported	
Accred expire date:	Not Reported	
Accred Org:	Not Reported	
Num beds:	0000	
Num cert beds:	0000	
Source:	US_HOSPITAL_POSCLIA	
Edr id:	SRHO20070133688	

A4			SRHO20070010897
WSW	Hospital type:	01	AHA Hospitals
1/4-1/2 mi	Num of times COO:	05	
2076	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	1	
	Compliance status:	A	
	SSA county code:	000	
	Cross ref number:	051506	
	FMS survey date:	Not Reported	
	Current survey date:	19980422	
	Medicare/Medicaid:	1	
	Facility name:	PATHWAYS HOSPICE	
	Intermediary/Carrier:	00040	
	Medicaid number:	Not Reported	
	Partcipation date:	19790628	
	Prior COO date:	19990423	
	Prior carrier:	00041	
	Provider ID:	057227	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Not Reported	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	BK	
	street address:	7901 OAKPORT STREET, SUITE 3500	
	Phone num:	5106324390	
	Termination reason:	01	
	Term Date:	19981231	
	Purpose of action:	2	
	Provider control:	03	
	Zip:	94621	
	Fips state:	06	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	0	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSOTHER	
	Edr id:	SRHO20070010897	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
A5			SRHO20070009474
WSW	Hospital type:	01	AHA Hospitals
1/4-1/2 mi	Num of times COO:	01	
2076	Owner date:	19990101	
Higher	City:	OAKLAND	
	Has plan of corr:	1	
	Compliance status:	A	
	SSA county code:	060	
	Cross ref number:	057227	
	FMS survey date:	Not Reported	
	Current survey date:	19980422	
	Medicare/Medicaid:	1	
	Facility name:	PATHWAYS HOME HEALTH AND HOSPICE	
	Intermediary/Carrier:	00040	
	Medicaid number:	Not Reported	
	Partcipation date:	19840316	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	051506	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Not Reported	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	SJ	
	street address:	7901 OAKPORT STREET, SUITE 3500	
	Phone num:	5106324390	
	Termination reason:	00	
	Term Date:	Not Reported	
	Purpose of action:	2	
	Provider control:	03	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	013	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	0	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSOTHER	
	Edr id:	SRHO20070009474	

MAP FINDINGS

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
A6			SRHO20070147316
WSW	Hospital type:	01	AHA Hospitals
1/4-1/2 mi	Num of times COO:	00	
2091	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	
	Medicare/Medicaid:	Not Reported	
	Facility name:	US HEALTHWORKS	
	Intermediary/Carrier:	Not Reported	
	Medicaid number:	Not Reported	
	Partcipation date:	19930526	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	05D0870772	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Y	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	M2	
	street address:	7817 OAKPORT STREET	
	Phone num:	5106380701	
	Termination reason:	00	
	Term Date:	20080831	
	Purpose of action:	Not Reported	
	Provider control:	04	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	Not Reported	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSCLIA	
	Edr id:	SRHO20070147316	

7			SRDCCA200731488
NE	EDR ID:	SRDCCA200731488	Daycare
1/2-1 mi	Facility number:	13418436	
2719	Facility name:	"BRAXTON, VICKI A "	
Higher	Facility eval. code:	0203	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	810	
	Facility status code:	03	
	Address:	945 84TH AVE #B	
	City:	OAKLAND	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	State:	CA	
	Zip:	94621	
	Alt. address:	945 84TH AVE #B	
	City:	OAKLAND	
	State:	CA	
	Zip:	94621	
	Facility investor:	"BRAXTON, VICKI A "	
	Licensee type:	A	
	License effective date:	50824	
	License expiration date:	Not Reported	
	License issue date:	050824	
	Program type:	"MAX. CAP: 6 - NO MORE THAN 3 INFANTS OR 4 INFANTS ONLY. CAP 8 - NO MORE THAN 2 INFANTS, 1 CHILD IN KINDERGARTEN OR ELEMENTARY SCHOOL AND 1 CHILD AT LEAST AGE 6. "	
	Original app. received date:	050810	
	Facility closed date:	Not Reported	
	Mailing address:	945 84TH AVE #B	
	Mailing city:	OAKLAND	
	Mailing state:	CA	
	Mailing zip:	94621	
	Contact person:	"BRAXTON, VICKI A "	
	Facility capacity:	8	
	Type of clients served:	960	
	Facility phone:	5106399082	

Map ID / Direction / Distance / Distance (ft.) / Elevation	Site		EDR ID / Database
8			SRDCCA200752429
ENE	EDR ID:	SRDCCA200752429	Daycare
1/2-1 mi	Facility number:	10216108	
2992	Facility name:	OAKLAND HEAD START - TASSAFARONGA	
Higher	Facility eval. code:	0207	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	850	
	Facility status code:	03	
	Address:	975- 85TH AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94621	
	Alt. address:	150 FRANK H. OGAWA PLAZA #5352	
	City:	OAKLAND	
	State:	CA	
	Zip:	94612	
	Facility investor:	CITY OF OAKLAND	
	Licensee type:	F	
	License effective date:	951018	
	License expiration date:	Not Reported	
	License issue date:	951018	
	Program type:	AGES: 2 YEARS TO FIRST GRADE ENTRY. HOURS OF OPERATION: MONDAY THROUGH FRIDAY 8:15 A.M. TO 4:45 P.M. IN ONE CLASSROOM.	
	Original app. received date:	940527	
	Facility closed date:	Not Reported	
	Mailing address:	505 - 14TH STREET SUITE #300	
	Mailing city:	OAKLAND	
	Mailing state:	CA	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Mailing zip:	94612	
	Contact person:	"COOPER, ARNETTA "	
	Facility capacity:	25	
	Type of clients served:	950	
	Facility phone:	5106390580	

9			SRDCCA200708001
SE	EDR ID:	SRDCCA200708001	Daycare
1/2-1 mi	Facility number:	13411434	
3153	Facility name:	"ADAMS, RAMONA "	
Higher	Facility eval. code:	0105	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	810	
	Facility status code:	03	
	Address:	9312 OSCARS AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94603	
	Alt. address:	9312 OSCARS AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94603	
	Facility investor:	"ADAMS, RAMONA "	
	Licensee type:	A	
	License effective date:	960419	
	License expiration date:	Not Reported	
	License issue date:	960419	
	Program type:	"MAXIMUM CAPACITY: 12 CHILDREN, INCLUDING LICENSEE'S CHILDREN UNDER 10 YEARS OF AGE WHO RESIDE IN THE HOME, WITH NO MORE THAN 4 INFANTS (INFANT MEANS A CHILD UNDER 2 YEARS OLD). "	
	Original app. received date:	960228	
	Facility closed date:	Not Reported	
	Mailing address:	9312 OSCARS AVENUE	
	Mailing city:	OAKLAND	
	Mailing state:	CA	
	Mailing zip:	94603	
	Contact person:	"ADAMS, RAMONA "	
	Facility capacity:	12	
	Type of clients served:	960	
	Facility phone:	5105684565	

10			SRDCCA200724957
NE	EDR ID:	SRDCCA200724957	Daycare
1/2-1 mi	Facility number:	13417498	
3345	Facility name:	"DAVIS, D'YENDIS "	
Higher	Facility eval. code:	0301	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	810	
	Facility status code:	03	
	Address:	1023 82ND AVENUE	
	City:	OAKLAND	

State:	CA
Zip:	94621
Alt. address:	1023 82ND AVENUE
City:	OAKLAND
State:	CA
Zip:	94621
Facility investor:	"DAVIS, D'YENDIS "
Licensee type:	A
License effective date:	50727
License expiration date:	Not Reported
License issue date:	050727
Program type:	"MAXIMUM CAPACITY: 6 CHILDREN WITH NO MORE THAN 3 INFANTS, OR 4 INFANTSONLY, OR CAPACITY 8 CHILDREN WHEN 2 ARE AT LEAST 6 YEARS OF AGE WITH AMAXIMUM OF 2 INFANTS; PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED "
Original app. received date:	040220
Facility closed date:	Not Reported
Mailing address:	1023 82ND AVENUE
Mailing city:	OAKLAND
Mailing state:	CA
Mailing zip:	94621
Contact person:	"DAVIS, D'YENDIS "
Facility capacity:	8
Type of clients served:	960
Facility phone:	5104308355

B11
NE
1/2-1 mi
3373
Higher

SRDCCA200755767
Daycare

EDR ID:	SRDCCA200755767
Facility number:	13418180
Facility name:	OUSD - ACORN/WOODLAND
Facility eval. code:	0207
Facility office number:	02
Facility county number:	01
Facility type code:	850
Facility status code:	03
Address:	1025 EIGHTY FIRST AVENUE
City:	OAKLAND
State:	CA
Zip:	94621
Alt. address:	495 JONES AVENUE
City:	OAKLAND
State:	CA
Zip:	94603
Facility investor:	OAKLAND UNIFIED SCHOOL DISTRICT
Licensee type:	F
License effective date:	60206
License expiration date:	Not Reported
License issue date:	060206
Program type:	"AGES 2 TO FIRST GRADE ENTRY. OPERATING MON - FRI, 8:15AM - 3:15PM IN 2 CLASSROOMS AND THE CAFETERIA. "
Original app. received date:	051220
Facility closed date:	Not Reported
Mailing address:	495 JONES AVENUE
Mailing city:	OAKLAND

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Mailing state:	CA	
	Mailing zip:	94603	
	Contact person:	"VASQUEZ, LINDA "	
	Facility capacity:	48	
	Type of clients served:	950	
	Facility phone:	5108790197	
B12			SRPU20071009657
NE	Ncessch:	062805010730	Public Schools
1/2-1 mi	Schname05:	ACORN WOODLAND ELEMENTARY	
3373	Mstreet05:	1025 81ST AVE.	
Higher	Mcity05:	OAKLAND	
	Mstate05:	CA	
	Mzip05:	94621	
	Mzip405:	Not Reported	
	Member05:	258	
	Phone05:	(510) 879-0190	
	Locale05:	1	
	Type05:	1	
	Level05:	1	
	Gslo05:	KG	
	Gshi05:	05	
	Edr id:	SRPU20071009657	
B13			SRPU20071009643
NE	Ncessch:	062805010686	Public Schools
1/2-1 mi	Schname05:	ENCOMPASS ACADEMY ELEMENTARY	
3373	Mstreet05:	1025 81ST AVE.	
Higher	Mcity05:	OAKLAND	
	Mstate05:	CA	
	Mzip05:	94621	
	Mzip405:	Not Reported	
	Member05:	152	
	Phone05:	(510) 879-0207	
	Locale05:	1	
	Type05:	1	
	Level05:	1	
	Gslo05:	KG	
	Gshi05:	03	
	Edr id:	SRPU20071009643	
14			SRHO20070149950
WSW	Hospital type:	01	AHA Hospitals
1/2-1 mi	Num of times COO:	00	
3382	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	
	Medicare/Medicaid:	Not Reported	

MAP FINDINGS

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Facility name:	HEALTH SERVICE SOLUTION	
	Intermediary/Carrier:	Not Reported	
	Medicaid number:	Not Reported	
	Partcipation date:	19951013	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	05D0907414	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Y	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	LAB	
	street address:	7700 EDGEWATER DRIVE SUITE 803	
	Phone num:	5106324872	
	Termination reason:	12	
	Term Date:	20010827	
	Purpose of action:	Not Reported	
	Provider control:	04	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	Not Reported	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSCLIA	
	Edr id:	SRHO20070149950	

15			SRHO20070009875
SSE	Hospital type:	01	AHA Hospitals
1/2-1 mi	Num of times COO:	00	
3483	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	
	Medicare/Medicaid:	Not Reported	
	Facility name:	OVER 60 HEALTH	
	Intermediary/Carrier:	00450	
	Medicaid number:	Not Reported	
	Partcipation date:	19950315	
	Prior COO date:	Not Reported	
	Prior carrier:	51051	
	Provider ID:	051981	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Y	
	state abbrev:	CA	

Map ID
Direction
Distance
Distance (ft.)
Elevation   Site   EDR ID
Database

ssa state:	05
state region cd:	SF
street address:	9255 EDES AVENUE
Phone num:	5103822190
Termination reason:	00
Term Date:	Not Reported
Purpose of action:	1
Provider control:	02
Zip:	94603
Fips state:	06
Fips cnty:	001
SSA MSA:	418
SSA MSA size code:	B
Date accredited:	Not Reported
Accred expire date:	Not Reported
Accred Org:	Not Reported
Num beds:	0000
Num cert beds:	0000
Source:	US_HOSPITAL_POSOTHER
Edr id:	SRHO20070009875

C16
North
1/2-1 mi
3531
Higher

SRDCCA200726266
Daycare

EDR ID:	SRDCCA200726266
Facility number:	13417859
Facility name:	"RODRIGUEZ, ALICIA "
Facility eval. code:	0301
Facility office number:	02
Facility county number:	01
Facility type code:	810
Facility status code:	03
Address:	1001 73RD AVENUE
City:	OAKLAND
State:	CA
Zip:	94621
Alt. address:	1001 73RD AVENUE
City:	OAKLAND
State:	CA
Zip:	94621
Facility investor:	"RODRIGUEZ, ALICIA "
Licensee type:	A
License effective date:	40917
License expiration date:	Not Reported
License issue date:	040917
Program type:	"MAXIMUM CAPACITY: 6 CHILDREN WITH NO MORE THAN 3 INFANTS, OR 4 INFANTSONLY, OR CAPACITY 8 CHILDREN WHEN 2 ARE AT LEAST 6 YEARS OF AGE WITH AMAXIMUM OF 2 INFANTS; PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED "
Original app. received date:	040826
Facility closed date:	Not Reported
Mailing address:	1001 73RD AVENUE
Mailing city:	OAKLAND
Mailing state:	CA
Mailing zip:	94621
Contact person:	"RODRIGUEZ, ALICIA "
Facility capacity:	8

	Type of clients served:	960
	Facility phone:	5106336314

C17 | SRDCCA200730746 | Daycare

North	EDR ID:	SRDCCA200730746
1/2-1 mi	Facility number:	13418137
3575	Facility name:	"JELKS,BARBARA "
Higher	Facility eval. code:	0301
	Facility office number:	02
	Facility county number:	01
	Facility type code:	810
	Facility status code:	03
	Address:	1011 -73RD AVE
	City:	OAKLAND
	State:	CA
	Zip:	94621
	Alt. address:	1011 -73RD AVE
	City:	OAKLAND
	State:	CA
	Zip:	94621
	Facility investor:	"JELKS, BARBARA "
	Licensee type:	A
	License effective date:	50411
	License expiration date:	Not Reported
	License issue date:	050411
	Program type:	MAX. CAP (WHEN THERE IS AN ASSISTANT PRESENT): 12 - NO MORE THAN 4 INFANTS. CAP 14 - NO MORE THAN 3 INFANTS. 1 CHILD IN KINDERGARTEN OR ELEMENTARY SCHOOL AND 1 CHILD AT LEAST AGE 6.
	Original app. received date:	050209
	Facility closed date:	Not Reported
	Mailing address:	1011 -73RD AVE
	Mailing city:	OAKLAND
	Mailing state:	CA
	Mailing zip:	94621
	Contact person:	A
	Facility capacity:	14
	Type of clients served:	960
	Facility phone:	5106394429

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18 | SRDCCA200701674 | Daycare

North	EDR ID:	SRDCCA200701674
1/2-1 mi	Facility number:	10210911
3665	Facility name:	"JOHNSON, PEGGY "
Higher	Facility eval. code:	0301
	Facility office number:	02
	Facility county number:	01
	Facility type code:	810
	Facility status code:	03
	Address:	7203 SPENCER STREET
	City:	OAKLAND
	State:	CA
	Zip:	94621
	Alt. address:	7203 SPENCER STREET
	City:	OAKLAND

State: CA
Zip: 94621
Facility investor: "JOHNSON, PEGGY "
Licensee type: A
License effective date: 930731
License expiration date: Not Reported
License issue date: Not Reported
Program type: "MAXIMUM CAPACITY: 12 CHILDREN, INCLUDING LICENSEE'S CHILDREN UNDER 10 YEARS OLD WHEN IN THE HOME, WITH NO MORE THAN 4 INFANTS. (INFANT MEANS A CHILD UNDER 2 YEARS OLD.
"
Original app. received date: 870826
Facility closed date: Not Reported
Mailing address: 7203 SPENCER STREET
Mailing city: OAKLAND
Mailing state: CA
Mailing zip: 94621
Contact person: "JOHNSON, PEGGY "
Facility capacity: 12
Type of clients served: 960
Facility phone: 5105623060

