



WAIRE Implementation Guidelines

**Rule 2305 – Warehouse Indirect Source Rule - Warehouse Actions
and Investments to Reduce Emissions (WAIRE) Program
Rule 316 – Fees for Rule 2305**

June 2021

Version 1.1

ERRATA FOR WAIRE IMPLEMENTATION GUIDELINES

The WAIRE Implementation Guidelines was included in Appendix A of the Final Staff Report for Proposed Rule 2305 and Proposed Rule 316, which was adopted by the South Coast AQMD Board on May 7, 2021. The WAIRE Implementation Guidelines is a user guide to assist warehouse owners and operators to comply with the requirements of Rule 2305 and Rule 316. This version of the document (version 1.1) reflects the following updates.

Five corrections have been made to the WAIRE Implementation Guidelines which do not change the meaning or intent of Rule 2305 or Rule 316. Corrections address an inadvertent omissions that were added to better describe concepts included in Rule 2305 regarding truck trip counting, a typographic error in reference to Table 4, a typographic error in numbering and in reference to Table 5, and two typographic errors with incomplete sentences. The corrections are listed below and are identified in underline/strikeout in the Guidelines.

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4. Guardshack – Many warehouse operators employ a guard or other personnel to ~~(incomplete sentence)~~ staff their gate guardshack to control trucks entering the warehouse. The guard or warehouse personnel who interact with the driver of the truck entering the warehouse would complete a log of the truck entering with both visual observations of the truck and may supplement with additional questions asked of the driver of the truck. A guardshack log would include such information as the number and class of trucks (Class 2b to 7 vs. Class 8) or alternatively the number and type of trucks (tractor or tractor-trailers vs. straight trucks). The log should be daily if available but in no case should be less than one weekday (Monday – Friday, for the warehouse’s entire operating hours) per month and one weekend day (Saturday or Sunday, for the warehouse’s entire operating hours) per month (if the warehouse is open on weekends). Each weekday and weekend day once-per-month representative sample must be taken at least three weeks apart from the next respective sample. With this less intensive once-per month sampling method, a representative peak weekday and weekend day must be recorded (with documentation indicating why those days of the week were chosen). The weekday count may then apply to all weekdays during that month, and the weekend count may then apply to all weekend days during that month. The name of the guard or personnel completing the guardshack log should be on the log itself in case further clarification is needed.

4.5. Contracts or other similar records – Many warehouse operators are responsible for shipments to/from their warehouse, including with their own fleet or through third party fleets. Records such as contracts or manifests that document the loads delivered to or picked up from a warehouse can be used to determine truck trip information provided that all trips to a site are documented (which could include supplementary sources of data, such as through methods described above).

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Table ~~3~~ 4 provides an overview of the reporting requirements for Rule 2305. Appendix A to these Guidelines will provide a user’s guide to the WAIRE Program Online Portal (POP)

through which warehouse operators and owners will submit their required reports and pay necessary fees.

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Table 45 below provides an overview of the reporting metrics that warehouse operators must report on their AWR to earn WAIRE Points from the WAIRE Menu.

Table 45 – WAIRE Menu Item Metrics

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Cameras may be used to record the trucks entering or exiting a warehouse site and document the truck license plate number (using either manual or automated tracking), and potentially other information such as fuel type, trucking company name, and DOT number. ~~Information from items (incomplete sentence)~~

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~~(incomplete sentence) For Phase 2 and 3, t~~There is an early action provision that allows for earning WAIRE Points ahead of their initial compliance period, and include a provision for the clock on three year life of the WAIRE Points for those early action WAIRE Points to not begin until after the initial compliance period.

In addition, a supplement was included in the approved board package. Supplement number one is a clarification to specifically identify a type of action that may be permissible in a Custom WAIRE Plan, which is now incorporated on Page 17 of the Guidelines as shown below. The footnote on Page 21 was a placeholder and it has been updated to provide a link to the Resolution of the adopted Board package. Because these changes were approved by the Board, they do not appear in strikeout/underline in the Guidelines.

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A Custom WAIRE Plan allows for local hire to be counted as points towards compliance with the rule by reducing employee commute emissions. Use of a local state certified apprenticeship program or a skilled and trained workforce with a local hire component can help demonstrate those emission reductions. NZE yard trucks may be submitted as a Custom WAIRE Plan for consideration but only if they only utilize renewable fuels such as renewable natural gas (RNG), renewable propane, or other equivalents.

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²²<http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2021/2021-May7-027.pdf?sfvrsn=10#page=16>~~A link to the resolution will be added here if the rule is approved.~~

Finally, the headers, footers, and the page numbers of the WAIRE Implementation Guidelines have been updated to reflect it as a standalone document. A cover page and a table of contents has been added. The references to “Proposed Rule (PR)” have been updated to “Rule.”

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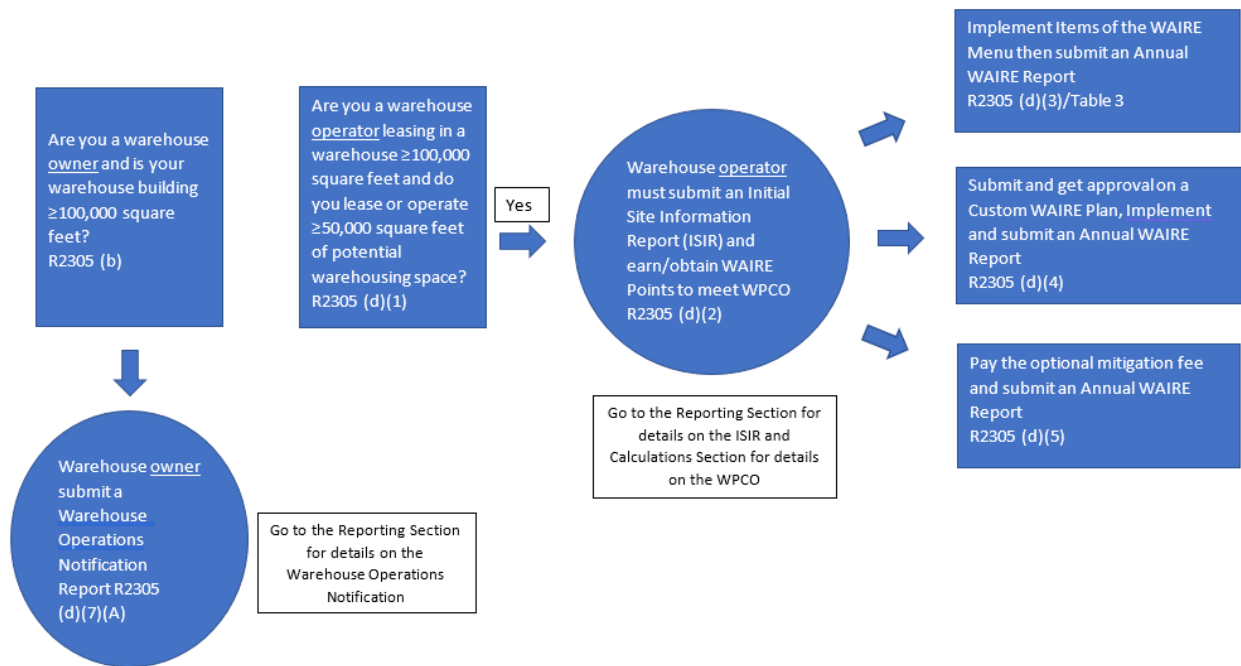
OVERVIEW

Rule 2305 is the Warehouse Indirect Source Rule (ISR) which provides the Warehouse Actions and Investments to Reduce Emissions (WAIRE) Program, a menu-based points system. The WAIRE Program determines a warehouse operator’s WAIRE Points Compliance Obligation (WPCO) based on annual truck trips to each applicable new and existing warehouse that has at least 100,000 square feet of indoor floorspace within a single building that may be used for warehousing activities. Each warehouse operator must earn or obtain WAIRE Points to meet their WPCO on an annual basis. Rule 316 establishes fees to fund South Coast AQMD compliance activities associated with Rule 2305.