19
ENE
1/2-1 mi
3776
Higher

SRDCCA200727907
Daycare

EDR ID: SRDCCA200727907
Facility number: 13418106
Facility name: "STANLEY, YOLANDA "
Facility eval. code: 0301
Facility office number: 02
Facility county number: 01
Facility type code: 810
Facility status code: 03
Address: 8819 D STREET
City: OAKLAND
State: CA
Zip: 94621
Alt. address: 8819 D STREET
City: OAKLAND
State: CA
Zip: 94621
Facility investor: "STANLEY, YOLANDA "
Licensee type: A
License effective date: 50228
License expiration date: Not Reported
License issue date: 050228
Program type: "MAX. CAP: 6 - NO MORE THAN 3 INFANTS OR 4 INFANTS ONLY. CAP 8 - NO MORE THAN 2 INFANTS, 1 CHILD IN KINDERGARTEN OR ELEMENTARY SCHOOL AND 1 CHILD AT LEAST AGE 6. "
Original app. received date: 050124
Facility closed date: Not Reported
Mailing address: 8819 D STREET
Mailing city: OAKLAND
Mailing state: CA
Mailing zip: 94621
Contact person: "STANLEY, YOLANDA "
Facility capacity: 8

	Type of clients served:	960	
	Facility phone:	5106339713	

D20			SRHO20070108896
WSW	Hospital type:	01	AHA Hospitals
1/2-1 mi	Num of times COO:	00	
3856	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	A	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	19960619	
	Medicare/Medicaid:	1	
	Facility name:	NEIGHBORHOOD HOME HEALTH DIV OF ABHOW	
	Intermediary/Carrier:	00140	
	Medicaid number:	Not Reported	
	Partcipation date:	19960619	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	557709	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Not Reported	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	BK	
	street address:	400 ROLAND WAY	
	Phone num:	5106357797	
	Termination reason:	01	
	Term Date:	19990630	
	Purpose of action:	1	
	Provider control:	01	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	0	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSOTHER	
	Edr id:	SRHO20070108896	

D21			SRHO20070147246
WSW	Hospital type:	01	AHA Hospitals
1/2-1 mi	Num of times COO:	00	
3856	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	
	Medicare/Medicaid:	Not Reported	
	Facility name:	NEIGHBORHOOD HOME HEALTH	
	Intermediary/Carrier:	Not Reported	
	Medicaid number:	Not Reported	
	Partcipation date:	19960610	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	05D0915846	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Y	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	LAB	
	street address:	400 ROLAND WAY	
	Phone num:	5106357797	
	Termination reason:	17	
	Term Date:	20000329	
	Purpose of action:	Not Reported	
	Provider control:	02	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	Not Reported	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSCLIA	
	Edr id:	SRHO20070147246	
D22			SRHO20070147538
WSW	Hospital type:	01	AHA Hospitals
1/2-1 mi	Num of times COO:	00	
3873	Owner date:	Not Reported	
Higher	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	
	Medicare/Medicaid:	Not Reported	
	Facility name:	ADVANTAGE OCCUPATIONAL MEDICINE CENTER	
	Intermediary/Carrier:	Not Reported	
	Medicaid number:	Not Reported	
	Partcipation date:	19970613	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	

Provider ID:	05D0929441
Record Status:	A
Region code:	09
Is Partial Record:	Y
state abbrev:	CA
ssa state:	05
state region cd:	LAB
street address:	401 ROLAND WAY STE 130
Phone num:	5106359515
Termination reason:	08
Term Date:	20050612
Purpose of action:	Not Reported
Provider control:	04
Zip:	94621
Fips state:	06
Fips cnty:	001
SSA MSA:	418
SSA MSA size code:	B
Date accredited:	Not Reported
Accred expire date:	Not Reported
Accred Org:	Not Reported
Num beds:	0000
Num cert beds:	0000
Source:	US_HOSPITAL_POSCLIA
Edr id:	SRHO20070147538

23
South
1/2-1 mi
3875
Higher

SRDCCA200740806
Daycare

EDR ID:	SRDCCA200740806
Facility number:	13419109
Facility name:	"WASHINGTON-BOLTON, ARNETTA "
Facility eval. code:	0105
Facility office number:	02
Facility county number:	01
Facility type code:	810
Facility status code:	03
Address:	9239 CORAL ROAD
City:	OAKLAND
State:	CA
Zip:	94603
Alt. address:	9239 CORAL ROAD
City:	OAKLAND
State:	CA
Zip:	94603
Facility investor:	"WASHINGTON-BOLTON, ARNETTA "
Licensee type:	A
License effective date:	61228
License expiration date:	Not Reported
License issue date:	061228
Program type:	"MAX. CAP: 6 - NO MORE THAN 3 INFANTS OR 4 INFANTS ONLY. CAP 8 - NO MORE THAN 2 INFANTS, 1 CHILD IN KINDERGARTEN OR ELEMENTARY SCHOOL AND 1 CHILD AT LEAST AGE 6. "
Original app. received date:	061117
Facility closed date:	Not Reported
Mailing address:	9239 CORAL ROAD
Mailing city:	OAKLAND

Mailing state: CA
Mailing zip: 94603
Contact person: "WASHINGTON-BOLTON, ARNETTA"
Facility capacity: 8
Type of clients served: 960
Facility phone: 5104308920

24
North
1/2-1 mi
4061
Higher

SRDCCA200714453
Daycare

EDR ID: SRDCCA200714453
Facility number: 13415788
Facility name: ROZELIA DOWNS
Facility eval. code: 0301
Facility office number: 02
Facility county number: 01
Facility type code: 810
Facility status code: 03
Address: 1039 71ST AVENUE
City: OAKLAND
State: CA
Zip: 94621
Alt. address: P.O.BOX 1002
City: OAKLAND
State: CA
Zip: 94604
Facility investor: ROZELIA DOWNS
Licensee type: A
License effective date: 10626
License expiration date: Not Reported
License issue date: 010626
Program type: "MAXIMUM CAPACITY: 6 CHILDREN WITH NO MORE THAN 3 INFANTS, OR 4 INFANTSONLY, OR CAPACITY 8 CHILDREN WHEN 2 ARE AT LEAST 6 YEARS OF AGE WITH AMAXIMUM OF 2 INFANTS; PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED "
Original app. received date: 010611
Facility closed date: Not Reported
Mailing address: P.O.BOX 1002
Mailing city: OAKLAND
Mailing state: CA
Mailing zip: 94604
Contact person: BROWN & DOWNS
Facility capacity: 8
Type of clients served: 960
Facility phone: 5105699249

25
WNW
1/2-1 mi
4072
Higher

ARE1438
Arenas

Name: OAKLAND ALAMEDA CNTY COLISEUM
Company: Not Reported
Street: 7000 COLISEUM WAY
City: OAKLAND
Telephone: 5105692121

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
26 SE 1/2-1 mi 4116 Higher			SRDCCA200752430 Daycare

EDR ID: SRDCCA200752430
Facility number: 10216109
Facility name: OAKLAND HEAD START - BROOKFIELD
Facility eval. code: 0203
Facility office number: 02
Facility county number: 01
Facility type code: 850
Facility status code: 03
Address: 9600 EDES AVENUE
City: OAKLAND
State: CA
Zip: 94603
Alt. address: "505 - 14TH STREET, SUITE #300 "
City: OAKLAND
State: CA
Zip: 94612
Facility investor: CITY OF OAKLAND
Licensee type: F
License effective date: 940921
License expiration date: Not Reported
License issue date: 940921
Program type: AGES 2YRS. TO FIRST GRADE ENTRY.
HOURS OF OPERATION: MON. - FRI. 8:15AM - 4:45PM IN 3 CLASSROOM AREAS.
Original app. received date: 940527
Facility closed date: Not Reported
Mailing address: "505 - 14TH STREET, SUITE #300 "
Mailing city: OAKLAND
Mailing state: CA
Mailing zip: 94612
Contact person: ANDREA BURNETT
Facility capacity: 48
Type of clients served: 950
Facility phone: 5106155737

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27 South 1/2-1 mi 4162 Higher			SRDCCA200721358 Daycare

EDR ID: SRDCCA200721358
Facility number: 13417031
Facility name: "WILLIAMS, KIMBERLY "
Facility eval. code: 0105
Facility office number: 02
Facility county number: 01
Facility type code: 810
Facility status code: 03
Address: 208 MAKIN ROAD
City: OAKLAND
State: CA
Zip: 94603
Alt. address: 208 MAKIN ROAD
City: OAKLAND
State: CA
Zip: 94603
Facility investor: "WILLIAMS, KIMBERLY "
Licensee type: A

License effective date:	30612
License expiration date:	Not Reported
License issue date:	030612
Program type:	"MAXIMUM CAPACITY: 6 CHILDREN WITH NO MORE THAN 3 INFANTS, OR 4 INFANTSONLY, OR CAPACITY 8 CHILDREN WHEN 2 ARE AT LEAST 6 YEARS OF AGE WITH AMAXIMUM OF 2 INFANTS; PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED "
Original app. received date:	030516
Facility closed date:	Not Reported
Mailing address:	208 MAKIN ROAD
Mailing city:	OAKLAND
Mailing state:	CA
Mailing zip:	94603
Contact person:	"WILLIAMS, KIMBERLY "
Facility capacity:	8
Type of clients served:	960
Facility phone:	5106336323

28
SSW
1/2-1 mi
4217
Higher

SRHO20070108623
AHA Hospitals

Hospital type:	01
Num of times COO:	00
Owner date:	Not Reported
City:	OAKLAND
Has plan of corr:	Not Reported
Compliance status:	A
SSA county code:	000
Cross ref number:	Not Reported
FMS survey date:	Not Reported
Current survey date:	19980225
Medicare/Medicaid:	1
Facility name:	HEALTH SERVICE SOLUTIONS
Intermediary/Carrier:	00040
Medicaid number:	Not Reported
Partcipation date:	19921006
Prior COO date:	Not Reported
Prior carrier:	Not Reported
Provider ID:	557234
Record Status:	A
Region code:	09
Is Partial Record:	Not Reported
state abbrev:	CA
ssa state:	05
state region cd:	BK
street address:	333 HEGENBERGER RD STE 401
Phone num:	5106324872
Termination reason:	01
Term Date:	20010731
Purpose of action:	2
Provider control:	03
Zip:	94621
Fips state:	06
Fips cnty:	001
SSA MSA:	418
SSA MSA size code:	B
Date accredited:	Not Reported

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Accred expire date:	Not Reported	
	Accred Org:	0	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSOTHER	
	Edr id:	SRHO20070108623	

29			SRCL20051004425
SSW	Unitid:	367608	Colleges
1/2-1 mi	Instnm:	CET-OAKLAND	
4251	Addr:	8390 CAPWELL DR	
Higher	City:	OAKLAND	
	Stabbr:	CA	
	Zip:	94621	
	Zip4:	Not Reported	
	Unk:	Not Reported	
	Fips:	094621	
	Oberge:	8	
	Chfnm:	Yolanda Ojeda	
	Chftitle:	Acting Director	
	Gentele:	4082877924	
	Fintele:	4082877924	
	Admtele:	4082877924	
	Ein:	941658311	
	Duns:	-1	
	Opeid:	2332820	
	Opeflag:	1	
	Webaddr:	-1	
	Sector:	8	
	Iclevel:	3	
	Control:	2	
	Hloffer:	2	
	Ugoffer:	1	
	Groffer:	2	
	Fpoffer:	2	
	Hdegoffer:	0	
	Deggrant:	2	
	Hbcu:	2	
	Hospital:	2	
	Medical:	2	
	Tribal:	2	
	Carnegie:	-3	
	Locale:	1	
	Openpubl:	1	
	Act:	A	
	Newid:	-2	
	Deathyr:	-2	
	Closedat:	-2	
	Cyactive:	1	
	Postsec:	1	
	Pseflag:	1	
	Pset4flg:	1	
	Rptmth:	2	
	Fte:	99	
	Enrtot:	99	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Edr id:	SRCL20051004425	

E30 SSE 1/2-1 mi 4339 Higher			SRDCCA200749311 Daycare

EDR ID: SRDCCA200749311
Facility number: 10215401
Facility name: O.U.S.D. - BROOKFIELD CDC
Facility eval. code: 0203
Facility office number: 02
Facility county number: 01
Facility type code: 850
Facility status code: 03
Address: 401 JONES AVENUE
City: OAKLAND
State: CA
Zip: 94603
Alt. address: 495 JONES AVE
City: OAKLAND
State: CA
Zip: 94603
Facility investor: OAKLAND UNIFIED SCHOOL DISTRICT
Licensee type: F
License effective date: 940222
License expiration date: Not Reported
License issue date: 940222
Program type: AGES 2-1ST GR ENTRY. HRS:MON-FRI (1)IN PORTABLE RM 1-7AM TO 5:3PM (2) IN PORT RM 3 & SCHOOL RM 9-8:30AM TO 2:30PM (3)IN PORT RM 2-8:30AM TO 12:30PM. MAX.# OF CHILDREN:(1)7AM-8:30AM-20 (2)8:30AM TO 12:30PM-82(3)12:30 PM TO 2:30PM-61 (4)2:30PM TO 5:30PM-20. SUBJECT TO 2 WAIVERS.
Original app. received date: 930512
Facility closed date: Not Reported
Mailing address: 1025 - 2ND AVENUE
Mailing city: OAKLAND
Mailing state: CA
Mailing zip: 94606
Contact person: JOSEPHINE ROLAND
Facility capacity: 59
Type of clients served: 950
Facility phone: 5106330462

E31 SSE 1/2-1 mi 4339 Higher			SRPU20071012618 Public Schools

Ncessch: 062805004243
Schname05: BROOKFIELD ELEMENTARY
Mstreet05: 401 JONES AVE.
Mcity05: OAKLAND
Mstate05: CA
Mzip05: 94603
Mzip405: 1123
Member05: 487
Phone05: (510) 879-1030
Locale05: 1
Type05: 1
Level05: 1
Gslo05: KG

Gshi05: 05
Edr id: SRPU20071012618

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32 SRDCCA200725670
NNE EDR ID: SRDCCA200725670 Daycare
1/2-1 mi Facility number: 13417431
4345 Facility name: "SHELTON, SANDRA "
Higher Facility eval. code: 0301
Facility office number: 02
Facility county number: 01
Facility type code: 810
Facility status code: 03
Address: 1268 - 78TH AVENUE
City: OAKLAND
State: CA
Zip: 94621
Alt. address: 1268 - 78TH AVENUE
City: OAKLAND
State: CA
Zip: 94621
Facility investor: "SHELTON, SANDRA "
Licensee type: A
License effective date: 40419
License expiration date: Not Reported
License issue date: 040419
Program type: MAX. CAP (WHEN THERE IS AN ASSISTANT PRESENT): 12 - NO MORE THAN 4 INFANTS. CAP 14 - NO MORE THAN 3 INFANTS. 1 CHILD IN KINDERGARTEN OR ELEMENTARY SCHOOL AND 1 CHILD AT LEAST AGE 6.
Original app. received date: 031218
Facility closed date: Not Reported
Mailing address: 1268 - 78TH AVENUE
Mailing city: OAKLAND
Mailing state: CA
Mailing zip: 94621
Contact person: "SHELTON, SANDRA "
Facility capacity: 14
Type of clients served: 960
Facility phone: 5106388328

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33 SRDCCA200707834
NE EDR ID: SRDCCA200707834 Daycare
1/2-1 mi Facility number: 13411769
4380 Facility name: "LYTLE, DONNA "
Higher Facility eval. code: 0301
Facility office number: 02
Facility county number: 01
Facility type code: 810
Facility status code: 03
Address: 1234 - 82ND AVENUE
City: OAKLAND
State: CA
Zip: 94621
Alt. address: 1234 - 82ND AVENUE
City: OAKLAND

State: CA
Zip: 94621
Facility investor: "LYTLE, DONNA "
Licensee type: A
License effective date: 961017
License expiration date: Not Reported
License issue date: 961017
Program type: "MAXIMUM CAPACITY: 12 CHILDREN WITH NO MORE THAN 4 INFANTS, OR CAPACITY14 CHILDREN WHEN 2 CHILDREN ARE AT LEAST 6 YEARS OF AGE WITH A MAXIMUMOF 3 INFANTS; PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED. "
Original app. received date: 960916
Facility closed date: Not Reported
Mailing address: 1234 - 82ND AVENUE
Mailing city: OAKLAND
Mailing state: CA
Mailing zip: 94621
Contact person: "LYTLE, DONNA "
Facility capacity: 14
Type of clients served: 960
Facility phone: 5105626200

F34 — SSW — 1/2-1 mi — 4466 — Higher — SRPU20071009655 — Public Schools

Ncessch: 062805010728
Schname05: EDUCATION FOR CHANGE EAST OAKLAND COMMUNITY CHARTE
Mstreet05: 303 HEGENBERGER RD., STE. 301
Mcity05: OAKLAND
Mstate05: CA
Mzip05: 94621
Mzip405: Not Reported
Member05: 606
Phone05: (510) 879-1240
Locale05: 1
Type05: 1
Level05: 4
Gslo05: KG
Gshi05: 04
Edr id: SRPU20071009655

F35 — SSW — 1/2-1 mi — 4466 — Higher — SRPU20071009675 — Public Schools

Ncessch: 062805011561
Schname05: EDUCATION FOR CHANGE UPPER ELEMENTARY
Mstreet05: 303 HEGENBERGER RD., STE. 301
Mcity05: OAKLAND
Mstate05: CA
Mzip05: 94621
Mzip405: Not Reported
Member05: -2
Phone05: M
Locale05: 1
Type05: 1
Level05: 4
Gslo05: N
Gshi05: N

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Edr id:	SRPU20071009675	

36			SRDCCA200712685
ESE	EDR ID:	SRDCCA200712685	Daycare
1/2-1 mi	Facility number:	13415388	
4483	Facility name:	"KEYS, JUNISE "	
Higher	Facility eval. code:	0105	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	810	
	Facility status code:	03	
	Address:	1010 ELMHURST AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94603	
	Alt. address:	1010 ELMHURST AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94603	
	Facility investor:	"KEYS, JUNISE "	
	Licensee type:	A	
	License effective date:	1023	
	License expiration date:	Not Reported	
	License issue date:	001023	
	Program type:	"MAXIMUM CAPACITY: 12 CHILDREN WITH NO MORE THAN 4 INFANTS, OR CAPACITY14 CHILDREN WHEN 2 CHILDREN ARE AT LEAST 6 YEARS OF AGE WITH A MAXIMUMOF 3 INFANTS;PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED. "	
	Original app. received date:	000928	
	Facility closed date:	Not Reported	
	Mailing address:	1010 ELMHURST AVENUE	
	Mailing city:	OAKLAND	
	Mailing state:	CA	
	Mailing zip:	94603	
	Contact person:	JUNISE KEYS	
	Facility capacity:	14	
	Type of clients served:	960	
	Facility phone:	5103821877	

37			SRDCCA200703942
North	EDR ID:	SRDCCA200703942	Daycare
1/2-1 mi	Facility number:	10215154	
4654	Facility name:	"TORRES, LORENA "	
Higher	Facility eval. code:	0301	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	810	
	Facility status code:	06	
	Address:	1089 - 69TH AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94621	
	Alt. address:	1089 - 69TH AVENUE	
	City:	OAKLAND	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	State:	CA	
	Zip:	94621	
	Facility investor:	"TORRES, LORENA SOCORRO "	
	Licensee type:	A	
	License effective date:	930617	
	License expiration date:	Not Reported	
	License issue date:	930617	
	Program type:	"MAXIMUM CAPACITY: 6 CHILDREN, WITH NO MORE THAN THREE CHILDREN UNDER AGE 2; OR 4 CHILDREN UNDER AGE TWO; OR A MAXIMUM OF 8 CHILDREN WHERE TWO CHILDREN ARE UNDER AGE 2 AND TWO ARE KINDERGARTEN OR FIRST GRADE "AND THE OTHER 4 ARE OVER AGE TWO.	
	Original app. received date:	921231	
	Facility closed date:	Not Reported	
	Mailing address:	1089 - 69TH AVE.	
	Mailing city:	OAKLAND	
	Mailing state:	CA	
	Mailing zip:	94621	
	Contact person:	"TORRES, LORENA S. "	
	Facility capacity:	8	
	Type of clients served:	960	
	Facility phone:	5105680728	

G38			SRPU20071012645
ENE	Ncessch:	062805004274	Public Schools
1/2-1 mi	Schname05:	HIGHLAND ELEMENTARY	
4702	Mstreet05:	8521 A ST.	
Higher	Mcity05:	OAKLAND	
	Mstate05:	CA	
	Mzip05:	94621	
	Mzip405:	1619	
	Member05:	437	
	Phone05:	(510) 879-1260	
	Locale05:	1	
	Type05:	1	
	Level05:	1	
	Gslo05:	KG	
	Gshi05:	05	
	Edr id:	SRPU20071012645	

G39			SRPU20071009673
ENE	Ncessch:	062805011559	Public Schools
1/2-1 mi	Schname05:	RISE COMMUNITY	
4702	Mstreet05:	8521 A ST.	
Higher	Mcity05:	OAKLAND	
	Mstate05:	CA	
	Mzip05:	94621	
	Mzip405:	Not Reported	
	Member05:	181	
	Phone05:	(510) 499-6574	
	Locale05:	1	
	Type05:	1	
	Level05:	1	
	Gslo05:	KG	
	Gshi05:	03	

Map ID / Direction / Distance / Distance (ft.) / Elevation	Site		EDR ID / Database
	Edr id:	SRPU20071009673	
40			SRDCCA200740092
SSE	EDR ID:	SRDCCA200740092	Daycare
1/2-1 mi	Facility number:	13419116	
4754	Facility name:	"BRADDY, THIMIKIA "	
Higher	Facility eval. code:	0105	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	810	
	Facility status code:	03	
	Address:	448 CASWELL STREET	
	City:	OAKLAND	
	State:	CA	
	Zip:	94603	
	Alt. address:	PO BOX 144	
	City:	SAN LORENZO	
	State:	CA	
	Zip:	94580	
	Facility investor:	"BRADDY, THIMIKIA "	
	Licensee type:	A	
	License effective date:	61219	
	License expiration date:	Not Reported	
	License issue date:	061219	
	Program type:	"MAX. CAP: 6 - NO MORE THAN 3 INFANTS OR 4 INFANTS ONLY. CAP 8 - NO MORE THAN 2 INFANTS, 1 CHILD IN KINDERGARTEN OR ELEMENTARY SCHOOL AND 1 CHILD AT LEAST AGE 6. "	
	Original app. received date:	061120	
	Facility closed date:	Not Reported	
	Mailing address:	PO BOX 144	
	Mailing city:	SAN LORENZO	
	Mailing state:	CA	
	Mailing zip:	94580	
	Contact person:	"BRADDY, THIMIKIA "	
	Facility capacity:	8	
	Type of clients served:	960	
	Facility phone:	5108782186	
41			SRDCCA200717391
North	EDR ID:	SRDCCA200717391	Daycare
1/2-1 mi	Facility number:	13416433	
4755	Facility name:	"GUEVARA, MARY JANE "	
Higher	Facility eval. code:	0301	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	810	
	Facility status code:	03	
	Address:	6734 EASTLAWN STREET	
	City:	OAKLAND	
	State:	CA	
	Zip:	94621	
	Alt. address:	6734 EASTLAWN STREET	
	City:	OAKLAND	
	State:	CA	

Zip:	94621	
Facility investor:	"GUEVARA, MARY JANE "	
Licensee type:	A	
License effective date:	41122	
License expiration date:	Not Reported	
License issue date:	041122	
Program type:	"MAXIMUM CAPACITY: 6 CHILDREN WITH NO MORE THAN 3 INFANTS, OR 4 INFANTSONLY, OR CAPACITY 8 CHILDREN WHEN 2 ARE AT LEAST 6 YEARS OF AGE WITH AMAXIMUM OF 2 INFANTS; PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED "	
Original app. received date:	020717	
Facility closed date:	Not Reported	
Mailing address:	6734 EASTLAWN STREET	
Mailing city:	OAKLAND	
Mailing state:	CA	
Mailing zip:	94621	
Contact person:	"GUEVARA, MARY JANE "	
Facility capacity:	8	
Type of clients served:	960	
Facility phone:	5106321940	

42
South
1/2-1 mi
4803
Higher

SRDCCA200729713
Daycare

EDR ID:	SRDCCA200729713	
Facility number:	13418339	
Facility name:	"MIJANGO, VILMA "	
Facility eval. code:	0105	
Facility office number:	02	
Facility county number:	01	
Facility type code:	810	
Facility status code:	03	
Address:	9561 EMPIRE ROAD	
City:	OAKLAND	
State:	CA	
Zip:	94603	
Alt. address:	9561 EMPIRE ROAD	
City:	OAKLAND	
State:	CA	
Zip:	94603	
Facility investor:	"MIJANGO, VILMA "	
Licensee type:	A	
License effective date:	50726	
License expiration date:	Not Reported	
License issue date:	050726	
Program type:	"MAX. CAP: 6 - NO MORE THAN 3 INFANTS OR 4 INFANTS ONLY. CAP 8 - NO MORE THAN 2 INFANTS, 1 CHILD IN KINDERGARTEN OR ELEMENTARY SCHOOL AND 1 CHILD AT LEAST AGE 6. "	
Original app. received date:	050603	
Facility closed date:	Not Reported	
Mailing address:	9561 EMPIRE ROAD	
Mailing city:	OAKLAND	
Mailing state:	CA	
Mailing zip:	94603	
Contact person:	"MIJANGO, VILMA "	
Facility capacity:	8	
Type of clients served:	960	

Facility phone: 5106326478

---

43 SRDCCA200718576
South EDR ID: SRDCCA200718576 Daycare
1/2-1 mi Facility number: 13416366
4813 Facility name: "HARRISON, SOPHIA "
Higher Facility eval. code: 0105

Facility office number: 02
Facility county number: 01
Facility type code: 810
Facility status code: 03
Address: 229 TUNIS ROAD
City: OAKLAND
State: CA
Zip: 94603
Alt. address: 229 TUNIS ROAD
City: OAKLAND
State: CA
Zip: 94603
Facility investor: "HARRISON, SOPHIA "
Licensee type: A
License effective date: 20620
License expiration date: Not Reported
License issue date: 020620
Program type: "MAXIMUM CAPACITY: 6 CHILDREN WITH NO MORE THAN 3 INFANTS, OR 4 INFANTSONLY, OR CAPACITY 8 CHILDREN WHEN 2 ARE AT LEAST 6 YEARS OF AGE WITH AMAXIMUM OF 2 INFANTS; PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED "
Original app. received date: 020430
Facility closed date: Not Reported
Mailing address: 229 TUNIS ROAD
Mailing city: OAKLAND
Mailing state: CA
Mailing zip: 94603
Contact person: "HARRISON, SOPHIA "
Facility capacity: 8
Type of clients served: 960
Facility phone: 5106353188

---

44 SRDCCA200748963
North EDR ID: SRDCCA200748963 Daycare
1/2-1 mi Facility number: 10215106
4825 Facility name: OUSD - LOCKWOOD
Higher Facility eval. code: 0207

Facility office number: 02
Facility county number: 01
Facility type code: 850
Facility status code: 03
Address: 1125 69TH AVENUE
City: OAKLAND
State: CA
Zip: 94621
Alt. address: 495 JONES AVE
City: OAKLAND

State:	CA	
Zip:	94603	
Facility investor:	OAKLAND UNIFIED SCHOOL DISTRICT	
Licensee type:	F	
License effective date:	951216	
License expiration date:	Not Reported	
License issue date:	921216	
Program type:	AGES 2YRS. TO FIRST GRADE ENTRY. HOURS OF OPERATION: MONDAY - FRIDAY 6:45 A.M. - 5:45 P.M.	
Original app. received date:	921113	
Facility closed date:	Not Reported	
Mailing address:	"1025 SECOND AVENUE, #320 "	
Mailing city:	OAKLAND	
Mailing state:	CA	
Mailing zip:	94606	
Contact person:	"SMITH, PEARLIE "	
Facility capacity:	48	
Type of clients served:	950	
Facility phone:	5108790823	

H45			SRPU20071013414
North	Ncessch:	062805010466	Public Schools
1/2-1 mi	Schname05:	RUDSDALE ACADEMY	
4837	Mstreet05:	1180 70TH AVE.	
Higher	Mcity05:	OAKLAND	
	Mstate05:	CA	
	Mzip05:	94621	
	Mzip405:	Not Reported	
	Member05:	-2	
	Phone05:	(510) 879-4237	
	Locale05:	N	
	Type05:	4	
	Level05:	4	
	Gslo05:	N	
	Gshi05:	N	
	Edr id:	SRPU20071013414	

H46			SRPU20071013394
North	Ncessch:	062805007326	Public Schools
1/2-1 mi	Schname05:	RUDSDALE CONTINUATION	
4837	Mstreet05:	1180 70TH AVE.	
Higher	Mcity05:	OAKLAND	
	Mstate05:	CA	
	Mzip05:	94621	
	Mzip405:	Not Reported	
	Member05:	94	
	Phone05:	(510) 879-4237	
	Locale05:	1	
	Type05:	4	
	Level05:	3	
	Gslo05:	09	
	Gshi05:	12	
	Edr id:	SRPU20071013394	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
47 NNW 1/2-1 mi 4889 Higher	EDR ID:	SRDCCA200753985	SRDCCA200753985 Daycare
	Facility number:	13415846	
	Facility name:	ACTS FULL GOSPEL CHRISTIAN ACADEMY	
	Facility eval. code:	0207	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	850	
	Facility status code:	03	
	Address:	1034 - 66TH AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94621	
	Alt. address:	1034 - 66TH AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94621	
	Facility investor:	ACTS FULL GOSPEL CHRISTIAN ACADEMY	
	Licensee type:	C	
	License effective date:	10904	
	License expiration date:	Not Reported	
	License issue date:	010904	
	Program type:	AGES 2 YEARS TO FIRST GRADE ENTRY. HOURS: 6:30AM TO 6:00PM. SUBJECT TO 2 WAIVERS TO BE POSTED.	
	Original app. received date:	010720	
	Facility closed date:	Not Reported	
	Mailing address:	1034 66TH AVENUE	
	Mailing city:	OAKLAND	
	Mailing state:	CA	
	Mailing zip:	94621	
	Contact person:	"MURPHY, ETHEL "	
	Facility capacity:	43	
	Type of clients served:	950	
	Facility phone:	5105683333	
48 East 1/2-1 mi 4924 Higher	EDR ID:	SRDCCA200710838	SRDCCA200710838 Daycare
	Facility number:	13414772	
	Facility name:	"STEVENS, ROSITA "	
	Facility eval. code:	0105	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	810	
	Facility status code:	03	
	Address:	9517 C STREET	
	City:	OAKLAND	
	State:	CA	
	Zip:	94603	
	Alt. address:	9517 C STREET	
	City:	OAKLAND	
	State:	CA	
	Zip:	94603	
	Facility investor:	"STEVENS, ROSITA "	
	Licensee type:	A	
	License effective date:	314	

Map ID / Direction / Distance / Distance (ft.) / Elevation	Site		EDR ID / Database
	License expiration date:	Not Reported	
	License issue date:	000314	
	Program type:	"MAXIMUM CAPACITY: 6 CHILDREN WITH NO MORE THAN 3 INFANTS, OR 4 INFANTSONLY, OR CAPACITY 8 CHILDREN WHEN 2 ARE AT LEAST 6 YEARS OF AGE WITH AMAXIMUM OF 2 INFANTS; PROPERTY OWNER/LANDLORD CONSENT IS REQUIRED "	
	Original app. received date:	991116	
	Facility closed date:	Not Reported	
	Mailing address:	9517 C STREET	
	Mailing city:	OAKLAND	
	Mailing state:	CA	
	Mailing zip:	94603	
	Contact person:	"STEVENS, ROSITA "	
	Facility capacity:	8	
	Type of clients served:	960	
	Facility phone:	5105625589	