The WAIRE Program Implementation Guidelines (Guidelines) do not supersede the requirements specifically stated in Rule 2305 and Rule 316 but are meant to provide warehouse operators and owners with further guidance on complying with the rules. In any instance where an interpretation of requirements in these Guidelines conflicts with Rule 2305 or Rule 316, the rule language takes precedence. All owners and operators subject to Rule 2305 and Rule 316 should anticipate that the reports they submit and the records that they keep will be reviewed by South Coast AQMD staff in desktop audits and onsite field inspections, and are subject to public records act requests. Further, data regarding warehouse operator compliance will be made publicly available on South Coast AQMD’s website. For any questions about this guidance document, please contact program staff at waire-program@aqmd.gov.

APPLICABILITY

Figure 1 – Applicability Flow Chart



The warehouse ISR applies to warehouse operators and owners of warehouses greater than or equal to 100,000 square feet of indoor floor space within a single building that may be used for warehousing activities. A warehouse operator or owner whose warehousing activity is not explicitly excluded from Rule 2305 is presumed to be included in rule requirements. Figure 1 represents a simplified diagram of the requirements for warehouse owners and operators of applicable warehouses. Warehouse owners are only required to submit a Warehouse Operation Notification Report which detail the size and tenant status of the warehouse, further details are provided in the Reporting Section of these Guidelines. Warehouse operators are required to submit an Initial Site Information Report and are required to earn WAIRE points. Warehouse owners may choose to earn WAIRE points on behalf of the warehouse operator.

In addition to the warehouse size applicability, the warehouse ISR is implemented over time based on the applicable warehouse sizes. The warehouse size phase-in shown in Table 1, and details the date range for the Initial Compliance Period when warehouse operators must earn or obtain WAIRE Points to meet their WPCO, and also the due dates for Initial Site Information Report, and the first Annual WAIRE Report.

Table 1 – Implementation Schedule

Phase	Warehouse Size (square feet)	Initial Site Information Report Due Date	First Annual WAIRE Report Due Date	Initial Compliance Period
1	> 250,000	July 1, 2022	January 31, 2023	January 1, 2022 to December 31, 2022
2	> 150,000- <250,000	July 1, 2023	January 31, 2024	January 1, 2023 to December 31, 2023
3	> 100,000- <150,000	July 1, 2024	January 31, 2025	January 1, 2023 to December 31, 2024

CALCULATIONS¹

The WPCO is the number of WAIRE Points a warehouse operator must earn or obtain to comply with Rule 2305. Figure 2 represents a simplified diagram of how a WPCO is calculated based on the number and type of trucks that enter or exit a warehouse site.

Figure 2



Truck trips are defined as one-way trips that tractors and straight trucks make to a warehouse facility when delivering goods to or from another location.² They are counted when a truck enters or exits a site. A single visit from a truck is equal to two trips. Rule 2305 refers to the total calculated truck trips in a compliance period as Weighted Annual Truck Trips (WATTs) which is calculated by inputting the actual truck trip counts of the number and type of trucks in the following equation:

$$WATTs = [Class\ 2b\ to\ 7\ truck\ trips] + [2.5 \times Class\ 8\ truck\ trips]$$

As shown in Figure 2, the WATTs are multiplied by the Stringency factor and the Annual Variable to provide the WPCO for the warehouse. The Stringency factor is defined as 0.0025 WAIRE Points per WATTs, and the annual variable is determined by the phase-in schedule of the warehouse and is provided in Table 2.

Table 2 – Annual Variable

Annual WAIRE Report Year*	Annual Variable		
	Phase 1	Phase 2	Phase 3
2022	0.33	0	0
2023	0.67	0.33	0
2024	1.0	0.67	0.33
2025	1.0	1.0	0.67
2026 and beyond	1.0	1.0	1.0

*This is the compliance period for which a warehouse operator is first required to submit its Annual WAIRE Report.

¹ The WAIRE Menu Technical Report, included as Appendix B in the Rule 2305 staff report, is included as an appendix to these Implementation Guidelines to assist in determining how WAIRE Points are calculated.

² A truck or yard truck delivering a trailer or goods from one part of a warehouse to another part of a warehouse is not considered a truck trip since it does not include delivery of goods to/from another location.

TRUCK TRIP COUNTS FOR DETERMINING WPCO

The WATTs calculation equation weighs the activity and emission contribution of a Class 2b-7 straight truck and that of a Class 8 tractor which emits approximately 2.5 times more NOx emissions. Class 8 tractors are differentiated from Class 2b-7 straight trucks by their Gross Vehicle Weight Rating being greater than 33,001 pounds. Absent more specific data, all tractors that can pull a trailer should be counted as Class 8, and all straight trucks should be counted as Class 2b-7.

With the WPCO being closely tied to the number of actual truck trips entering and exiting the warehouse site, it is important to accurately document the total number of truck trips and whether they were Class 8 tractors or Class 2b-7 straight trucks. Truck trips must be counted and records must be verifiable, where date and time of the truck trips recorded may be tied to the compliance period records for review. Below are five examples of methods to count the number of truck trips. The key criteria for ensuring that the truck trip counts are accurate enough for determining a warehouse operator's WPCO is that the data needs to be collected using a method that provides reliable and verifiable truck trip counts that are either contemporaneous (e.g., daily) or extrapolated from a short term contemporaneous tracking during a representative peak period, as described below. Warehouse operators are responsible for maintaining data that support the truck trip count and the data must be made available to South Coast AQMD for verification. Verifiable data can be provided through the following methods:

1. Electronic Telematics Systems – These systems are used to track truck activity, typically through the use of on-board GPS systems and fleet management software. These systems can track when equipped vehicles are located at a warehouse.
2. In-Roadway or Driveway Sensors - Various sensor technologies are available to count vehicles such as pneumatic tubes, radar, or lasers installed at a driveway. These devices are used to count the number of vehicles passing a certain point and can provide truck classification data (e.g., straight trucks).
3. Video Monitoring – Many warehouse operators already employ security cameras to monitor their gates. Warehouse operators could use staff or software to identify the number and type of trucks that enter the gate and note truck Class (i.e. straight trucks vs. tractors) from video recordings. Video recordings and subsequent counts can be continuous but in no cases should be less than one weekday (Monday – Friday) per month and one weekend day (Saturday or Sunday) per month (if the warehouse is open on weekends). Each weekday and weekend day once-per-month sample must be taken at least three weeks apart from the next respective sample. With this less intensive once-per month sampling method, a representative peak weekday and weekend day must be recorded (with documentation indicating why those days of the week were chosen). The weekday count may then apply to all weekdays during that month, and the weekend count may then apply to all weekend days during that month.
4. Guardshack – Many warehouse operators employ a guard or other personnel to ~~(incomplete sentence)~~ staff their gate guardshack to control trucks entering the warehouse. The guard or warehouse personnel who interact with the driver of the truck entering the warehouse would complete a log of the truck entering with both visual observations of the truck and may supplement with additional questions asked of the driver of the truck. A guardshack log would include such information as the number and class of trucks (Class 2b to 7 vs. Class 8) or alternatively the number and type of trucks (tractor or tractor-trailers vs. straight trucks). The log should be daily

if available but in no case should be less than one weekday (Monday – Friday, for the warehouse’s entire operating hours) per month and one weekend day (Saturday or Sunday, for the warehouse’s entire operating hours) per month (if the warehouse is open on weekends). Each weekday and weekend day once-per-month representative sample must be taken at least three weeks apart from the next respective sample. With this less intensive once-per month sampling method, a representative peak weekday and weekend day must be recorded (with documentation indicating why those days of the week were chosen). The weekday count may then apply to all weekdays during that month, and the weekend count may then apply to all weekend days during that month. The name of the guard or personnel completing the guardshack log should be on the log itself in case further clarification is needed.

5. Contracts or other similar records – Many warehouse operators are responsible for shipments to/from their warehouse, including with their own fleet or through third party fleets. Records such as contracts or manifests that document the loads delivered to or picked up from a warehouse can be used to determine truck trip information provided that all trips to a site are documented (which could include supplementary sources of data, such as through methods described above).