49			SRDCCA200750095
ENE	EDR ID:	SRDCCA200750095	Daycare
1/2-1 mi	Facility number:	10206130	
4970	Facility name:	OUSD - HIGHLAND	
Higher	Facility eval. code:	0207	
	Facility office number:	02	
	Facility county number:	01	
	Facility type code:	850	
	Facility status code:	03	
	Address:	1322 - 86TH AVENUE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94621	
	Alt. address:	495 JONES AVE	
	City:	OAKLAND	
	State:	CA	
	Zip:	94603	
	Facility investor:	OAKLAND UNIFIED SCHOOL DISTRICT	
	Licensee type:	F	
	License effective date:	940405	
	License expiration date:	Not Reported	
	License issue date:	Not Reported	
	Program type:	"AGES 2 TO KINDERGARTEN ENTRY. HOURS: 7 A.M. TO 6 P.M. MONDAY THROUGH FRIDAY ROOM 1 CAPACITY: 31, ROOM 1A CAPACITY: 30 ROOM 0 CAPACITY: 27 "	
	Original app. received date:	840202	
	Facility closed date:	Not Reported	
	Mailing address:	1025 SECOND AVENUE	
	Mailing city:	OAKLAND	
	Mailing state:	CA	
	Mailing zip:	94606	
	Contact person:	"MORRISON, MARSHA "	
	Facility capacity:	96	
	Type of clients served:	950	
	Facility phone:	5108790815	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
I50 NNE 1/2-1 mi 5043 Higher			SRHO20070141630 AHA Hospitals
	Hospital type:	01	
	Num of times COO:	00	
	Owner date:	Not Reported	
	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	A	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	20040826	
	Medicare/Medicaid:	1	
	Facility name:	EAST OAKLAND HEALTH CENTER	
	Intermediary/Carrier:	Not Reported	
	Medicaid number:	Not Reported	
	Partcipation date:	19920901	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	05D0717298	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Not Reported	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	M2	
	street address:	7450 EAST 14TH STREET	
	Phone num:	5106132227	
	Termination reason:	00	
	Term Date:	20070404	
	Purpose of action:	2	
	Provider control:	02	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	Not Reported	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSCLIA	
	Edr id:	SRHO20070141630	

I51 NNE 1/2-1 mi 5043 Higher			SRHO20070106983 AHA Hospitals
	Hospital type:	01	
	Num of times COO:	00	
	Owner date:	Not Reported	
	City:	OAKLAND	
	Has plan of corr:	Not Reported	
	Compliance status:	Not Reported	
	SSA county code:	000	
	Cross ref number:	Not Reported	
	FMS survey date:	Not Reported	
	Current survey date:	Not Reported	

Map ID Direction Distance Distance (ft.) Elevation	Site		EDR ID Database
	Medicare/Medicaid:	Not Reported	
	Facility name:	EAST OAKLAND HEALTH CENTER	
	Intermediary/Carrier:	00450	
	Medicaid number:	Not Reported	
	Partcipation date:	20040225	
	Prior COO date:	Not Reported	
	Prior carrier:	Not Reported	
	Provider ID:	551956	
	Record Status:	A	
	Region code:	09	
	Is Partial Record:	Y	
	state abbrev:	CA	
	ssa state:	05	
	state region cd:	BK	
	street address:	7450 INTERNATION BLVD	
	Phone num:	5104309401	
	Termination reason:	00	
	Term Date:	Not Reported	
	Purpose of action:	1	
	Provider control:	03	
	Zip:	94621	
	Fips state:	06	
	Fips cnty:	001	
	SSA MSA:	418	
	SSA MSA size code:	B	
	Date accredited:	Not Reported	
	Accred expire date:	Not Reported	
	Accred Org:	Not Reported	
	Num beds:	0000	
	Num cert beds:	0000	
	Source:	US_HOSPITAL_POSOTHER	
	Edr id:	SRHO20070106983	

52			SRPU20071013411
NE	Ncessch:	062805010463	Public Schools
1/2-1 mi	Schname05:	GROWING CHILDREN CHARTER	
5104	Mstreet05:	8000 INTERNATIONAL BLVD.	
Higher	Mcity05:	OAKLAND	
	Mstate05:	CA	
	Mzip05:	94621	
	Mzip405:	Not Reported	
	Member05:	153	
	Phone05:	(510) 568-0500	
	Locale05:	1	
	Type05:	1	
	Level05:	1	
	Gslo05:	KG	
	Gshi05:	06	
	Edr id:	SRPU20071013411	

RECORDS SEARCHED/DATA CURRENCY TRACKING

Census

Source: U.S. Census Bureau
Telephone: 301-763-4636
2010 U.S. Census data was used to estimate residential population following these EPA guidelines:
"Census data are presented by Census tract. If your circle covers only a portion of the tract, you should develop an estimate for that portion...Determine the population density per square mile (total population of the Census tract divided by the number of square miles in the tract) and apply that density figure to the number of square miles within your circle."

FED_LAND: Federal Lands

Source: USGS
Telephone: 888-275-8747
Federal lands data. Includes data from several Federal land management agencies, including Fish and Wildlife Service, Bureau of Land Management, National Park Service, and Forest Service. Includes National Parks, Forests, Monuments; . Wildlife Sanctuaries, Preserves, Refuges; Federal Wilderness Areas.

AHA Hospitals:

Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing

Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes

Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools

Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools

Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Colleges - Integrated Postsecondary Education Data

Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on integrated postsecondary education in the United States.

Arenas

Source: Dunhill International
EDR indicates the location of buildings and facilities - arenas - where individuals who are public receptors are likely to be located.

Prisons: Bureau of Prisons Facilities

Source: Federal Bureau of Prisons
Telephone: 202-307-3198
List of facilities operated by the Federal Bureau of Prisons.

Daycare Centers: Licensed Facilities

Source: Department of Social Services
Telephone: 916-657-4041

STREET AND ADDRESS INFORMATION

FIRSTCARBON SOLUTIONS™

Noise Impact Analysis Report
Silverado/Argent Materials Recycling Project
City of Oakland, Alameda County, California

Prepared for:
Silverado/Argent Materials, Inc.
8300 Baldwin Street
Oakland, California 94621
510.638.7188

Contact: William Crotinger, Owner

Prepared by:
FirstCarbon Solutions
1350 Treat Blvd, Suite 380
Walnut Creek, CA 94597
925.357.2562

Contact: Mary Bean, Project Director
Philip Ault, Project Manager, Noise Scientist

Date: January 3, 2020

ATTACHMENT D

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Table of Contents

List of Tables

List of Exhibits

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ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
ADT	average daily traffic
ANSI	American National Standards Institute
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dB	decibel
dBA	A-weighted decibel
dBA/DD	dBA per each doubling of the distance
DNL	day-night level
EPA	United States Environmental Protection Agency
FCS	FirstCarbon Solutions
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GPA	General Plan Amendment
in/sec	inch per second
L_{dn}	day-night average sound level
L_{eq}	equivalent continuous sound level
L_{max}	maximum noise/sound level
OSHA	Occupational Safety and Health Administration
PPV	peak particle velocity
rms	root mean square
SEL	Single Event Level
SPCA	Society for the Prevention of Cruelty to Animals
VdB	vibration in decibels

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SECTION 1: INTRODUCTION

1.1 - Purpose of Analysis and Study Objectives

This Noise Impact Analysis Report has been prepared by FirstCarbon Solutions (FCS) to determine the off-site and on-site noise impacts associated with the proposed Silverado/Argent Materials Recycling Project (project) as it currently operates. The following is provided in this report:

- A description of the study area, project site, and project operations
- Information regarding the fundamentals of noise and vibration
- A description of the local noise guidelines and standards
- A description of the existing noise environment
- An analysis of existing operations-related noise impacts from the project

1.2 - Project Summary

1.2.1 - Site Location

The Silverado/Argent Materials project site is located at 8291-8304 Baldwin Street and a portion of the warehouse at 685 85th Street in the City of Oakland, in Alameda County, California.

The existing recycling center is located in an industrial area of the City near Interstate 880 (I-880), set amid railroad tracks, a junkyard (used to source recycled car and truck parts), and other industrial uses. The nearest residential homes are located thousands of feet away. Silverado/Argent Material's immediate neighbors are the Golden Gate Truck Center, the East Bay Society for the Prevention of Cruelty to Animals (SPCA), and various cannabis-related businesses.

A rail line runs parallel to the northeast boundary of the project site. Regional access to the project site is provided via I-880 through the Edes Avenue interchange, located to the south of the project site. Local access to the project site is provided from Baldwin Street, via 85th Avenue.

1.2.2 - Project Description

Silverado/Argent Materials (applicant) accepts the delivery of concrete and asphalt. Materials are unloaded at the receiving yard from incoming trucks, and are then sent through primary processing where materials are broken into softball-sized rocks by a mechanical crusher. The receiving yard includes areas for parking, materials storage, and equipment repair.

The site also contains a 40,000-square-foot warehouse space. The warehouse includes approximately 16,000 square feet of space used to accommodate the secondary processing and sorting equipment, and approximately 24,000 square feet of space used to store processed materials and to repair heavy equipment.

Ultimately, the yard and warehouse are operated as an integrated whole, and together allow Silverado/Argent Materials to recycle about 425,000 tons of aggregate annually. In past years, Silverado/Argent Materials has taken down and recycled enormous projects such as the Bay Bridge and Candlestick Park, diverting recycled building materials back into local construction projects. Silverado/Argent Materials' customers consist largely of utilities, cement suppliers, and contractors (including general engineering, underground, demolition, and paving contractors), and its recycled products are used in a variety of applications, including as components of infrastructure projects (e.g., road and utility beds) and as ingredients in other products (e.g., concrete).

This report evaluates the noise levels associated with these existing operations.

SECTION 2: NOISE FUNDAMENTALS

2.1 - Characteristics of Noise

Noise is generally defined as unwanted or objectionable sound. Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm, or when it has adverse effects on health. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and in the extreme, hearing impairment. Noise effects can be caused by pitch or loudness. *Pitch* is the number of complete vibrations or cycles per second of a wave that result in the range of tone from high to low; higher-pitched sounds are louder to humans than lower-pitched sounds. *Loudness* is the intensity or amplitude of sound.

Sound is produced by the vibration of sound pressure waves in the air. Sound pressure levels are used to measure the intensity of sound and are described in terms of decibels. The decibel (dB) is a logarithmic unit, which expresses the ratio of the sound pressure level being measured to a standard reference level. The 0 point on the dB scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Changes of 3 dB or less are only perceptible in laboratory environments. Audible increases in noise levels generally refer to a change of 3 dB or more, as this level has been found to be barely perceptible to the human ear in outdoor environments. Only audible changes in existing ambient or background noise levels are considered potentially significant.

The human ear is not equally sensitive to all frequencies within the audible sound spectrum, so sound pressure level measurements can be weighted to better represent frequency-based sensitivity of average healthy human hearing. One such specific "filtering" of sound is called "A-weighting." A-weighted decibels (dBA) approximate the subjective response of the human ear to a broad frequency noise source by discriminating against very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies that are audible to the human ear. Because decibels are logarithmic units, they cannot be added or subtracted by ordinary arithmetic means. For example, if one noise source produces a noise level of 70 dB, the addition of another noise source with the same noise level would not produce 140 dB; rather, they would combine to produce a noise level of 73 dB.

As noise spreads from a source, it loses energy so that the farther away the noise receiver is from the noise source, the lower the perceived noise level. Noise levels diminish or attenuate as distance from the source increases based on an inverse square rule, depending on how the noise source is physically configured. Noise levels from a single-point source, such as a single piece of construction equipment at ground level, attenuate at a rate of 6 dB for each doubling of distance (between the single-point source of noise and the noise-sensitive receptor of concern). Heavily traveled roads with few gaps in traffic behave as continuous line sources and attenuate roughly at a rate of 3 dB per doubling of distance.

2.1.1 - Noise Descriptors

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. Equivalent continuous sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and community noise equivalent level (CNEL) or the day-night average level (L_{dn}) based on dBA. CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally exchangeable. The noise adjustments are added to the noise events occurring during the more sensitive hours.

Other noise rating scales of importance when assessing the annoyance factor include the maximum noise level (L_{max}), which is the highest exponential time-averaged sound level that occurs during a stated time period. L_{max} reflects peak operating conditions and addresses the annoying aspects of intermittent noise.

2.1.2 - Noise Propagation

From the noise source to the receiver, noise changes both in level and frequency spectrum. The most obvious is the decrease in noise as the distance from the source increases. The manner in which noise reduces with distance depends on whether the source is a point or line source, as well as ground absorption, atmospheric conditions (wind, temperature gradients, and humidity) and refraction, and shielding by natural and manmade features. Sound from point sources, such as an air conditioning condenser, a piece of construction equipment, or an idling truck, radiates uniformly outward as it travels away from the source in a spherical pattern.

The attenuation or sound drop-off rate is dependent on the conditions of the land between the noise source and receiver. To account for this ground-effect attenuation (absorption), two types of site conditions are commonly used in noise models: soft-site and hard-site conditions. Soft-site conditions account for the sound propagation loss over natural surfaces such as normal earth and ground vegetation. For point sources, a drop-off rate of 7.5 dBA per each doubling of the distance (dBA/DD) is typically observed over soft ground with landscaping, as compared with a 6 dBA/DD drop-off rate over hard ground such as asphalt, concrete, stone and very hard packed earth. For line sources, such as traffic noise on a roadway, a 4.5 dBA/DD is typically observed for soft-site conditions compared to the 3 dBA/DD drop-off rate for hard-site conditions. Table 1 briefly defines these measurement descriptors and other sound terminology used in this section.

Table 1: Sound Terminology

Term	Definition
Sound	A vibratory disturbance created by a vibrating object which, when transmitted by pressure waves through a medium such as air, can be detected by a receiving mechanism such as the human ear or a microphone.
Noise	Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
Ambient Noise	The composite of noise from all sources near and far in a given environment.
Decibel (dB)	A unitless measure of sound on a logarithmic scale, which represents the squared ratio of sound-pressure amplitude to a reference sound pressure. The reference pressure is 20 micropascals, representing the threshold of human hearing (0 dB).
A-weighted Decibel (dBA)	An overall frequency-weighted sound level that approximates the frequency response of the human ear.
Equivalent Noise Level (L_{eq})	The average sound energy occurring over a specified time period. In effect, L_{eq} is the steady-state sound level that in a stated period would contain the same acoustical energy as the time-varying sound that actually occurs during the same period.
Maximum and Minimum Noise Levels (L_{max} and L_{min})	The maximum or minimum instantaneous sound level measured during a measurement period.
Day-Night Level (DNL or L_{dn})	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring between 10:00 p.m. and 7:00 a.m. (nighttime).
Community Noise Equivalent Level (CNEL)	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added to the A-weighted sound levels occurring between 7:00 p.m. and 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring between 10:00 p.m. and 7:00 a.m.
Source: Data compiled by FCS 2018	

2.1.3 - Stationary Noise

A stationary noise producer is any entity in a fixed location that emits noise. Examples of stationary noise sources include machinery, engines, and other mechanical or powered equipment and activities such as loading and unloading activities. Furthermore, while noise generated by the use of motor vehicles over public roads is preempted from local regulation, the use of these vehicles is considered a stationary noise source when operated on private property such as the project site.

The effects of stationary noise depend on factors such as characteristics of the equipment and operations, distance and pathway between the generator and receptor, and weather. Stationary noise sources are typically regulated at the point of manufacture (e.g., equipment or engines), with limitations on the hours of operation, or with provision of intervening structures, barriers or topography.

2.1.4 - Noise from Multiple Sources

Because sound pressure levels in decibels are based on a logarithmic scale, they cannot be added or subtracted in the usual arithmetical way. Therefore, sound pressure levels in decibels are logarithmically added on an energy summation basis. In other words, adding a new noise source to an existing noise source, both producing noise at the same level, will not double the noise level. Instead, if the difference between two noise sources is 10 dBA or more, the louder noise source will dominate and the resultant noise level will be equal to the noise level of the louder source. In general, if the difference between two noise sources is 0–1 dBA, the resultant noise level will be 3 dBA higher than the louder noise source, or both sources if they are equal. If the difference between two noise sources is 2–3 dBA, the resultant noise level will be 2 dBA above the louder noise source. If the difference between two noise sources is 4–10 dBA, the resultant noise level will be 1 dBA higher than the louder noise source.

SECTION 3: REGULATORY SETTING

3.1 - State Regulations

The State of California has established regulations that help prevent adverse impacts to occupants of buildings located near noise sources. Referred to as the "State Noise Insulation Standard," it requires buildings to meet performance standards through design and/or building materials that would offset any noise source in the vicinity of the receptor. State regulations include requirements for the construction of new hotels, motels, apartment houses, and dwellings other than detached single-family dwellings that are intended to limit the extent of noise transmitted into habitable spaces. These requirements are found in the California Code of Regulations, Title 24 (known as the Building Standards Administrative Code), Part 2 (known as the California Building Code), Appendix Chapters 12 and 12A. However, the proposed project does not contain or affect any type of residential development, nor are there any residential uses within 1,000 feet of the project site that would experience noise from its operations. Therefore, these standards are not applicable to the proposed project.

Government Code Section 65302 mandates that the legislative body of each county and city in California adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines published by the State Department of Health Services. The guidelines rank noise/land use compatibility in terms of normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable. The City of Oakland has established land use compatibility guidelines for determining acceptable noise levels for specified land uses as described below.

3.2 - Local Regulations

The project site is located within the City of Oakland, in Alameda County, California. The City's noise performance standards are contained in the Oakland Municipal Code.[1] The City's land use compatibility guidelines are contained in the General Plan Noise Element.

The City of Oakland noise performance standards are codified in Chapter 17.120 of the City's Municipal Code. Section 17.120.050 establishes a maximum allowable noise level for any receiving land uses within any commercial or industrial zone. These standards are show in Table 2.

Table 2: Maximum Allowable Receiving Noise Level Standards, dBA

Receiving Land Use	Cumulative Number of Minutes in a 1-hour Period[1]	Maximum Allowable Noise Level per Indicted Time Period[2]
Commercial	20 (L_{33})	65
	10 ($L_{16.7}$)	70
	5 ($L_{8.3}$)	75

1 City of Oakland. 2019. Oakland Municipal Code. Website: https://library.municode.com/ca/oakland/codes/code_of_ordinances. Accessed October 21, 2019.

Table 2 (cont.): Maximum Allowable Receiving Noise Level Standards, dBA

Receiving Land Use	Cumulative Number of Minutes in a 1-hour Period[1]	Maximum Allowable Noise Level per Indicted Time Period[2]
	1 ($L_{1.7}$)	80
	0 (L_{max})	85
Industrial	20 (L_{33})	70
	10 ($L_{16.7}$)	75
	5 ($L_{8.3}$)	80
	1 ($L_{1.7}$)	85
	0 (L_{max})	90

Notes:
1 L_x represents the noise level that is exceeded X percent of a given period. L_{max} is the maximum instantaneous noise level.
2 These standards are reduced 5 dBA for simple tone noise, noise consisting primarily of speech or music, or recurring impact noise. If the ambient noise level exceeds these standards, the standard shall be adjusted to equal the ambient noise level.
Source: City of Oakland. 2019. Oakland Municipal Code. Website: https://library.municode.com/ca/oakland/codes/code_of_ordinances. Accessed December 26, 2019.

Noise measurements are required to utilize the "A" weighting scale of the sound level meter and the "slow" meter response, and must be located at a position or positions at any point on the receiver's property.

Nuisance regulations are codified in Chapter 8.18 of the City's Municipal Code. Section 8.18.010 prohibits excessive and annoying noises. This section defines "annoying noise" as any noise with a repetitive pattern, shrill frequency and/or static-like sounds, and "excessive noise" as any unnecessary noise that persists for 10 minutes or more. Such a period of noise need not be witnessed by enforcement personnel if the occupants of two or more separate housing or commercial units certify that they have experienced such period of noise and describe with particularity the source. Sounding of any electronically amplified signal from any stationary bell, chime, siren, whistle, or similar device, intended primarily for nonemergency purposes, from any place, for more than ten seconds in an hourly period is prohibited. Loading, unloading, opening, closing, or other handling of boxes, crates, containers, building materials, refuse, or similar objects between the hours of 9:00 p.m. and 6:00 a.m. in such a manner as to cause a noise disturbance across a residential property line or at any time to violate the applicable noise provisions of the Oakland Planning Code are prohibited.

Finally, the City has also established noise impact analysis guidelines in the City of Oakland CEQA Thresholds of Significance.[2] According to these thresholds, a proposed development project would have

2 City of Oakland. 2013. City of Oakland CEQA Thresholds of Significance Guidelines. October 28. Website: http://www2.oaklandnet.com/oakca1/groups/ceda/documents/report/oak051200.pdf. Accessed December 6, 2019.

a significant impact on the environment if it would (1) generate noise in violation of the City of Oakland Noise Ordinance regarding construction noise; (2) generate noise in violation of the City's nuisance standards regarding persistent construction-related noise; (3) generate noise in violation of the City of Oakland Noise Ordinance regarding operational noise; (4) generate noise resulting in a 5 dBA permanent increase in ambient noise levels in the project vicinity above levels existing without the project; (5) expose persons to interior L_{dn} or CNEL greater than 45 dBA for multi-family dwellings, hotels, motels, dormitories, and long-term care facilities;[3] and (5) expose the project to community noise in conflict with the land use compatibility guidelines in the Oakland General Plan after incorporation of all applicable standard conditions of approval. Of these standards, the City's Noise Ordinance regarding operational noise is in fact the most protective of the environment in these circumstances, and therefore the following analysis conservatively focuses on the Noise Ordinance's framework. The City's land use compatibility guidelines establish a "normally acceptable" threshold of 70 dBA CNEL for new industrial land use development. Noise environments between 70 dBA and 80 dBA are considered "conditionally acceptable" for new industrial land use development. However, the City's noise land use compatibility standards are designed to measure impacts on new land use development projects from the existing environment, and therefore are not applicable to any discussion of an existing property's impacts on off-site receptors.

[3] There are no such facilities within 1,000 feet of the project site; therefore this threshold is not applicable.

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SECTION 4: EXISTING NOISE CONDITIONS

4.1 - Existing Ambient Noise Levels

The existing noise levels in the project vicinity were documented through noise monitoring measurements taken at the project site. The measurements provide a baseline of current noise conditions. Short-term and long-term noise monitoring locations are provided in Exhibit 1. The noise monitoring data is provided in Appendix A of this document.

Five short-term noise measurements (10 minutes each) were taken on Tuesday, November 5, 2019, starting at 9:40 a.m. and ending at 11:40 a.m. These short-term noise measurement results are summarized in Table 3. One long-term ambient noise measurement (24 hours) was also conducted at the closest noise receptor to the project site's loudest uses (i.e., near the northeastern corner of the East Bay SPCA Oakland Facilities (East Bay SPCA) property located across Baldwin Street),[4] starting at 9:30 a.m. on Tuesday, November 5, 2019, and ending at 10:50 a.m. on Wednesday, November 6, 2019. These measurements provide a baseline of current noise conditions. Short-term and long-term noise monitoring locations are provided in Exhibit 1. The noise monitoring data is provided in Appendix A of this document.

4.1.1 - Short-term Noise Measurement

Average hourly L_{eq} noise levels, as documented by short-term noise measurements, are summarized below in Table 3.

Table 3: Short-Term Noise Monitoring Summary

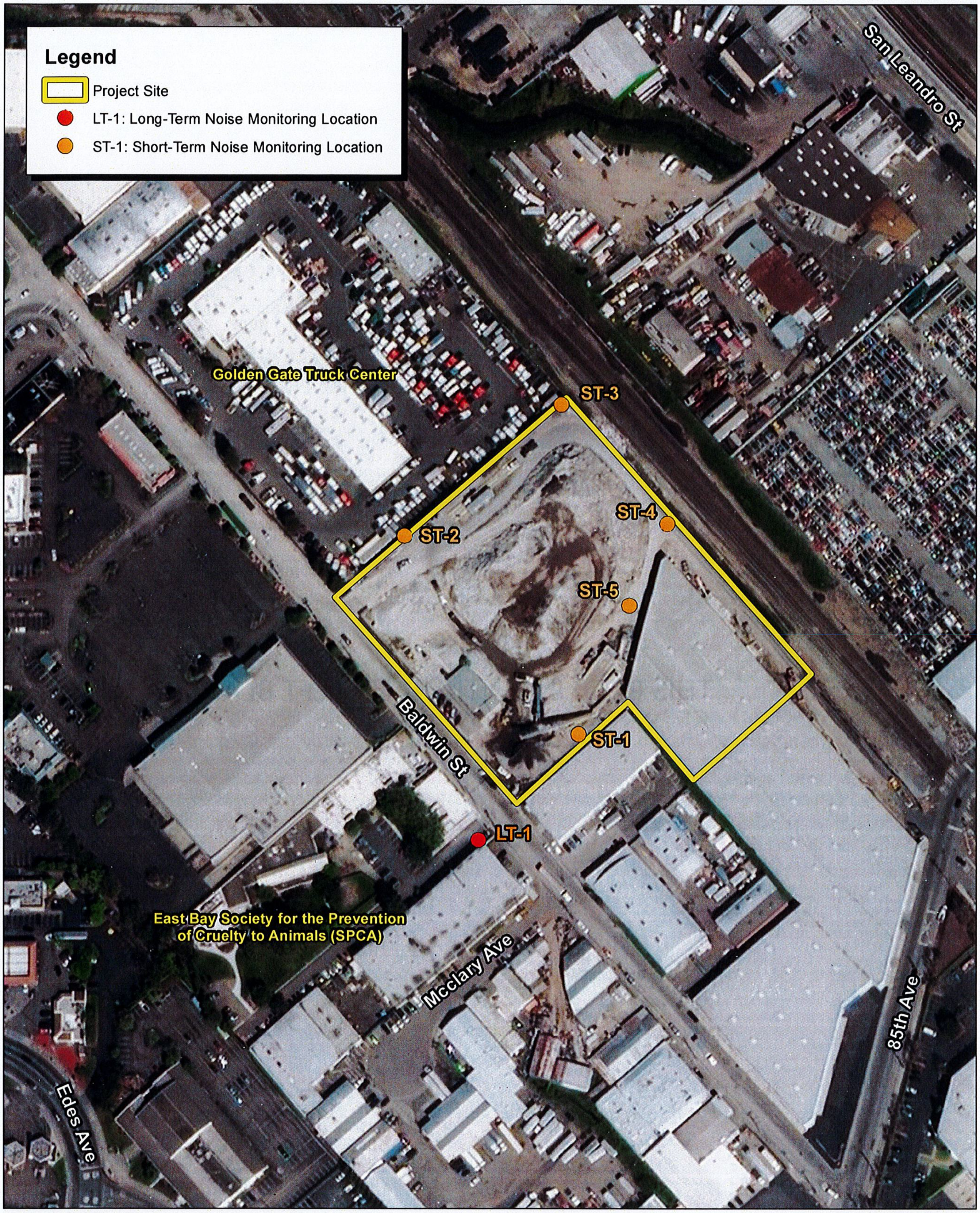
Site Location	Description	L_{eq}
ST-1	In southeastern corner of site, 40 feet to conveyer belt and 50 feet to adjacent building to the east.	74.2
ST-2	Along northwestern fence line, 200 feet east of Baldwin Street.	69.9
ST-3	Northern corner of project site, adjacent to BART tracks.	69.9
ST-4	Along fence line in northeast portion of site; near north truck entrance.	77.2
ST-5	20 feet to warehouse's northern entrance, 100 feet to noise source, and 10 feet to backhoe dumping materials into loading truck.	79.9
Source: FCS 2019.		

[4] Although the property at 8378 Baldwin Street is located closer to the project's property line than the East Bay SPCA property, the property line between the project site and 8378 Baldwin Street is occupied by an uninterrupted building wall that absorbs and reflects noise; therefore, noise would not travel across the property line to any yard or other exposed area in such a manner that would potentially result in noise levels in excess of the City's operational noise performance standards. In addition, this building wall would reduce exterior to interior noise levels by a minimum of 25 dBA, resulting in interior hourly average noise levels below 50 dBA L_{eq}, from project operations. Additionally, this building provides shielding to land uses southeast of the building, thereby reducing noise levels at those land uses. Therefore, this analysis evaluates worst-case potential impacts to a receiving property, which in this case is the East Bay SPCA property.

4.1.2 - Long-term Noise Measurement

The long-term noise measurement was conducted at the closest off-site noise receptor, near the northeastern corner of the East Bay SPCA property located on Baldwin Street, approximately 100 feet from the project's southern corner. The resulting measurement determined that ambient noise levels at this location averaged 67.1 dBA CNEL. Daytime noise levels at this location averaged 65.2 dBA L_{eq}, evening noise levels averaged 59.9 dBA L_{eq}, and nighttime noise levels averaged 59.2 dBA L_{eq}.

As was observed by the technician at the time of the noise measurement, the dominant noise source at this noise measurement location is traffic noise on Baldwin Street.



Source: ESRI Aerial Imagery.

FIRSTCARBON SOLUTIONS™

200 100 0 200 Feet

Exhibit 1

Noise Monitoring Locations

53580001 • 12/2019 | 1_noise_monitoring_loc.mxd

SILVERADO/ARGENT MATERIALS, INC.
SILVERADO/ARGENT MATERIALS RECYCLING PROJECT
NOISE IMPACT ANALYSIS REPORT

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SECTION 5: OPERATIONAL COMPLIANCE ANALYSIS

5.1 - Current Operational Noise Analysis

The City regulates operational noise in Section 17.120.050 of the City's Municipal Code. This ordinance establishes, for example, a maximum allowable operational noise level of 70 dBA, for a cumulative of 20 minutes in any 1-hour time period, as measured at any receiving land use activity within an Industrial Zone. Noise measurements are required to utilize the "A" weighing scale of the sound level meter and the "slow" meter response, and must be located at a position or positions at any point on the receiver's property.

A long-term noise measurement was conducted to evaluate noise impacts on the surrounding land uses from current operations. The noise measurement was conducted at the closest receiving land use that could potentially be considered noise sensitive, the East Bay SPCA located at 8323 Baldwin Street. The measurement was taken at the northeast-corner of this property, adjacent to Baldwin Street, directly across the street from the project site. The noise measurement location is shown in Exhibit 1. The noise measurement data is provided in Appendix A.

The long-term noise measurement captured noise levels from all sources in the project vicinity, including operations on the project site, as well as traffic noise levels along Baldwin Avenue.

The long-term noise measurement results at this location show that the 65 dBA noise level was exceeded only 14.56 percent of the entire 25-hour long-term noise measurement. This is the equivalent of exceeding 65 dBA for an average of only 9-minutes per hour during the entire 25-hour noise measurement.

The long-term noise measurement results at this location show that the 70 dBA noise level was exceeded only 3.68 percent of the entire 25-hour long-term noise measurement. This is the equivalent of exceeding 70 dBA for an average of only 2-minutes per hour during the entire 25-hour noise measurement.

The results further show that the 75 dBA and 80 dBA noise levels were each exceeded less than 1-minute per hour on average during the entire 25-hour noise measurement. The noise measurement did record a few instantaneous maximum level exceedances of the 85 dBA and 90 dBA thresholds at this location, but none of them for a cumulative period of even 1-second per hour.

It should be further noted that, based on the short-term operational noise measurements taken on the project site, none of the documented on-site noise levels during maximum operations would exceed 85 dBA at the project's property line adjacent to Baldwin Street (factoring in distance attenuation from each noise source). Therefore, it can reasonably be concluded that all of the instantaneous maximum level exceedances of 85 dBA and 90 dBA at the long-term noise measurement location was a result of another noise source, most likely a vehicle passing in close proximity to the sound level meter.

These operational noise measurement results are summarized in Table 4 below. The documented operational noise levels, as measured at this closest receptor location, did not exceed any of the City's maximum allowable noise level standards, as compared to both the commercial and industrial land use standards.

Table 4: Operational Noise Levels Summary

Receiving Land Use	Maximum Allowable Noise Level per Indicted Time Period (dBA)	Maximum Permitted Cumulative Number of Minutes in a 1-hour Period[1]	Average Minutes in a 1-hour Period that Operational Noise Levels Exceed the Threshold[2]	Exceeds the Standard?
Commercial	65	20 (L_{33})	9	No
	70	10 ($L_{16.7}$)	2	No
	75	5 ($L_{8.3}$)	0[3]	No
	80	1 ($L_{1.7}$)	0[3]	No
	85	0 (L_{max})	0[4]	No
Industrial	70	20 (L_{33})	2	No
	75	10 ($L_{16.7}$)	0[3]	No
	80	5 ($L_{8.3}$)	0[3]	No
	85	1 ($L_{1.7}$)	0[4]	No
	90	0 (L_{max})	0[4]	No

Notes:
1 L_x represents the noise level that is exceeded X percent of a given period. L_{max} is the maximum instantaneous noise level.
2 Project operational noise levels as measured at the nearest receptor, the East Bay SPCA, based on the long-term ambient noise measurement.
3 Value indicates that the maximum noise levels were less than a cumulative minute per hour.
4 Value indicates that the maximum noise levels were less than a cumulative second per hour. As indicated in the discussion above, the long-term measurement's documented exceedances of these levels were from sources outside the project site.
Source: City of Oakland. 2019. Oakland Municipal Code. Website: https://library.municode.com/ca/oakland/codes/code_of_ordinances. Accessed December 26, 2019.

The City also regulates operational noise in Section 17.120.050 of the City's Municipal Code. Section 8.18.010 prohibits excessive and annoying noises. Particularly, the ordinance prohibits loading, unloading activities of building materials, refuse, or similar objects between the hours of 9:00 p.m. and 6:00 a.m. in such a manner as to cause a noise disturbance across a residential property line or at any time to violate the applicable noise provisions of the Oakland Planning Code. The project site is located more than 1,000 feet from the closest residential property line, and noises from the project site would not be noticeable above background ambient noise levels as measured at any such residential properties. Moreover, as explained above, project operations do not violate any applicable noise provisions of the Oakland Planning Code.