Loss of Truck Trip Count Data

In the event that there is insufficient truck trip data due to events beyond the warehouse operator’s control such as with records destroyed in a fire or other force majeure event, an alternative WATTs calculation may be used as described below.³ The WATTs must be calculated using the equation and table below.

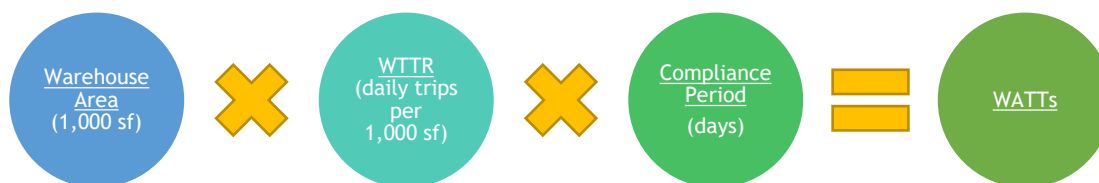


Table 3 Weighted Truck Trip Rates (WTTR)

Warehouse Type	WTTR (trips/1,000 sf)
>200,000 sf	0.95
≥100,000 – 199,999 sf	0.67
Cold Storage (≥100,000 sf)	2.17

Example calculation for a 250,000 square foot (non-cold storage) warehouse that experienced a force majeure event and lost 30 days of records:

$$250 \text{ tsf} \times 0.95 \text{ trips/tsf} \times 30 \text{ days} = 7,125 \text{ WATTs}$$

³ This alternative calculation can only be used in cases of force majeure. Normal practice requires the warehouse operator to count all truck trips. Further details on the alternative WPCO calculation are available at Rule 2305 (d)(1)(C).

These calculated WATTs would be added to the other WATTs counted during the rest of the compliance period to determine the warehouse operator's WPCO.

REPORTING

Report Submission

Warehouse operators and owners subject to Rule 2305 are required to submit reports to South Coast AQMD to provide details on their applicable warehouse operations and compliance. Rule 2305 requires that all records used to demonstrate compliance be maintained by warehouse operators or owners, as applicable, for a period of no less than seven years and made available to South Coast AQMD upon request during normal business hours in order to determine compliance. Table 34 provides an overview of the reporting requirements for Rule 2305. Appendix A to these Guidelines will provide a user's guide to the WAIRE Program Online Portal (POP) through which warehouse operators and owners will submit their required reports and pay necessary fees.⁴

⁴ This appendix will be developed if the rule is approved and once the WAIRE POP has been developed. If the WAIRE POP system is not available, all reports should be submitted to waire-program@aqmd.gov.

Table 4 Reporting Overview

WAIRE Program Report	Reporting Entity	Information Required	Due Dates
Warehouse Operations Notification (WON)	Warehouse Owners	<ul style="list-style-type: none"> Warehouse size and area that may be used for warehousing activity, Warehouse operator(s) name and contact information, Lease end date (if applicable), Previous warehouse operator(s) information, Square footage used by the warehouse owner for warehousing activities 	<ul style="list-style-type: none"> <u>On or before September 1, 2021</u> Within 14 days of a new warehouse operator having access to at least of 50,000 square feet of space for warehousing activities, Within 30 days after a renovation that alters the size of the warehouse, Within 3 days of a request for the report from South Coast AQMD
Initial Site Information Report (ISIR)	Warehouse Operators*	<ul style="list-style-type: none"> Warehouse size and space used for warehousing activities,** Number of truck trips in the previous 12-month period,*** Number of truck trips anticipated during the compliance period for which the upcoming AWR must be submitted, Anticipated actions to meet the WPCO for the current compliance period, Details on the following potential onsite equipment: owned or leased truck fleet, onsite alternative fueling stations, yard trucks, and onsite energy generation systems (e.g., solar) 	<ul style="list-style-type: none"> On or before July 1 of the first compliance period when the warehouse operator must submit their first Annual WAIRE Report for that warehouse Within 30 days of a request for the report from South Coast AQMD
Annual WAIRE Report (AWR)	Warehouse Operators*	<ul style="list-style-type: none"> Truck trip counts for the compliance period, Number of WAIRE Points earned for each action, Associated metrics for the WAIRE Menu actions used to earn WAIRE Points 	<ul style="list-style-type: none"> No more than 30 days after January 1 of the compliance period If an operator vacates a warehouse before <u>the AWR submission deadline</u> in any year, they must submit an AWR <u>no later than the date they vacate the warehouse.</u>

* The warehouse owner may choose to comply on behalf of the warehouse operator, or may be required to submit the report if they are also the warehouse operator.

** If the warehouse building size is <100,000 sf, or if the warehouse operator leases <50,000 sf for warehousing activities, then no further reporting is required. Multiple warehouse operators owned or controlled by a single parent company collectively leasing ≥50,000 sf for warehousing activities in a warehouse do not qualify for this exemption from additional reporting. Also, if an activity is not expressly exempt from rule requirements, it is presumed to be subject to the rule.

*** Warehouses submitting an ISIR before July 1 2022 are only required to report truck trips since July 1, 2021.

Warehouse Operations Notification Report

The Warehouse Operations Notification (WON) must be submitted by an authorized official of the warehouse owner through the WAIRE POP online system. The applicable administrative fee listed in Rule 316 must be submitted via e-check or credit card at the same time as the WON. Warehouse owners submitting a WON for a warehouse with less than 100,000 square feet of floor area dedicated to warehousing activities are exempt from the reporting fee.

Warehouse Renovation or Size Change

In the event there is a change in the applicable 100,000 square feet or greater of indoor floor space within a single building that may be used for warehousing activities, a WON must be submitted within 30 days of receiving a certificate of occupancy from the applicable local building department. Example renovations could include expanding the size of the building to add more warehousing space, or constructing more office space within the warehouse such that the indoor floor space that may be used for warehousing activities is now less than 100,000 feet.

New Warehouse Operator

Any time a new warehouse operator takes over operational control of at least 50,000 square feet of a warehouse building with more than 100,000 square feet that may be used for warehouse activities, a WON must be submitted within 14 days to report that change. A typical example would include a new tenant's starting date for their lease.

Initial Site Information Report

The Initial Site Information Report (ISIR) must be submitted by an authorized official of the warehouse operator through the WAIRE POP online system. ISIRs are only submitted during the first compliance period a warehouse operator is occupying the warehouse⁵, and prior to the first AWR unless requested by the South Coast AQMD Executive Officer. The applicable administrative fee listed in Rule 316 must be submitted via e-check or credit card at the same time as the ISIR.

Warehouse Size

The ISIR must include the total indoor floor square footage of the applicable warehouse building and the amount of space the warehouse operator leases that may be used for warehousing activities. Typical records used to determine this information will be the operator's lease, information from the warehouse owner, and/or property tax assessment data. The warehouse operator may need to make their own determination about how much of the warehouse facility they can use for warehousing activities.⁶ Vacant areas that may be used for warehousing activities (e.g., empty storage racks, open floor space designed for warehousing, drive paths for

⁵ Additional ISIRs would be required to be submitted by the warehouse operator should they relocate to a different warehouse subject to Rule 2305.

⁶ Areas that may be used for warehousing activities include indoor spaces related to the storage and distribution of goods, including but not limited to the storage, labelling, sorting, consolidation and deconsolidation of products into different size packages. Supporting office administration (e.g., employee break areas, restrooms, offices, etc.), maintenance (e.g., vehicle maintenance or charging/fueling areas), manufacturing areas, or retail sales areas open to the general public, within the same warehouse building, that are physically separate from the warehouse area, are not considered warehousing activities.

pallet jacks or forklifts used in warehousing activities) must be included in the square footage calculation.

No additional reporting is required in the ISIR if 1) the total square footage that may be used for warehousing activities in that facility is less than 100,000 square feet, or 2) the warehouse operator's lease does not allow them to use more than 50,000 square feet for warehousing activities.

Truck Trips

There are two sets of truck trip data that must be reported in the ISIR. First, truck trips from the previous 12-month period must be recorded using the same types of methods used to determine the operator's WPCO (see discussion beginning on page 4). Because the ISIR is due by July 1, the typical applicable period for this reporting would be from the previous June 1 through May 31 period. Trips only need to be reported from periods when the operator occupied the warehouse. For example, if an operator's lease only began in September of that previous year, then truck trips only need to be reported from that period on.