Therefore, the current operational activities are operating in compliance with the City's applicable noise performance standards for this type of land use.

5.2 - Conclusion

This analysis shows that existing operations as measured at the closest receiving land use do not exceed any of the City's maximum allowable noise levels for receiving land uses within any industrial zone.

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Appendix A: Noise Monitoring Data

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Summary			
Filename	ST-1		
Serial Number	4228		
Model	SoundTrack LxT®		
Firmware Version	2.206		
User			
Location			
Job Description			
Note			
Measurement Description			
Start	11/05/2019 9:43:55		
Stop	11/05/2019 9:54:20		
Duration	0:10:25.5		
Run Time	0:10:25.5		
Pause	0:00:00.0		
Pre Calibration	11/05/2019 9:43:45		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT2L		
Microphone Correction	Off		
Integration Method	Exponential		
Overload	124.6 dB		
	A	**C**	**Z**
Under Range Peak	**80.8**	77.8	82.8 dB
Under Range Limit	**27.1**	27.1	31.7 dB
Noise Floor	18.0	17.9	22.6 dB
Results			
LASeq	74.2 dB		
LASE	102.1 dB		
EAS	1.821 mPa²h		
EAS8	83.846 mPa²h		
EAS40	419.228 mPa²h		
LApeak (max)	11/05/2019 9:51:27	96.1 dB	
LASmax	11/05/2019 9:51:27	78.3 dB	
LASmin	11/05/2019 9:49:34	72.2 dB	
SEA	[illegible] dB		
LAS > 85.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LAS > 115.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**	**LNight 22:00-07:00**
	74.2	74.2	[illegible]	74.2	74.2	[illegible]	[illegible]
LCSeq	83.1 dB						
LASeq	74.2 dB						
LCSeq - LASeq	9.0 dB						
LAIeq	75.2 dB						
LAeq	74.2 dB						
LAIeq - LAeq	1.0 dB						
# Overloads	0						
Overload Duration	0.0 s						

Dose Settings		
Dose Name	OSHA-1	OSHA-2
Exch. Rate	5	5 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h
Results		
Dose	[illegible]	[illegible] %
Projected Dose	[illegible]	[illegible] %
TWA (Projected)	[illegible]	[illegible] dB
TWA (t)	[illegible]	[illegible] dB
Lep (t)	57.6	57.6 dB
Statistics		
LAS5.00	76.3 dB	
LAS10.00	75.5 dB	
LAS33.30	74.4 dB	
LAS50.00	73.9 dB	
LAS75.00	73.0 dB	
LAS90.00	72.6 dB	

Summary			
Filename	**ST-2**		
Serial Number	4228		
Model	SoundTrack LxT®		
Firmware Version	2.206		
User			
Location			
Job Description			
Note			
Measurement Description			
Start	11/05/2019 10:02:02		
Stop	11/05/2019 10:12:34		
Duration	0:10:32.6		
Run Time	0:10:32.6		
Pause	0:00:00.0		
Pre Calibration	11/05/2019 9:43:18		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT2L		
Microphone Correction	Off		
Integration Method	Exponential		
Overload	124.6 dB		
	A	**C**	**Z**
Under Range Peak	**80.8**	77.8	82.8 dB
Under Range Limit	**27.1**	27.1	31.7 dB
Noise Floor	18.0	17.9	22.6 dB
Results			
LASeq	69.6 dB		
LASE	97.6 dB		
EAS	646.766 µPa²h		
EAS8	29.445 mPa²h		
EAS40	147.225 mPa²h		
LApeak (max)	11/05/2019 10:02:41	99.5 dB	
LASmax	11/05/2019 10:02:36	81.1 dB	
LASmin	11/05/2019 10:07:58	57.2 dB	
SEA	[illegible] dB		
LAS > 85.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LAS > 115.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**	**LNight 22:00-07:00**
	69.6	69.6	[illegible]	69.6	69.6	[illegible]	[illegible]

LCSeq	79.2 dB
LASeq	69.6 dB
LCSeq - LASeq	9.5 dB
LAIeq	71.3 dB
LAeq	69.6 dB
LAIeq - LAeq	1.7 dB
# Overloads	0
Overload Duration	0.0 s

Dose Settings		
Dose Name	OSHA-1	OSHA-2
Exch. Rate	5	5 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h
Results		
Dose	[illegible]	0.00 %
Projected Dose	[illegible]	0.11 %
TWA (Projected)	[illegible]	40.6 dB
TWA (t)	[illegible]	13.1 dB
Lep (t)	53.1	53.1 dB
Statistics		
LAS5.00	74.8 dB	
LAS10.00	73.4 dB	
LAS33.30	68.4 dB	
LAS50.00	66.5 dB	
LAS75.00	64.3 dB	
LAS90.00	61.9 dB	

Summary			
Filename	ST-3		
Serial Number	4228		
Model	SoundTrack LxT®		
Firmware Version	2.206		
User			
Location			
Job Description			
Note			
Measurement Description			
Start	11/05/2019 10:27:23		
Stop	11/05/2019 10:37:24		
Duration	0:10:00.6		
Run Time	0:10:00.6		
Pause	0:00:00.0		
Pre Calibration	11/05/2019 9:43:18		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT2L		
Microphone Correction	Off		
Integration Method	Exponential		
Overload	124.6 dB		
	A	C	Z
Under Range Peak	80.8	77.8	82.8 dB
Under Range Limit	27.1	27.1	31.7 dB
Noise Floor	18.0	17.9	22.6 dB

Results		
LASeq	69.9 dB	
LASE	97.7 dB	
EAS	654.958 µPa²h	
EAS8	31.407 mPa²h	
EAS40	157.033 mPa²h	
LApeak (max)	11/05/2019 10:36:26	93.3 dB
LASmax	11/05/2019 10:36:27	80.5 dB
LASmin	11/05/2019 10:35:26	57.5 dB
SEA	[illegible] dB	
LAS > 85.0 dB (Exceedence Counts / Duration)	0	0.0 s
LAS > 115.0 dB (Exceedence Counts / Duration)	0	0.0 s
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s

Community Noise	Ldn	LDay 07:00-22:00	LNight 22:00-07:00	Lden	LDay 07:00-19:00	LEvening 19:00-22:00	LNight 22:00-07:00
	69.9	69.9	[illegible]	69.9	69.9	[illegible]	[illegible]

LCSeq	82.7 dB
LASeq	69.9 dB
LCSeq - LASeq	12.8 dB
LAIeq	71.1 dB
LAeq	69.9 dB
LAIeq - LAeq	1.2 dB
# Overloads	0
Overload Duration	0.0 s

Dose Settings		
Dose Name	OSHA-1	OSHA-2
Exch. Rate	5	5 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h
Results		
Dose	[illegible]	0.00 %
Projected Dose	[illegible]	0.06 %
TWA (Projected)	[illegible]	36.1 dB
TWA (t)	[illegible]	8.2 dB
Lep (t)	53.1	53.1 dB

Statistics	
LAS5.00	75.6 dB
LAS10.00	75.4 dB
LAS33.30	69.4 dB
LAS50.00	66.8 dB
LAS75.00	62.9 dB
LAS90.00	60.4 dB

Summary			
Filename	**ST-4**		
Serial Number	4228		
Model	SoundTrack LxT®		
Firmware Version	2.206		
User			
Location			
Job Description			
Note			
Measurement Description			
Start	11/05/2019 10:40:25		
Stop	11/05/2019 10:50:26		
Duration	0:10:00.5		
Run Time	0:10:00.5		
Pause	0:00:00.0		
Pre Calibration	11/05/2019 9:43:18		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT2L		
Microphone Correction	Off		
Integration Method	Exponential		
Overload	124.6 dB		
	A	**C**	**Z**
Under Range Peak	**80.8**	77.8	82.8 dB
Under Range Limit	**27.1**	27.1	31.7 dB
Noise Floor	18.0	17.9	22.6 dB
Results			
LASeq	77.2 dB		
LASE	105.0 dB		
EAS	3.538 mPa²h		
EAS8	169.660 mPa²h		
EAS40	848.300 mPa²h		
LApeak (max)	11/05/2019 10:44:12	113.3 dB	
LASmax	11/05/2019 10:44:14	99.0 dB	
LASmin	11/05/2019 10:46:26	63.8 dB	
SEA	dB		
LAS > 85.0 dB (Exceedence Counts / Duration)	3	12.1 s	
LAS > 115.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**	**LNight 22:00-07:00**
	77.2	77.2		77.2	77.2		

LCSeq	83.4 dB	
LASeq	77.2 dB	
LCSeq - LASeq	6.2 dB	
LAIeq	80.2 dB	
LAeq	77.2 dB	
LAIeq - LAeq	3.0 dB	
# Overloads	0	
Overload Duration	0.0 s	
Dose Settings		
Dose Name	OSHA-1	OSHA-2
Exch. Rate	5	5 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h
Results		
Dose	0.03	0.07 %
Projected Dose	1.67	3.35 %
TWA (Projected)	60.5	65.5 dB
TWA (t)	32.6	37.6 dB
Lep (t)	60.4	60.4 dB
Statistics		
LAS5.00	79.1 dB	
LAS10.00	76.1 dB	
LAS33.30	70.3 dB	
LAS50.00	67.7 dB	
LAS75.00	65.9 dB	
LAS90.00	65.3 dB	

Summary

Filename	ST-5		
Serial Number	4228		
Model	SoundTrack LxT®		
Firmware Version	2.206		
User			
Location			
Job Description			
Note			
Measurement Description			
Start	11/05/2019 11:30:48		
Stop	11/05/2019 11:40:49		
Duration	0:10:00.6		
Run Time	0:10:00.6		
Pause	0:00:00.0		
Pre Calibration	11/05/2019 9:43:18		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT2L		
Microphone Correction	Off		
Integration Method	Exponential		
Overload	124.6 dB		
	A	**C**	**Z**
Under Range Peak	**80.8**	77.8	82.8 dB
Under Range Limit	**27.1**	27.1	31.7 dB
Noise Floor	18.0	17.9	22.6 dB
Results			
LASeq	79.9 dB		
LASE	107.6 dB		
EAS	6.455 mPa^2h		
EAS8	309.530 mPa^2h		
EAS40	1.548 Pa^2h		
LApeak (max)	11/05/2019 11:33:35	109.6 dB	
LASmax	11/05/2019 11:33:33	98.1 dB	
LASmin	11/05/2019 11:40:43	67.8 dB	
SEA	[illegible] dB		
LAS > 85.0 dB (Exceedence Counts / Duration)	4	33.7 s	
LAS > 115.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**	**LNight 22:00-07:00**
	79.9	79.9	[illegible]	79.9	79.9	[illegible]	[illegible]

LCSeq	86.4 dB
LASeq	79.9 dB
LCSeq - LASeq	6.5 dB
LAIeq	83.7 dB
LAeq	79.9 dB
LAIeq - LAeq	3.8 dB
# Overloads	0
Overload Duration	0.0 s

Dose Settings		
Dose Name	OSHA-1	OSHA-2
Exch. Rate	5	5 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h
Results		
Dose	0.08	0.16 %
Projected Dose	3.81	7.71 %
TWA (Projected)	66.4	71.5 dB
TWA (t)	38.5	43.6 dB
Lep (t)	63.0	63.0 dB

Statistics	
LAS5.00	85.4 dB
LAS10.00	80.3 dB
LAS33.30	72.5 dB
LAS50.00	71.3 dB
LAS75.00	69.4 dB
LAS90.00	68.9 dB

Summary			
Filename	**LT-1**		
Serial Number	4397		
Model	SoundTrack LxT®		
Firmware Version	2.301		
User			
Location			
Job Description			
Note			
Measurement Description			
Start	2019/11/05 9:36:07		
Stop	2019/11/06 10:48:36		
Duration	1 Day 01:12:29.6		
Run Time	1 Day 01:12:29.6		
Pause	0:00:00.0		
Pre Calibration	2019/11/05 9:31:16		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT2B		
Microphone Correction	Off		
Integration Method	Exponential		
Overload	145.7 dB		
	A	**C**	**Z**
Under Range Peak	**101.9**	98.9	103.9 dB
Under Range Limit	**38.0**	36.0	44.0 dB
Noise Floor	25.2	25.7	33.1 dB
Results			
LASeq	63.4 dB		
LASE	112.9 dB		
EAS	21.904 mPa²h		
EAS8	6.951 mPa²h		
EAS40	34.757 mPa²h		
LApeak (max)	2019/11/06 10:48:30	114.9 dB	
LASmax	2019/11/05 23:44:36	91.0 dB	
LASmin	2019/11/06 1:56:21	48.8 dB	
SEA	[illegible] dB		
LAS > 85.0 dB (Exceedence Counts / Duration)	5	13.6 s	
LAS > 115.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**	**LDay 07:00-19:00**	**LEvening 19:00-22:00**	**LNight 22:00-07:00**
	66.9	64.6	59.2	67.1	65.2	59.9	59.2

LCSeq	72.3 dB
LASeq	63.4 dB
LCSeq - LASeq	9.0 dB
LAIeq	66.4 dB
LAeq	63.4 dB
LAIeq - LAeq	3.1 dB
# Overloads	0
Overload Duration	0.0 s

Dose Settings		
Dose Name	OSHA-1	OSHA-2
Exch. Rate	5	5 dB
Threshold	90	80 dB
Criterion Level	90	90 dB
Criterion Duration	8	8 h
Results		
Dose	0.00	0.07 %
Projected Dose	0.00	0.02 %
TWA (Projected)	1.7	29.3 dB
TWA (t)	10.0	37.5 dB
Lep (t)	68.4	68.4 dB

Statistics	
LAS5.00	69.1 dB
LAS10.00	66.5 dB
LAS33.30	60.9 dB
LAS50.00	58.2 dB
LAS66.60	56.3 dB
LAS90.00	53.7 dB

Statistics Level (dB)	Count	Percent
Under	0	0.00
48.8	4	0.00
48.9	208	0.00
49.0	692	0.01
49.1	1525	0.02
49.2	2922	0.03
49.3	4055	0.04
49.4	5240	0.06
49.5	6820	0.08
49.6	7270	0.08
49.7	7987	0.09
49.8	8382	0.09
49.9	9163	0.10
50.0	9225	0.10
50.1	9576	0.11
50.2	10906	0.12
50.3	10755	0.12
50.4	9414	0.10
50.5	8686	0.10
50.6	8095	0.09
50.7	7785	0.09
50.8	7847	0.09
50.9	8257	0.09
51.0	7887	0.09
51.1	8779	0.10
51.2	9273	0.10
51.3	9089	0.10
51.4	10804	0.12
51.5	10154	0.11
51.6	13153	0.14
51.7	14922	0.16
51.8	14392	0.16
51.9	16092	0.18
52.0	18904	0.21
52.1	22724	0.25
52.2	24859	0.27
52.3	27503	0.30
52.4	29890	0.33
52.5	28827	0.32
52.6	31738	0.35
52.7	35717	0.39
52.8	36116	0.40
52.9	38157	0.42
53.0	37839	0.42
53.1	38165	0.42

Duration	Minutes
1 Day 01:12:29.6	1512

	Counts	Percent of Total	Minutes	Minutes/Hour
Totals 65 & under	7753539	85.44%	1292	52
Totals above 65	1321421	14.56%	220	9
Totals	9074960	100.00%	1512	60

	Counts	Percent of Total	Minutes	Minutes/Hour
Totals 70 & under	8741121	96.32%	1456	58
Totals above 70	333839	3.68%	56	2
Totals	9074960	100.00%	1512	60

	Counts	Percent of Total	Minutes	Minutes/Hour
Totals 75 & under	9024419	99.44%	1504	60
Totals above 75	50541	0.56%	8	0
Totals	9074960	100.00%	1512	60

	Counts	Percent of Total	Minutes	Minutes/Hour
Totals 80 & under	9069882	99.94%	1511	60
Totals above 80	5078	0.06%	1	0
Totals	9074960	100.00%	1512	60

	Counts	Percent of Total	Minutes	Minutes/Hour
Totals 85 & under	9074070	99.99%	1512	60
Totals above 85	890	0.01%	0	0
Totals	9074960	100.00%	1512	60

	Counts	Percent of Total	Minutes	Minutes/Hour
Totals 90 & under	9074917	100.00%	1512	60
Totals above 90	43	0.00%	0	0
Totals	9074960	100.00%	1512	60