Second, the operator must provide an estimate of the number of truck trips that will be reported during the applicable period for their upcoming Annual WAIRE Report. This estimate could just be an extrapolation of the data reported above for the previous 12-month period, or could include an estimate based on expected business through the end of the compliance period.

These two sets of truck trip data can serve as a basis for the operator to estimate their WPCO for that compliance period. However, the final WPCO used in the Annual WAIRE Report must be based on the actual truck trip counts during the compliance period itself (see discussion below).

Onsite Warehouse Equipment

The Initial Site Information Report requires information on existing onsite equipment at the warehouse for onsite fleets, ZE charging/fueling station, yard trucks, and solar panels. Baseline information on the onsite equipment is required to assist in calculating future WAIRE Points that may be potentially earned from the usage of the existing onsite equipment.

Anticipated Approach for Earning WAIRE Points

Using the truck trip data provided in the ISIR (described above) and the subsequent estimated WPCO, the warehouse operator must also submit how they anticipate meeting that WPCO for the current compliance period. This could include any combination of approaches from the WAIRE Menu, a Custom Plan, transferred Points, or the mitigation fee. This portion of the report is a planning exercise to assist the operator and the South Coast AQMD on the anticipated mechanisms that will be used for compliance. Recognizing that conditions can change, the actual approach used to earn WAIRE Points in the Annual WAIRE Report does not need to follow the approach outlined in the ISIR.

Annual WAIRE Report

An Annual WAIRE Report (AWR) must be submitted by every warehouse operator who must satisfy a WPCO for every compliance period, beginning with their Initial Compliance Period (see page 2). Warehouse owners who intend to voluntarily want to earn WAIRE Points, on

behalf of a warehouse operator, must also submit an AWR at the end of the compliance period when the Points were earned. The AWR must be submitted by an authorized official of either the warehouse operator, or owner if the WAIRE Points are earned by the owner, through the WAIRE POP online system. The applicable administrative fee listed in Rule 316 must be submitted via e-check or credit card at the same time as the AWR.

Truck Trip Counts

The number of truck trips for the compliance period must be reported specifying the number of Class 2b-7 straight trucks and Class 8 tractors that entered or exited the warehouse site, following the methods described beginning on page 3. Upon entering the truck trip data for the compliance period into the WAIRE POP system, the corresponding WPCO will be displayed using the equation shown on page 3.

Earned WAIRE Points

The warehouse operator must report how the WPCO was satisfied in terms of how many WAIRE Points were earned from:

- 1) Each WAIRE Menu action, and/or
- 2) Actions in an approved Custom WAIRE Plan, and/or
- 3) Points transferred from another site, the warehouse owner, or banked from a previous year, and/or
- 4) The mitigation fee.

For WAIRE Points earned from the WAIRE Menu, the warehouse operator must report the associated level of implementation using the reporting metrics for each WAIRE Menu action (see Table 3 of Rule 2305). The applicable increments of progress must be reported for actions implemented from an approved Custom WAIRE Plan. For WAIRE Points that were transferred or banked, the original method used to earn those WAIRE Points must also be reported, including who originally earned the WAIRE Points and when and how the WAIRE Points were earned.

RECORDKEEPING

Adequate records that document all reported information must be maintained for seven years after the applicable report was submitted and be available upon request during normal business hours. While summarized information is reported in the WON, ISIR, and AWR, during audits and field inspections South Coast AQMD staff will require warehouse operators and owners to provide detailed records in order to verify the accuracy of the information submitted.

WAIRE MENU

The WAIRE Menu provides flexibility in a warehouse operator’s ability to comply with the WPCO. Table 3 in Rule 2305 provides the WAIRE Menu showing the actions, the annual metrics, and the WAIRE Points based on the listed annual metric. The following discussion describes the factors that South Coast AQMD staff will review during audits and inspections for each WAIRE Menu option. Table 45 below provides an overview of the reporting metrics that warehouse operators must report on their AWR to earn WAIRE Points from the WAIRE Menu.

Table 45 – WAIRE Menu Item Metrics

WAIRE Menu Action/Investment	WAIRE Menu Reporting Metric for Each Compliance Period
Acquire ZE/NZE Trucks	Number of ZE/NZE Trucks Acquired by Truck Class
Visit from ZE/NZE Trucks	Number of ZE/NZE Truck Visits
Acquire ZE Yard Trucks	Number of ZE Yard Trucks Acquired
Use ZE Yard Truck	Number of Hours a ZE Yard Truck Operated
Install Onsite Solar Panel System	Kilowatt Rating of Installed System
Use Onsite Solar Panel System	Number of kWh Generated by the Solar Panel System
Install Stand-Alone MERV 16 or Greater Air Filtration Systems	Number of Stand-Alone Air Filtration Systems Installed
Replace MERV 16 or Greater Air Filters	Number of MERV 16 or Greater Air Filters Replaced

NZE/ZE Truck Acquisition

Many warehouse operators already own and operate trucks, and they may acquire NZE or ZE trucks for their fleet to earn WAIRE Points. Vehicle Identification Numbers and records verifying that the truck was acquired by the warehouse operator must be kept. Acquisition could include purchasing, leasing, or renting trucks. If a truck is leased or rented, the WAIRE Points earned for that temporary acquisition are proportional to the amount of the compliance period that the truck is leased or rented. For example, if truck is leased for 6 months of a 12-month compliance period, the number of WAIRE Points earned would be one half of the amount shown in Table 3 of Rule 2305. In the case of a Class 6 NZE truck, the warehouse operator would earn 13 WAIRE Points, instead of the 26 WAIRE Points shown in the WAIRE Menu for the full annual period.

NZE trucks fueled by natural gas have been commercially available for the past few years in a variety of Classes, with engines ranging from 6.7 liters to 11.9 liters to serve both medium duty

and heavy duty applications.⁷ NZE engines are defined as the lowest non-zero optional low NOx standard at the time of the engine's manufacture, which is currently 0.02 g/bhp-hr. One benefit of NZE is that publicly accessible fueling infrastructure for trucks already exists throughout the region and beyond.⁸

Many ZE trucks are also commercially available today in a variety of truck Classes, and many more are expected in the next few years.⁹ In the near term, charging or fueling infrastructure may be installed at a warehouse facility (which also would earn WAIRE Points), or may be available from a truck leasing company. Additional ZE charging and fueling infrastructure is expected to be installed in the coming years.

If a warehouse operator earns WAIRE Points from the acquisition of ZE or NZE trucks, they will need to retain records of the purchase, lease, or rental of the truck (such as a purchase invoices, or lease agreement), and documentation (e.g., onsite video or photographs from multiple days) that the truck serves that warehouse facility (e.g., that it is domiciled at that site or regularly visits that site). The purchase, lease, or rental documentation must contain enough information to demonstrate that the truck is NZE or ZE, as well as the truck Classification (e.g., the gross vehicle weight rating).

Existing funding programs¹⁰ like Carl Moyer, Proposition 1B, Hybrid Voucher Incentive Program, etc. cannot be used to purchase a truck and also earn WAIRE Points for truck acquisition due to statutory prohibitions preventing those incentive programs from being used to comply with a regulation. The warehouse operator therefore has the option of either receiving incentives to reduce the purchase price of a NZE or ZE truck or foregoing the incentives to earn WAIRE Points for the NZE/ZE truck acquisition.