53.2	40364	0.44
53.3	44342	0.49
53.4	46522	0.51
53.5	49407	0.54
53.6	51727	0.57
53.7	53900	0.59
53.8	56969	0.63
53.9	58788	0.65
54.0	62346	0.69
54.1	67107	0.74
54.2	74169	0.82
54.3	75241	0.83
54.4	81642	0.90
54.5	84965	0.94
54.6	88454	0.97
54.7	88267	0.97
54.8	91725	1.01
54.9	93762	1.03
55.0	94938	1.05
55.1	92209	1.02
55.2	89441	0.99
55.3	89170	0.98
55.4	89031	0.98
55.5	88004	0.97
55.6	88955	0.98
55.7	87420	0.96
55.8	90638	1.00
55.9	91379	1.01
56.0	91079	1.00
56.1	85920	0.95
56.2	84439	0.93
56.3	85015	0.94
56.4	85591	0.94
56.5	84794	0.93
56.6	86898	0.96
56.7	87630	0.97
56.8	86853	0.96
56.9	86579	0.95
57.0	86414	0.95
57.1	86340	0.95
57.2	82968	0.91
57.3	82449	0.91
57.4	79839	0.88
57.5	78803	0.87
57.6	77929	0.86
57.7	75771	0.83
57.8	73353	0.81

57.9	69970	0.77
58.0	68409	0.75
58.1	67209	0.74
58.2	65734	0.72
58.3	64474	0.71
58.4	64020	0.71
58.5	62855	0.69
58.6	62739	0.69
58.7	60214	0.66
58.8	60574	0.67
58.9	59712	0.66
59.0	59813	0.66
59.1	57960	0.64
59.2	56913	0.63
59.3	57062	0.63
59.4	57373	0.63
59.5	55414	0.61
59.6	52768	0.58
59.7	53552	0.59
59.8	55270	0.61
59.9	54171	0.60
60.0	52519	0.58
60.1	51400	0.57
60.2	49879	0.55
60.3	49717	0.55
60.4	49185	0.54
60.5	49227	0.54
60.6	48700	0.54
60.7	48256	0.53
60.8	48194	0.53
60.9	47902	0.53
61.0	46158	0.51
61.1	44980	0.50
61.2	45250	0.50
61.3	45079	0.50
61.4	44380	0.49
61.5	44683	0.49
61.6	44435	0.49
61.7	44343	0.49
61.8	44898	0.49
61.9	45513	0.50
62.0	44997	0.50
62.1	46015	0.51
62.2	45444	0.50
62.3	44441	0.49
62.4	43915	0.48
62.5	42815	0.47

62.6	42658	0.47
62.7	42297	0.47
62.8	41124	0.45
62.9	42896	0.47
63.0	43161	0.48
63.1	41690	0.46
63.2	40811	0.45
63.3	40628	0.45
63.4	40766	0.45
63.5	39691	0.44
63.6	38567	0.42
63.7	38104	0.42
63.8	37922	0.42
63.9	37551	0.41
64.0	36629	0.40
64.1	36183	0.40
64.2	35559	0.39
64.3	35759	0.39
64.4	35297	0.39
64.5	34583	0.38
64.6	33367	0.37
64.7	33070	0.36
64.8	33106	0.36
64.9	31836	0.35
65.0	32409	0.36
65.1	31665	0.35
65.2	31267	0.34
65.3	31306	0.34
65.4	29727	0.33
65.5	28487	0.31
65.6	28739	0.32
65.7	28055	0.31
65.8	27657	0.30
65.9	27009	0.30
66.0	26442	0.29
66.1	26669	0.29
66.2	25963	0.29
66.3	25234	0.28
66.4	24290	0.27
66.5	24147	0.27
66.6	23731	0.26
66.7	23293	0.26
66.8	22271	0.25
66.9	21753	0.24
67.0	20959	0.23
67.1	20748	0.23
67.2	20005	0.22

67.3	19788	0.22
67.4	19704	0.22
67.5	18776	0.21
67.6	18359	0.20
67.7	18355	0.20
67.8	18035	0.20
67.9	16928	0.19
68.0	16485	0.18
68.1	16329	0.18
68.2	15888	0.18
68.3	15566	0.17
68.4	15309	0.17
68.5	15505	0.17
68.6	14671	0.16
68.7	14667	0.16
68.8	14637	0.16
68.9	14175	0.16
69.0	14037	0.15
69.1	13462	0.15
69.2	13396	0.15
69.3	13140	0.14
69.4	12471	0.14
69.5	12074	0.13
69.6	11539	0.13
69.7	11633	0.13
69.8	11278	0.12
69.9	11271	0.12
70.0	10687	0.12
70.1	10633	0.12
70.2	10406	0.11
70.3	10163	0.11
70.4	9541	0.11
70.5	9273	0.10
70.6	8885	0.10
70.7	8613	0.09
70.8	8784	0.10
70.9	8394	0.09
71.0	8419	0.09
71.1	8173	0.09
71.2	8234	0.09
71.3	7577	0.08
71.4	7425	0.08
71.5	7158	0.08
71.6	6659	0.07
71.7	6870	0.08
71.8	6669	0.07
71.9	6472	0.07

72.0	5987	0.07
72.1	5776	0.06
72.2	5732	0.06
72.3	5822	0.06
72.4	5598	0.06
72.5	5573	0.06
72.6	5242	0.06
72.7	5163	0.06
72.8	5001	0.06
72.9	4688	0.05
73.0	4889	0.05
73.1	4644	0.05
73.2	4342	0.05
73.3	4182	0.05
73.4	4164	0.05
73.5	3936	0.04
73.6	3667	0.04
73.7	3757	0.04
73.8	3669	0.04
73.9	3299	0.04
74.0	3070	0.03
74.1	3144	0.03
74.2	2975	0.03
74.3	2970	0.03
74.4	2669	0.03
74.5	2628	0.03
74.6	2575	0.03
74.7	2592	0.03
74.8	2525	0.03
74.9	2365	0.03
75.0	2306	0.03
75.1	2205	0.02
75.2	2184	0.02
75.3	2061	0.02
75.4	2209	0.02
75.5	2033	0.02
75.6	1930	0.02
75.7	1782	0.02
75.8	1715	0.02
75.9	1575	0.02
76.0	1464	0.02
76.1	1534	0.02
76.2	1496	0.02
76.3	1362	0.02
76.4	1454	0.02
76.5	1349	0.01
76.6	1159	0.01

76.7	1135	0.01
76.8	1060	0.01
76.9	973	0.01
77.0	961	0.01
77.1	900	0.01
77.2	802	0.01
77.3	844	0.01
77.4	853	0.01
77.5	803	0.01
77.6	787	0.01
77.7	687	0.01
77.8	685	0.01
77.9	651	0.01
78.0	592	0.01
78.1	528	0.01
78.2	545	0.01
78.3	474	0.01
78.4	434	0.00
78.5	461	0.01
78.6	425	0.00
78.7	321	0.00
78.8	297	0.00
78.9	271	0.00
79.0	277	0.00
79.1	259	0.00
79.2	231	0.00
79.3	229	0.00
79.4	198	0.00
79.5	201	0.00
79.6	216	0.00
79.7	220	0.00
79.8	196	0.00
79.9	216	0.00
80.0	219	0.00
80.1	232	0.00
80.2	204	0.00
80.3	176	0.00
80.4	228	0.00
80.5	247	0.00
80.6	162	0.00
80.7	186	0.00
80.8	174	0.00
80.9	113	0.00
81.0	108	0.00
81.1	97	0.00
81.2	77	0.00
81.3	76	0.00

81.4	100	0.00
81.5	88	0.00
81.6	94	0.00
81.7	102	0.00
81.8	94	0.00
81.9	77	0.00
82.0	89	0.00
82.1	99	0.00
82.2	101	0.00
82.3	80	0.00
82.4	67	0.00
82.5	73	0.00
82.6	69	0.00
82.7	56	0.00
82.8	83	0.00
82.9	44	0.00
83.0	42	0.00
83.1	43	0.00
83.2	42	0.00
83.3	51	0.00
83.4	39	0.00
83.5	42	0.00
83.6	57	0.00
83.7	48	0.00
83.8	53	0.00
83.9	33	0.00
84.0	40	0.00
84.1	43	0.00
84.2	29	0.00
84.3	29	0.00
84.4	35	0.00
84.5	31	0.00
84.6	27	0.00
84.7	23	0.00
84.8	32	0.00
84.9	28	0.00
85.0	25	0.00
85.1	22	0.00
85.2	23	0.00
85.3	33	0.00
85.4	47	0.00
85.5	23	0.00
85.6	9	0.00
85.7	10	0.00
85.8	10	0.00
85.9	12	0.00
86.0	14	0.00

86.1	15	0.00
86.2	12	0.00
86.3	16	0.00
86.4	17	0.00
86.5	15	0.00
86.6	21	0.00
86.7	25	0.00
86.8	19	0.00
86.9	21	0.00
87.0	19	0.00
87.1	26	0.00
87.2	14	0.00
87.3	21	0.00
87.4	18	0.00
87.5	18	0.00
87.6	19	0.00
87.7	19	0.00
87.8	22	0.00
87.9	20	0.00
88.0	22	0.00
88.1	20	0.00
88.2	16	0.00
88.3	17	0.00
88.4	15	0.00
88.5	18	0.00
88.6	21	0.00
88.7	20	0.00
88.8	15	0.00
88.9	15	0.00
89.0	17	0.00
89.1	14	0.00
89.2	14	0.00
89.3	6	0.00
89.4	8	0.00
89.5	9	0.00
89.6	9	0.00
89.7	7	0.00
89.8	8	0.00
89.9	9	0.00
90.0	7	0.00
90.1	3	0.00
90.2	3	0.00
90.3	4	0.00
90.4	3	0.00
90.5	5	0.00
90.6	3	0.00
90.7	4	0.00

90.8	5	0.00
90.9	5	0.00
91.0	8	0.00
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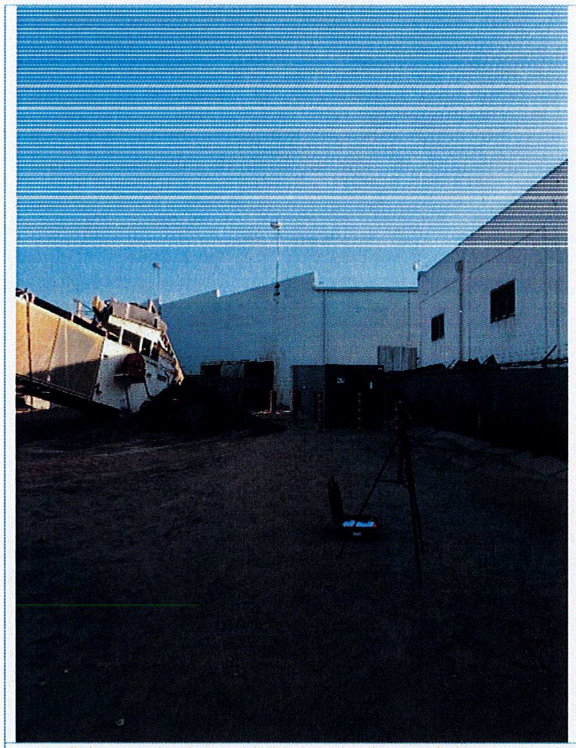
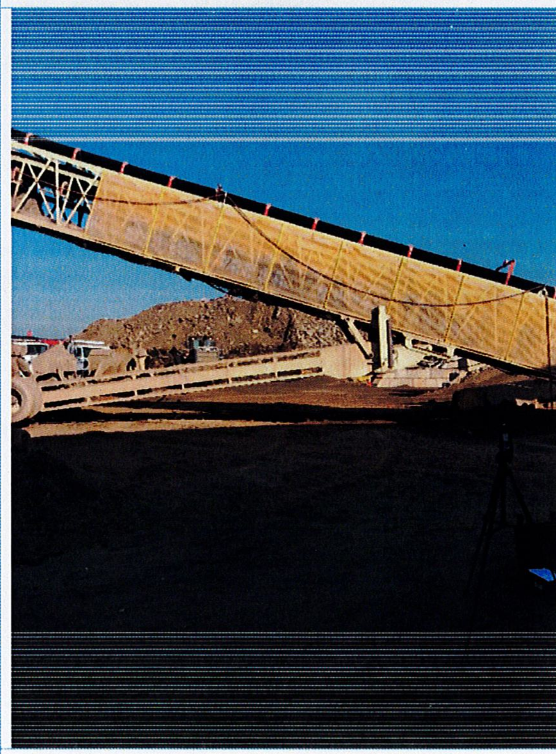