NZE/ZE Truck Visits

WAIRE Points may also be earned for every visit to a warehouse by a NZE or ZE truck.¹¹ It is important to note, that WAIRE Points for acquisition and visits from the same truck can be earned in the same compliance period. Trucks that were purchased using incentive funds from the previously described funding programs, can be used for crediting towards number of ZE or NZE truck visits. WAIRE Points are earned for each NZE or ZE truck visit, which includes the truck trip into and out of the facility. The number of truck trips to earn WAIRE Points can be more or less than the annualized metric in the WAIRE Menu. WAIRE Point values from the WAIRE Menu can be ratioed (for any WAIRE Menu action), as demonstrated in the following example. In the WAIRE Menu, 42 Points are earned for 365 visits from a Class 8 NZE truck. If

⁷ <https://www.epa.gov/sites/production/files/2021-01/documents/420f21002.pdf>,

<https://ww3.arb.ca.gov/msprog/onroad/cert/cert.php#6>,

https://www.ngvamerica.org/vehicles/availability/?vehicle_type=heavy-duty-truck-oems

⁸ https://afdc.energy.gov/fuels/natural_gas_locations.html#/analyze?region=US-CA&fuel=LNG&fuel=CNG&lng_vehicle_class=HD&show_map=true&cng_vehicle_class=HD

⁹ <https://globaldrivetozero.org/tools/zero-emission-technology-inventory/>

¹⁰ <http://www.aqmd.gov/home/programs/business/business-detail?title=vehicle-engine-upgrades>

¹¹ Trucks that have been purchased through incentive programs can earn WAIRE Points at the same level as trucks that are not incentivized.

a warehouse operator has 1,000 Class 8 NZE truck visits during their compliance period, the number of WAIRE Points earned would be:

$$\frac{42 \text{ Points}}{365 \text{ visits}} = \frac{XX \text{ Points}}{1,000 \text{ Visits}} \rightarrow \mathbf{115.1 \text{ Points}}$$

NZE and ZE truck visits can come from the warehouse operator's own fleet or by any other third party fleet (whether contracted by the warehouse operator or not). NZE and ZE truck visit counts must be made contemporaneously with the trips and records documenting the visits must be verifiable by South Coast AQMD staff. Example methods to record these truck visits are described below.

1. Trucker check-in – Many warehouses already require some type of check-in from truck drivers when they arrive onsite. As part of that check-in process, warehouse operators could fill out a short form with the following information for every ZE or NZE truck that visits the site¹² (either themselves or through a form filled out by the truck driver):
 - a. The date and time that the truck arrived
 - b. Truck license plate number¹³ and Vehicle Identification Number (VIN)
 - c. Truck fuel type (e.g., natural gas, electric, hydrogen)
 - d. Trucking Company Name, DOT number, and contact phone number (if not owned by the warehouse operator)
 - e. If filled out by a truck driver unaffiliated with the warehouse, the driver's name and signature confirming that the above information is accurate
2. Electronic Telematics System (ETS) – ETS systems are increasingly used to track truck activity, and warehouse operators that employ these systems can use the data it collects and supplement it with truck characteristics (i.e., items b. through d. above) to determine how many NZE and ZE visits occur.
3. Security Cameras – Cameras may be used to record the trucks entering or exiting a warehouse site and document the truck license plate number (using either manual or automated tracking), and potentially other information such as fuel type, trucking company name, and DOT number. ~~Information from items (incomplete sentence)~~
4. Contractual Records – Some warehouse operators arrange for trucking services from third party fleets. Provisions within the contract requiring NZE or ZE trucks to be used (and resulting in a specified number of visits) could be used as one method of documentation. Additional documentation verifying that the NZE or ZE trucks have actually visited the warehouse must also be maintained.

ZE Yard Trucks

¹² As a point of reference, for a typical 250,000 sf warehouse that has about 42 Class 8 truck visits per day, only about 5 NZE Class 8 truck visits would be required per day on average (at a stringency of 0.0025) if this method was used to earn WAIRE Points.

¹³ The license plate number of the truck/tractor, not the trailer.

Yard trucks are utility trucks that can be classified as on-road or off-road vehicles and are typically used to move trailers and containers around a warehouse yard or to nearby locations. NZE yard trucks are not included as an option in the WAIRE Menu but may earn WAIRE Points in a Custom WAIRE Plan (further details are provided in the Custom WAIRE Plan section). WAIRE Points may be earned for the acquisition¹⁴ as well as the use of the ZE yard truck within the same compliance period. Proof of the acquisition of the ZE yard truck in the form of receipt, invoices, contract or similar documents must be kept by the warehouse operator.

Warehouse operators must keep records of the number of hours of ZE yard truck use during every compliance period for which it earns WAIRE Points. In most cases the operating hours for a yard truck can be obtained from an hour meter on the yard truck. If the yard truck does not have an hour meter installed, a warehouse operator could have one installed as a way to document the hours of operation needed to earn WAIRE Points, or the hours could be recorded through other means (like a time sheet). The hours of operation should be logged regularly either weekly or monthly to keep the records accurate and prevent errors in reporting the annual metric.

ZE Charging or Fueling Infrastructure

ZE charging or fueling infrastructure for on-road vehicles and yard trucks¹⁵ can earn WAIRE Points when installed¹⁶ and when used.¹⁷ NZE fueling infrastructure installation or use is not included as an option in the WAIRE Menu and is prohibited from earning WAIRE Points in a Custom WAIRE Plan. Warehouse operators will need to consult with warehouse owners, local utilities, and local building departments prior to installing ZE infrastructure. Warehouse facility or land owners may also voluntarily install the ZE infrastructure and earn WAIRE Points, and subsequently transfer those WAIRE Points to the warehouse operator(s) at that site. Offsite installations can earn WAIRE Points, but only through a Custom WAIRE Plan.

Electric Charging Infrastructure Installation

A long lead time may be needed to install electric charging infrastructure at some sites, and WAIRE Points may be earned for several milestones that are achieved during project completion. The table below describes the milestones and examples of the documentation needed to verify that the milestone was achieved.

Electric Charger Installation Milestone	Examples of Documentation
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¹⁴ Similar to the discussion on truck acquisitions above, existing incentive programs cannot be used to acquire ZE yard trucks, due to limitations within the incentive funding programs.

¹⁵ ZE charging/fueling infrastructure installations or usage for industrial trucks used indoors (e.g., pallet jacks or forklifts) cannot earn WAIRE Points.

¹⁶ In order to avoid potential problems of low quality workmanship and subsequent safety concerns, warehouse operators and owners earning WAIRE Points from installing ZE infrastructure are encouraged - though not required - to use a skilled and trained workforce as defined in Public Contract Code section 2601 for all construction work, and follow the Public Utilities Code section 740.20, subdivision (2) requirement that at least 25 percent of the total electricians working on an electric vehicle infrastructure project, at any given time, hold Electric Vehicle Infrastructure Training Program certification.

¹⁷ Similar to truck acquisitions, most incentive funding programs from CARB, South Coast AQMD, and the Energy Commission cannot be used to install charging infrastructure used to earn WAIRE Points. However, utility programs like Southern California Edison's Charge Ready Transport program have different requirements and do not have the same restrictions.

Acquisition of the charger(s) (also called EVSE's)	Invoices and photo/video documentation that the chargers have been delivered to the site. Records of any incentives or rebates received for the chargers or charger installation.
Initiating onsite construction	Copies of permits and photo/video documentation showing that construction was initiated.
The latter of final energization or permit sign-off for the system	Permit records and/or photo/video documentation of the system in use.

The WAIRE Menu only includes ZE charging infrastructure up to 350 kW. Chargers with higher ratings are not yet commercialized but are expected in the near future. Warehouse operators can earn WAIRE Points for these larger systems through a Custom WAIRE Plan. WAIRE Points can also be earned for installing chargers for Transportation Refrigeration Units (TRUs). As of February 2021, CARB is currently developing a new regulation that could mandate the installation and use of TRU chargers at cold storage warehouses covered by Rule 2305. In order to earn WAIRE Points for TRU charger installations, if CARB's proposed rule is adopted and goes into effect, warehouse operators would be required to either install more chargers than required by CARB's rule in any given year, or install chargers before CARB's rule requires them.

Electric Charging Infrastructure Usage

Warehouse operators earning WAIRE Points from charger usage¹⁸ for on-road vehicles and/or yard trucks are required to report total kWh dispensed from charging stations at that site. Charger usage earns WAIRE Points equally for trucks owned by a warehouse operator and for third party fleets. Individual charger kWh are not required to be recorded or reported if a single master electrical meter is dedicated to all chargers and does not serve any other electrical loads (this is a common setup in charger installations). Records documenting this electrical usage would typically include electric utility bills, but could also include photo documentation of meter readouts, or charging software system reports.