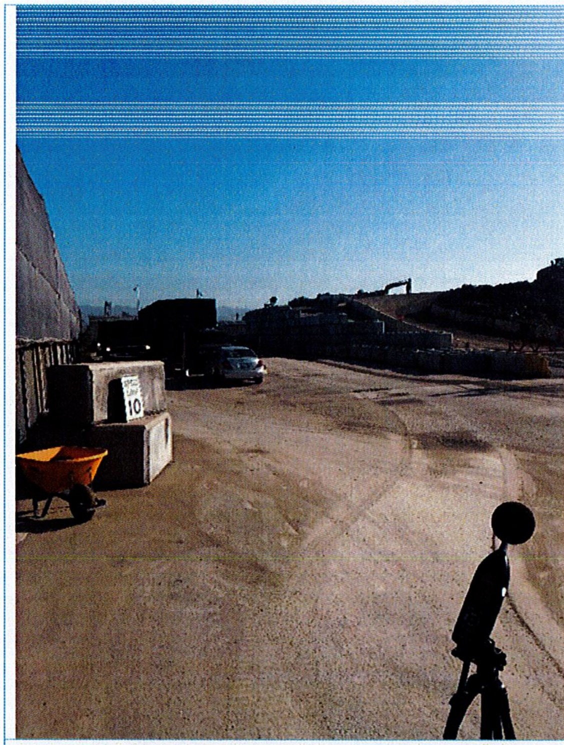
View from ST-1 facing north

View from ST-1 facing east

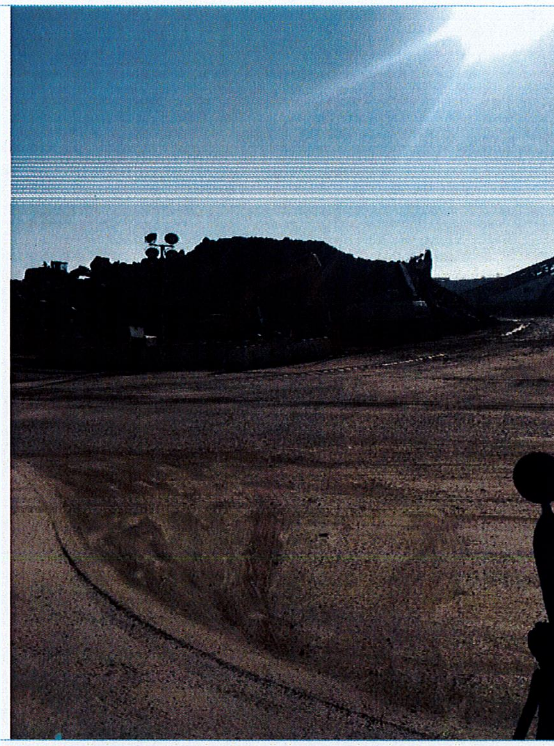
View from ST-1 facing south



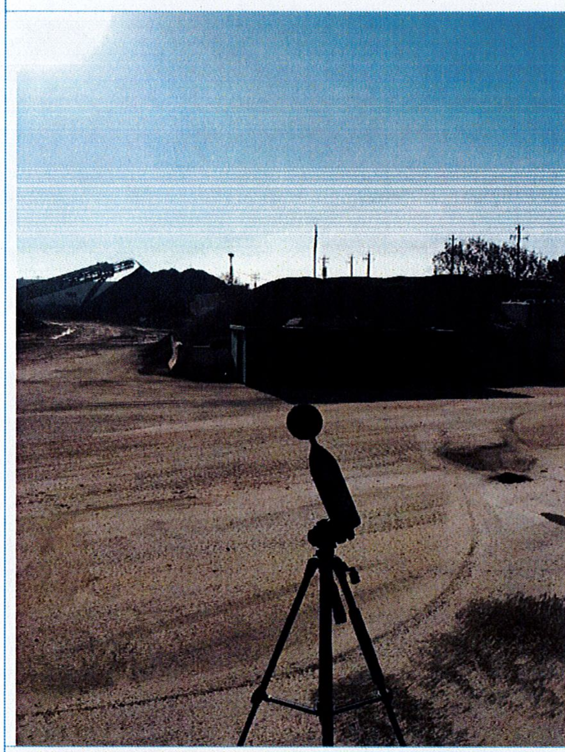
View from ST-1 facing west



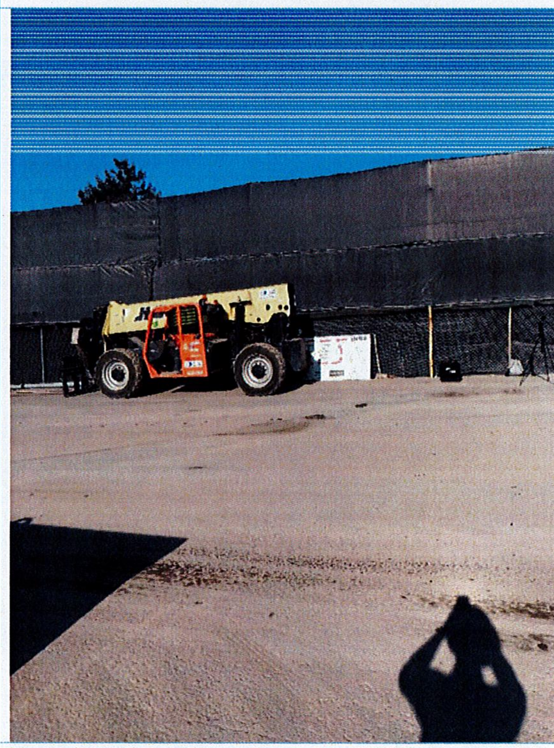
View from ST-2 facing north



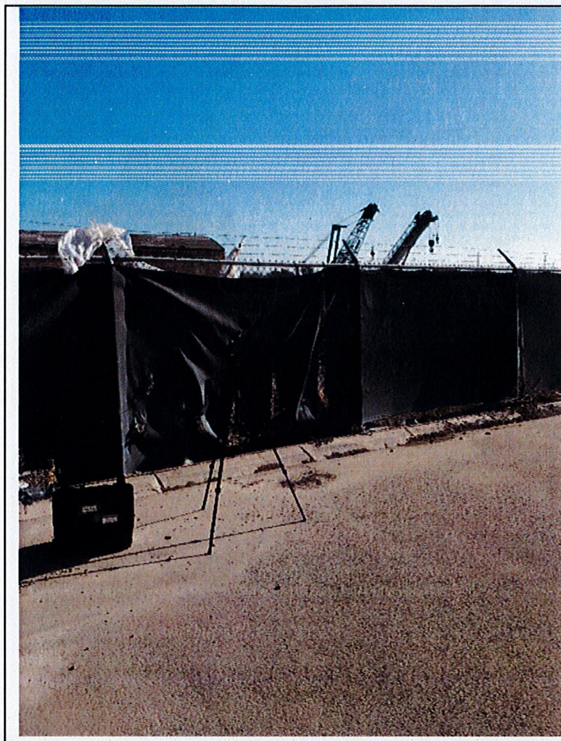
View from ST-2 facing east



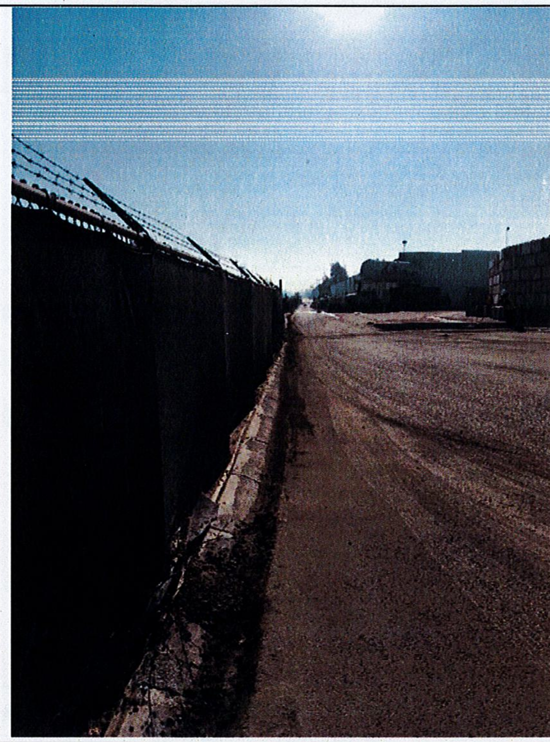
View from ST-2 facing south



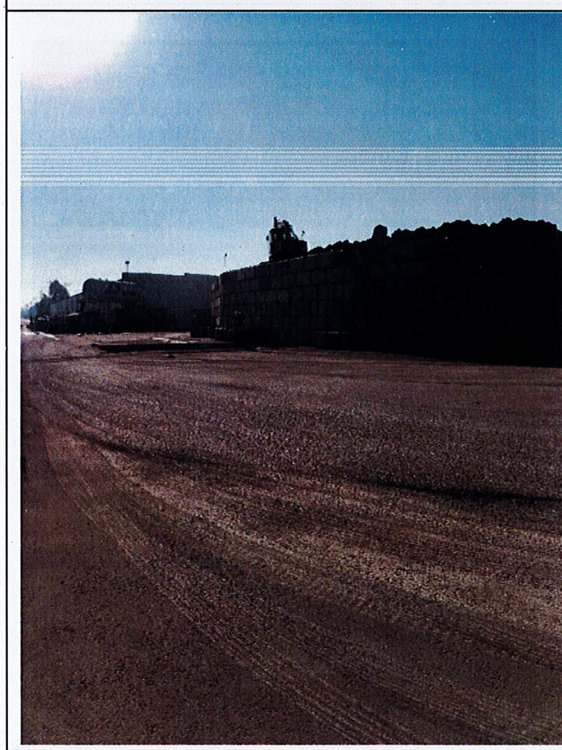
View from ST-2 facing west



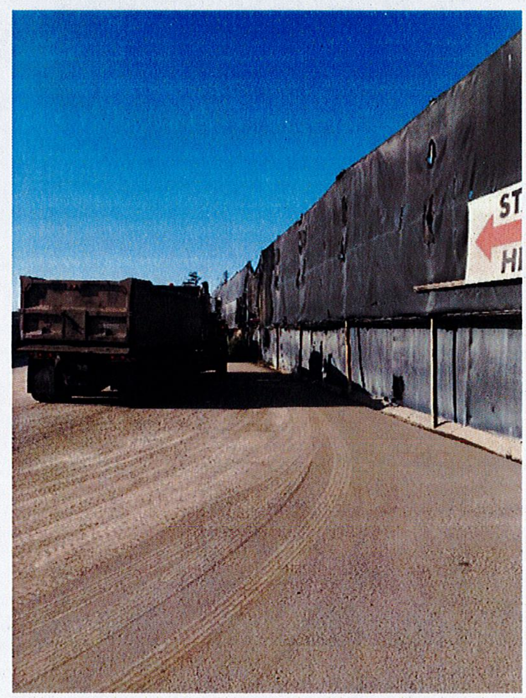
View from ST-3 facing north



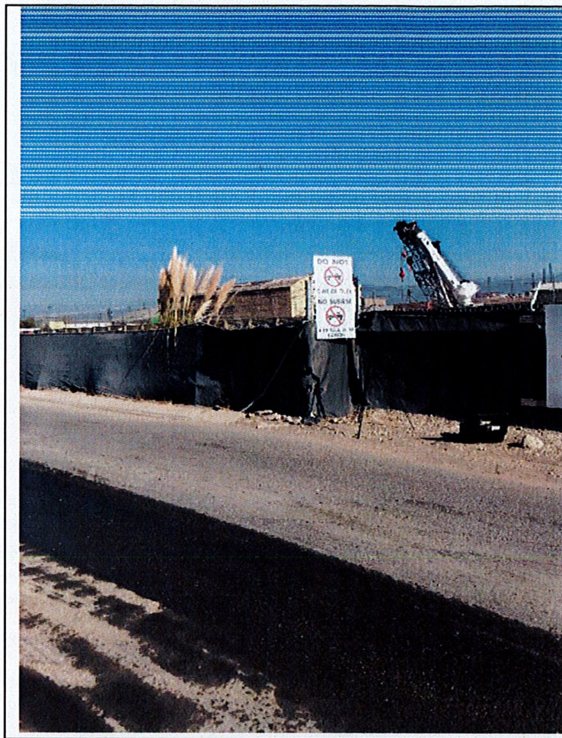
View from ST-3 facing east



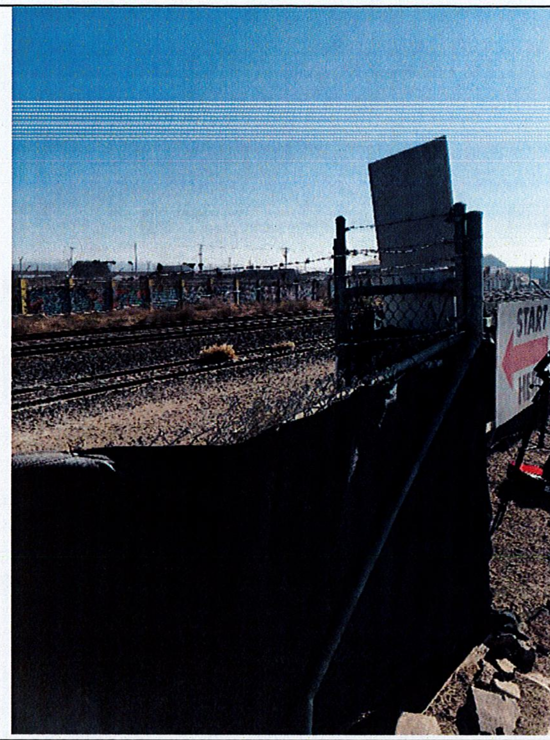
View from ST-3 facing south



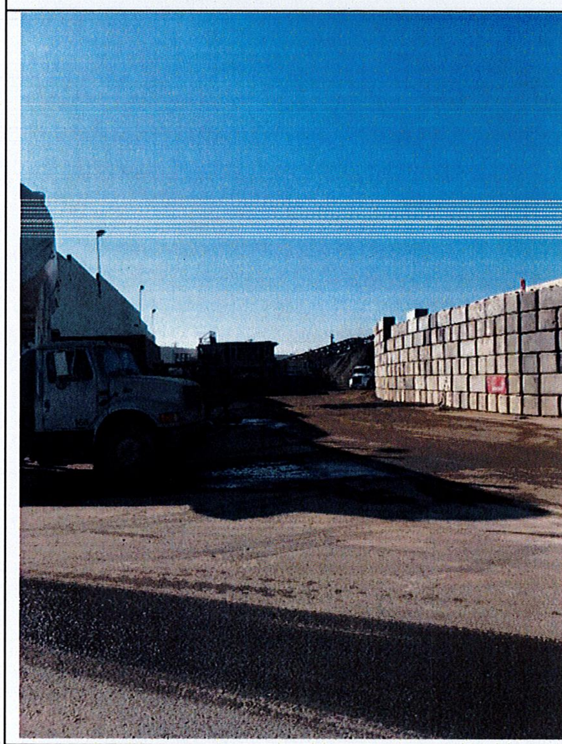
View from ST-3 facing west



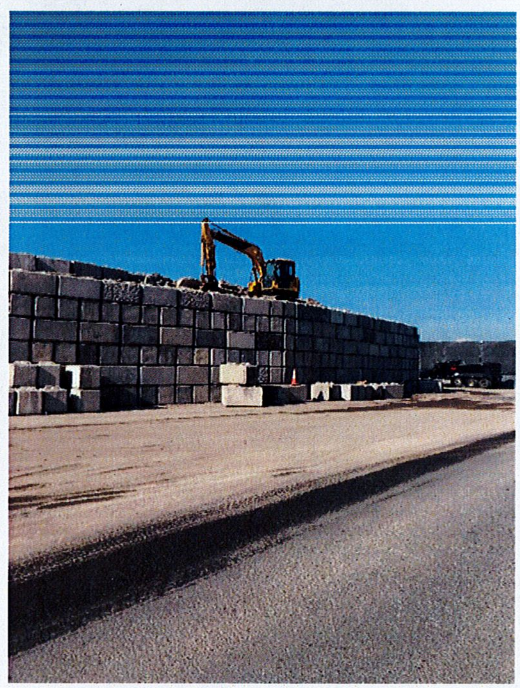
View from ST-4 facing north



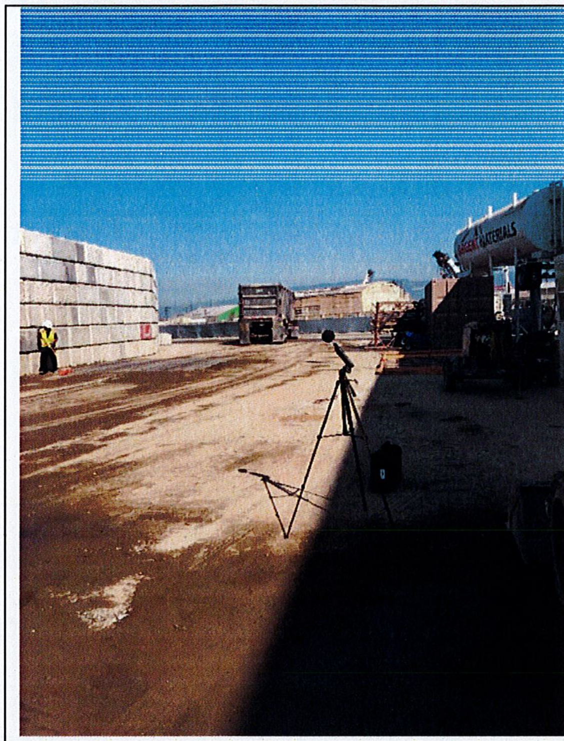
View from ST-4 facing east



View from ST-4 facing south

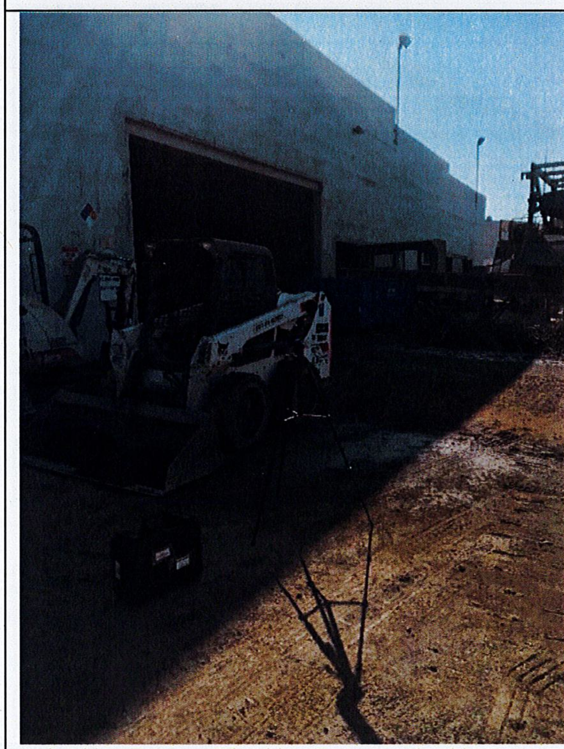


View from ST-4 facing west

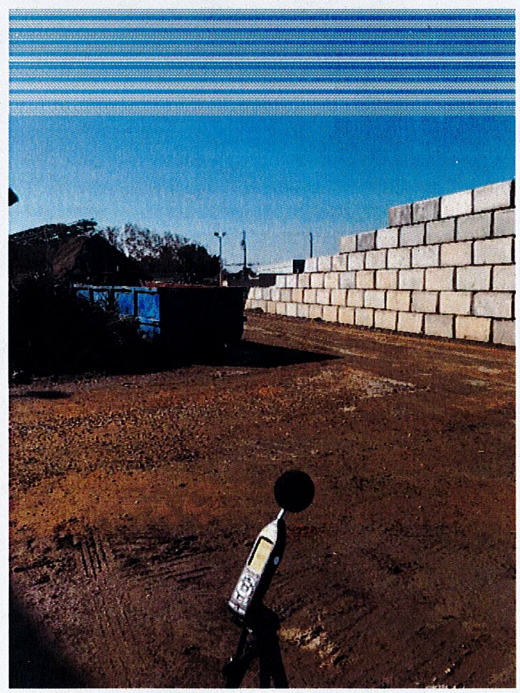


View from ST-5 facing north

View from ST-5 facing east



View from ST-5 facing south



View from ST-5 facing west

N/A

View from LT-1 facing north

View from LT-1 facing east

View from LT-1 facing south

View from LT-1 facing west