Similar to the discussion above for TRU charger installation, if CARB's proposed rule on TRU's is approved and goes into effect, WAIRE Points may only be earned for TRU charging if it exceeds requirements in CARB's rule. Records must be kept documenting how the usage goes beyond CARB requirements for any WAIRE Points earned in this situation.

Hydrogen Station Installation and Use

Hydrogen station installations are expected to occur on a faster timeline than electric charging infrastructure, and specific milestones are not included in the WAIRE Menu. WAIRE Points may be earned upon final station installation and availability for fueling. Records documenting the station installation can include permit records, invoices, and photo/video documentation of the station. The WAIRE Menu assigns 1,680 WAIRE Points for the installation of a hydrogen station capable of dispensing 700 kg/day for on-road vehicles and/or yard trucks. Similar to the

¹⁸ Warehouse operators may obtain Low Carbon Fuel Standard (LCFS) credits and/or revenue from those credits and still earn WAIRE Points for that dispensed electricity.

ratio method described in the truck visit section, stations with higher or lower throughput capacities would receive proportionally more or less WAIRE Points than listed in the WAIRE Menu.

Hydrogen station use must be reported in total kilogram dispensed during the compliance period. The station can be used for the warehouse operator's own fleet or for third party trucks. Records documenting this use should include a meter read-out and can also include invoices for delivered hydrogen, or other similar records.

Solar Panel System Installation and Use

Solar panel system installations can be installed either on the roof of the warehouse or as a carport configuration. Warehouse operators will need to consult with warehouse owners, local utilities, and local building departments prior to installing solar panel systems. Additionally, the warehouse facility or land owner may voluntarily install the solar panels and earn WAIRE Points that they can subsequently transfer to their warehouse operator(s). Proof of the installation of the solar panel system and its kilowatt (kW) rating in the form of receipt, invoices, contract, photos/videos, or similar documents should be maintained for future audits and inspections. WAIRE Points will be awarded upon the latter date of system energization or final permit sign-off.

The total energy produced by the solar system is typically recorded through software systems and may differ from reports provided by utilities. The total system energy production (measured in kilowatt-hours or kWh) is available to earn WAIRE Points, not just the net energy reported by the utility. Both the installation size and the system usage can be scaled using the ratio method described in the truck visits section.

Air Filtration Systems

Air filtration systems can be installed or air filters replaced at residences, schools, daycares, hospitals, or community centers within three miles of the warehouse in order to reduce exposure to particulate matter.¹⁹ The minimum type of filters that can be installed or replaced are minimum efficiency reporting value (MERV) 16 or greater efficiency. Records documenting the number of systems installed or filters replaced could include invoices, contracts, photos/videos of installed systems, or similar documents. The documentation must include proof that the systems were actually installed, and not just purchased. Earning WAIRE Points with this approach will therefore require coordination with, and voluntary cooperation from other entities. Air filtration system installations and filter replacements can be scaled using the ratio method described in the truck visits section.

¹⁹ Example systems are described here:

<http://www.aqmd.gov/docs/default-source/ceqa/handbook/aqmdpilotstudyfinalreport.pdf>

CUSTOM WAIRE PLANS

Rule 2305 provides the option of proposing a Custom WAIRE Plan for actions that are not on the WAIRE Menu. WAIRE Points can only be earned upon approval of the Custom WAIRE Plan, any action or investments made prior to the approval of the Custom WAIRE Plan will not be considered for WAIRE Points. The process for applying for a Custom WAIRE Plan is shown in Figure 3 below. Custom WAIRE Plan Applications must be submitted through the WAIRE POP system, or as otherwise directed by South Coast AQMD, along with the applicable fee in Rule 316.

Some examples of potential Custom WAIRE Plan proposals include jointly owned off-site ZE charging or fueling infrastructure, the use of battery storage systems or energy management that reduces emissions from local natural gas fired powerplants, and the acquisition and/or usage of NZE yard trucks. A Custom WAIRE Plan allows for local hire to be counted as points towards compliance with the rule by reducing employee commute emissions. Use of a local state certified apprenticeship program or a skilled and trained workforce with a local hire component can help demonstrate those emission reductions. NZE yard trucks may be submitted as a Custom WAIRE Plan for consideration but only if they only utilize renewable fuels such as renewable natural gas (RNG), renewable propane, or other equivalents.²⁰ The section below provides an example of a Custom WAIRE Plan calculation methodology to earn WAIRE Points for NZE yard trucks.

NZE Yard Truck WAIRE Points Calculation Example

The acquisition and/or use of NZE yard trucks may be proposed as a Custom WAIRE Plan if the NZE yard truck's engine meets CARB's lowest Optional Low NOx standard (currently 0.02 g/hp-hr) applicable at the time of engine manufacture and is fueled with renewable fuels. The expected WAIRE Points for NZE yard trucks in a Custom WAIRE Plan are shown below, following the same methods as is described for ZE yard truck acquisition and usage in Appendix B – WAIRE Menu Technical Report.²¹

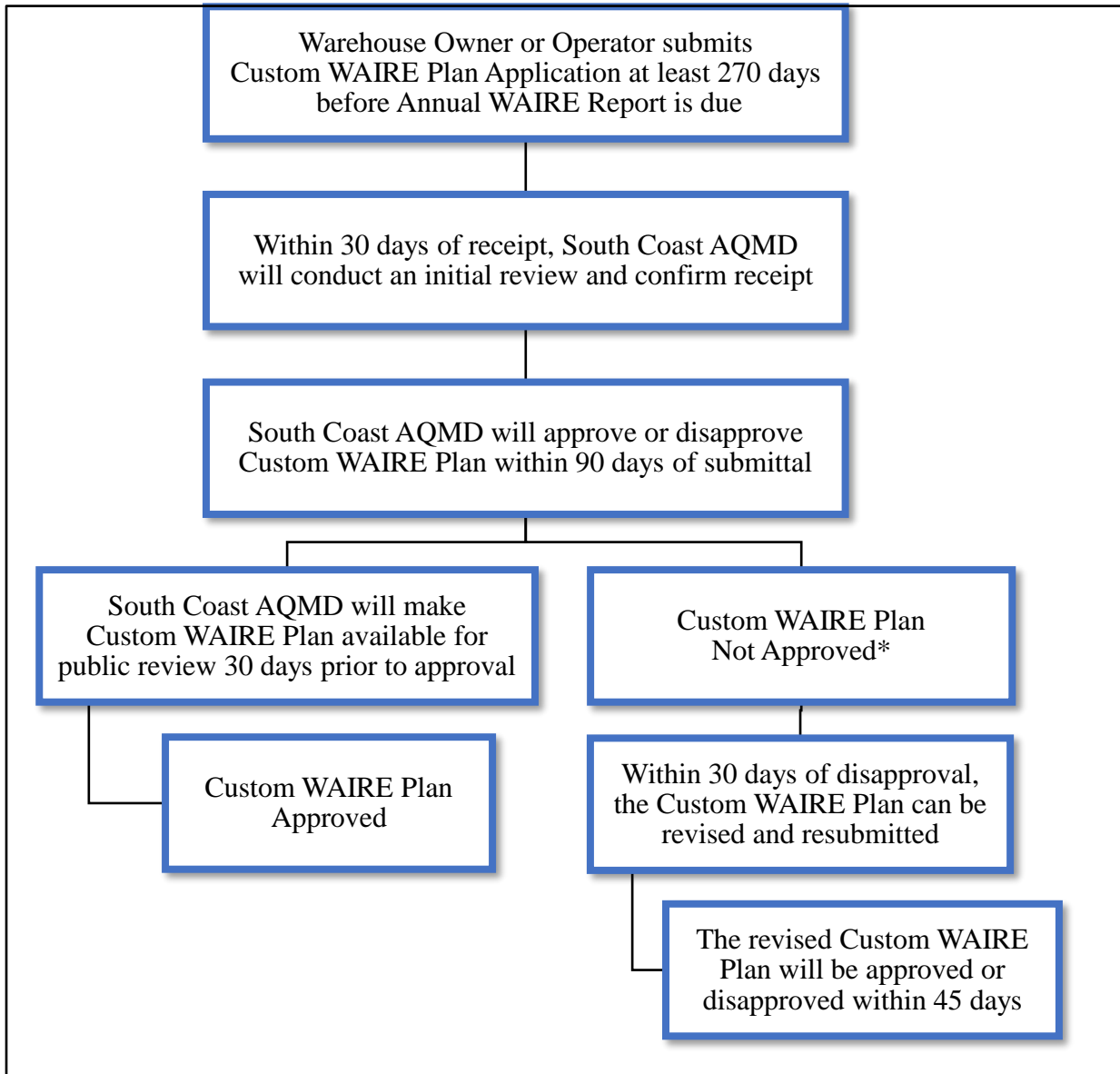
Acquire One NZE Yard Truck = 42 WAIRE Points

Use One NZE Yard Truck for 1,000 hrs in a year = 288 WAIRE Points

²⁰ Renewable fuels include any non-fossil fuel whose carbon intensity is lower than the applicable standard for that year as determined through CARB's Low Carbon Fuel Standards program.

²¹ The following key assumptions are used here: \$50,000 incremental acquisition cost relative to diesel counterpart, \$2,250 incremental annual usage cost relative to diesel (<https://cleanairactionplan.org/documents/final-cargo-handling-equipment-che-feasibility-assessment.pdf/>), 90% of the NOx emissions benefit as a ZE yard truck, and 100% of the Diesel PM benefit of a ZE yard truck.

Figure 3 – Custom WAIRE Plan Application Process



** A disapproval will identify the deficiencies in the application that must be revised before approval can be considered. Applications that have not been explicitly approved within the review period are presumed to be disapproved.*

Custom WAIRE Plan actions must meet similar criteria to the analysis conducted for the actions and investments included in the WAIRE Menu. Custom WAIRE Plan Applications must include the following elements:

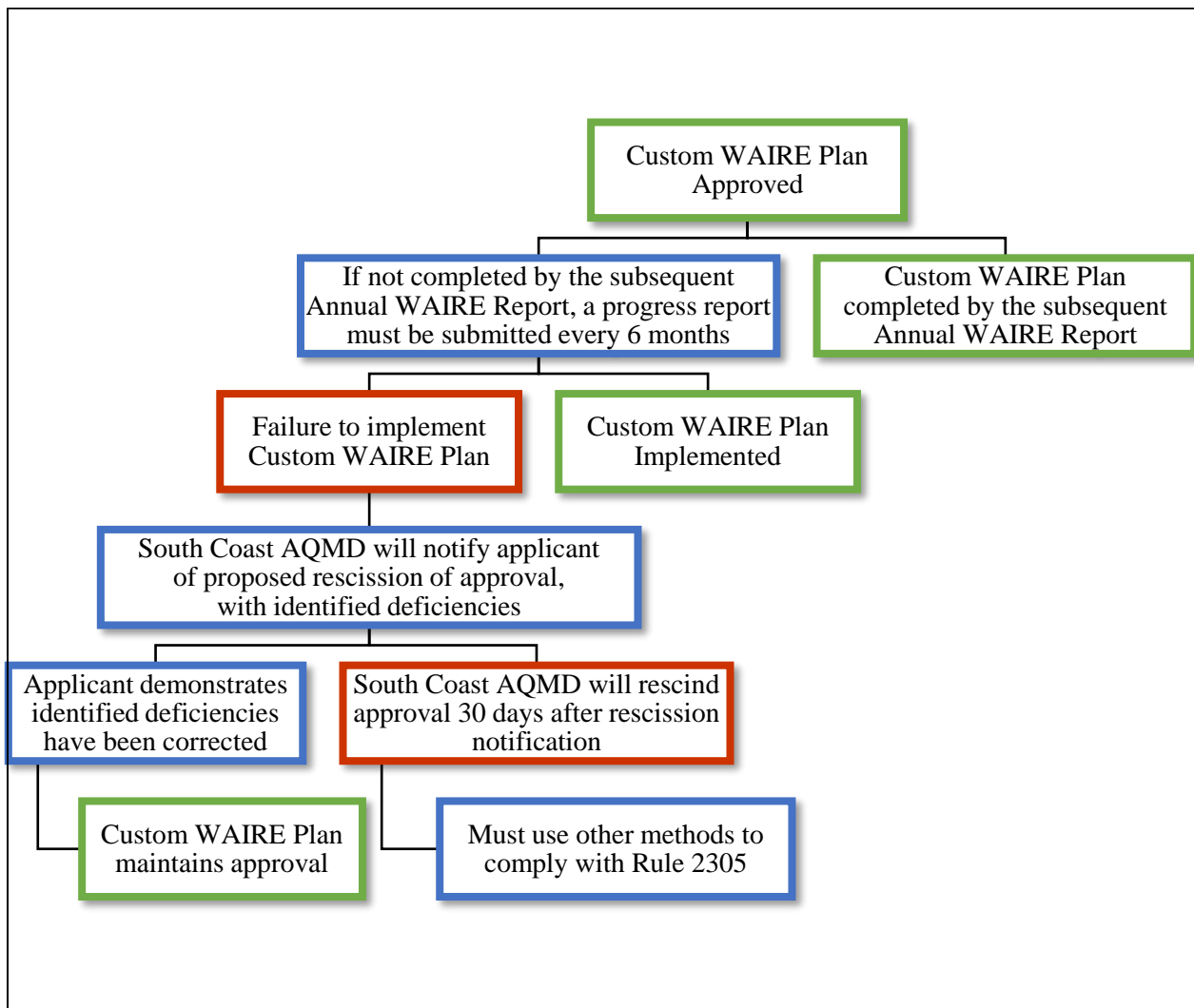
- A demonstration how the proposed action will earn WAIRE Points based on the incremental cost of the action, the NO_x emission reductions from the action, and the DPM emission reductions from the action, relative to baseline conditions if the warehouse operator had not completed the action in that compliance period,
 - Baseline conditions should be calculated using the latest emissions estimation methodologies, such as those used in the most recently approved Air Quality Management Plan. The calculation of WAIRE Points from actions in a Custom WAIRE Plan should be consistent with the calculation methodologies included in the WAIRE Menu Technical Report included as Appendix B to the Rule 2305 Staff Report. Emission reductions that go beyond baseline conditions must consider the effect of existing regulations that phase in through time, if applicable.
- A demonstration how WAIRE Points earned from the Custom WAIRE Plan for emission reductions are quantifiable, verifiable, and real,
- A description of how the proposed actions will achieve quantifiable, verifiable, and real NO_x and DPM emission reductions as quickly as feasible, but no later than three years after plan approval,
 - All Custom WAIRE Plans must result in emission reductions, or directly facilitate emission reductions. Examples of facilitating projects could include installation of ZE charging infrastructure at an offsite location or acquisition of ZE TRUs that go beyond CARB requirements.
- A quantification of expected NO_x and/or DPM emission reductions from the proposed actions within the South Coast AQMD and within three miles of the warehouse,
 - All Custom WAIRE Plan projects, including facilitating projects, must result in verifiable NO_x and/or DPM emission reductions within three miles of the warehouse.
- A description of the method to be used to verify that the proposed actions will achieve NO_x and/or DPM emission reductions,
 - Example methods documenting how the effectiveness of an action can be verified are included in these Guidelines for WAIRE Menu items.
- A schedule of key milestones showing the increments of progress to complete the proposed actions,
- A description of the location and a map of where the proposed actions will occur,
- Any expected permits or approvals required by other private parties, or South Coast AQMD, or other federal, state, or local government agencies to implement the Custom WAIRE Plan

Custom WAIRE Plan Milestones

The timetable of an approved Custom WAIRE Plan application allows for at least six months to implement the custom WAIRE Plan project (or three and a half months if the application was disapproved, resubmitted, and then approved). Some projects may take longer to implement and could extend beyond the compliance period when the Custom WAIRE Plan application was submitted. In these cases, a progress report must be submitted every six months after the Custom

WAIRE Plan was approved. In the event milestones are not reached, the progress report must explain the conditions that resulted in the milestone not being reached and propose a new milestone date. If in reviewing the progress report, South Coast AQMD staff determines that progress on the approved Custom WAIRE Plan is not adequate, a notice may be sent to the Custom WAIRE Plan applicant advising of the inadequate progress. The Custom WAIRE Plan approval may be rescinded 30 days after the notice if the applicant does not demonstrate how the identified deficiencies have been corrected. Figure 4 shows the Custom WAIRE Plan implementation process.

Figure 4 – Custom WAIRE Plan Implementation



WAIRE MITIGATION FEE

Warehouse operators may earn WAIRE Points by paying a mitigation fee at \$1,000 per WAIRE Point, but any of the other methods that can earn WAIRE Points (i.e., the WAIRE Menu, Custom Plans, transferring) can be used to fully satisfy a warehouse operator's WPCO so that no mitigation fees are paid. There is also an additional 6.25% administration fee charged on top of any mitigation fees paid to cover South Coast AQMD's costs of administering the WAIRE Mitigation Program. Mitigation fees and accompanying administrative fees must be submitted through the WAIRE POP system with the AWR. Payments less than \$300,000 can be made by e-check or credit card. Payments larger than this must be mailed to South Coast AQMD or submitted in person.

The WAIRE Mitigation Fee Program is expected to provide incentives toward the purchase of NZE and ZE trucks and ZE charging and fueling infrastructure. Warehouse operators may apply for the WAIRE Mitigation Fee Program funds. However, similar to other funding programs, the incentivized vehicle or equipment may not earn WAIRE Points for its acquisition, only for its subsequent use. Further, any ZE charging or fueling infrastructure funded by the WAIRE Mitigation Program must be publicly accessible and cannot solely be for the use of the operator's private fleet.

Projects funded by the WAIRE Mitigation Program will be approved annually or more often by the South Coast AQMD Governing Board and will follow the policies described in the Board Resolution that accompanies Rule 2305 as well as subsequent requirements set out by the Board (e.g., in future solicitations).²²

WAIRE POINTS TRANSFERS

WAIRE Points can only be transferred under limited situations, and only WAIRE Points in excess of the warehouse operator's WPCO may be transferred. The following are the three sole instances when WAIRE Points may be transferred or banked:

1. Excess WAIRE Points transferred to a warehouse operator's other warehouses:
If a warehouse operator conducts warehousing activities at more than one warehouse during any single compliance period, then WAIRE Points earned for one warehouse may be used at the other warehouse(s) under the operational control of that same warehouse operator. Only those points earned in excess of a warehouse operator's WPCO at that site may be transferred, and only for the current compliance period. Any WAIRE Points transferred to a different warehouse shall be discounted as shown in the rightmost column in the WAIRE Menu in Table 3 of Rule 2305.
2. WAIRE Points transferred between a warehouse owner and operator:
A warehouse facility or land owner may voluntarily earn WAIRE Points during a compliance Period using the WAIRE Menu, a Custom WAIRE Plan, by paying a mitigation fee, or may have WAIRE Points transferred to them from the warehouse operator at that site. The warehouse facility or land owner may then transfer these WAIRE Points to any warehouse operator at the site where the WAIRE Points were earned within a three-year period after the points were originally earned. Any warehouse operator using these transferred WAIRE Points to satisfy a

²²<http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2021/2021-May7-027.pdf?sfvrsn=10#page=16>

WPCO during this three-year period must demonstrate that any onsite improvements or equipment installations that were used to earn the WAIRE Points being transferred are still operational at that warehouse facility in the year that WAIRE Points are used.

- a. Warehouse operators that vacate a warehouse before the end of a compliance period may transfer any excess WAIRE Points to the warehouse owner. These Points may then be transferred to the next warehouse operator.
3. Excess WAIRE Points banked for future use at that site:
WAIRE Points in excess of the warehouse operator's WPCO in one compliance period may be banked for use in any of the next three compliance periods. After this time, any remaining banked WAIRE Points will expire and can no longer be used. WAIRE Points banked for future use in this way cannot be transferred to another warehouse. WAIRE Points may not be transferred to a subsequent compliance period if the WAIRE Menu items used to earn WAIRE Points are required by U.S. EPA, CARB, or South Coast AQMD rules and regulations in that subsequent year. An example could include CARB's anticipated TRU rule that could require charging infrastructure at a future date. Installations earlier than CARB requirements could earn Points and be banked for future years. However, the banked Points can no longer be used in any year in which CARB requires those chargers to be installed. Further, if any onsite improvements or equipment installations that were used to originally earn the WAIRE Points are no longer functional, the banked WAIRE Points may not be used to satisfy a WPCO. Finally, if WAIRE Points are earned prior to a warehouse operator's first compliance period, the three-year clock on banked WAIRE Points does not begin until after their first compliance period.
In order to use banked WAIRE Points, the WAIRE Menu item that generated the WAIRE Points must still be onsite and was used for the compliance period that the WAIRE Points are to be used to comply with the WPCO. ~~(Incomplete sentence) For Phase 2 and 3, t~~There is an early action provision that allows for earning WAIRE Points ahead of their initial compliance period, and include a provision for the clock on three year life of the WAIRE Points for those early action WAIRE Points to not begin until after the initial compliance period.

It is the responsibility of the warehouse operator who uses transferred or banked WAIRE Points to keep records documenting how and when the WAIRE Points were originally earned. If WAIRE Points are transferred between the warehouse owner and operator, both entities must keep records documenting the agreement to transfer the WAIRE Points. To avoid any potential disputes, the agreement should be signed by authorized officials for both entities.

EXEMPTIONS

Warehouse operators may be exempt from parts of Rule 2305 in three limited instances. First, warehouse operators who can only use less than 50,000 sq. ft. of a warehouse for warehousing activities are not required to earn any WAIRE Points. However, if the warehouse operator has the same parent company as another warehouse operator in the same building, and collectively they may use more than 50,000 sq. ft., then the exemption does not apply.

Second, warehouse operators with a calculated WPCO <10 are not required to earn any WAIRE Points but will still need to submit required reporting. This exemption is in place to reduce the burden on small warehouse operations with only a small volume of truck trips to their warehouse.

Third, there may be rare instances when a warehouse operator invests in new technology to comply with Rule 2305. If that equipment malfunctions through no fault of the operator, then they may apply for an exemption from the portion of their WPCO for which that action applies. An example could include a warehouse operator who purchases a ZE or NZE truck that experiences a significant manufacturer's defect that renders the truck inoperable for an extended period of time. Applications for this exemption should be submitted to waire-program@aqmd.gov. Applications should include a description of the investment that has the defect, relevant details about the defect, and the number of WAIRE Points anticipated during the current compliance period from that investment for which the operator is seeking an exemption. The warehouse operator's WPCO should not be assumed to be reduced unless South Coast AQMD staff submits an approval of the exemption in writing or email. The application will be reviewed based on evidence provided by the applicant that the vehicle or equipment had defects caused by the manufacturer of the vehicle or equipment, or a defect in the installation of equipment following manufacturer-approved methods. Further, the applicant must demonstrate that they made a good faith effort to have the equipment or vehicle repaired but was unable to do so or do so in a timely manner.

COMPLIANCE PROGRAM

South Coast AQMD will periodically conduct both desktop and field audits for compliance with the WAIRE Program. The South Coast AQMD staff may contact warehouse owners and operators to request further documentation or clarification on submitted WAIRE Program reports. Additionally, South Coast AQMD inspectors may conduct field visits of the warehouse facilities. South Coast AQMD inspections are generally unannounced, and a South Coast AQMD inspector may visit a warehouse facility any time during regular business hours to verify a facility is following recordkeeping requirements and other applicable requirements. Upon arrival, the South Coast AQMD inspector will present proper South Coast AQMD identification and inform a facility representative of the purpose and scope of the inspection. Most inspections are conducted to verify the information submitted on the required WAIRE Program reports. An inspector may also request a tour of the facility to verify the onsite presence of any equipment related to WAIRE Program compliance. It is helpful if a facility representative familiar with the WAIRE Program assist with the inspection, and that an organized collection of the WAIRE Program related documents be readily available either as a hardcopy or digitally.

Some of the records that a South Coast AQMD inspector could inquire about include:

- Current contact information of warehouse operator
- Truck trip count records
- WPCO calculation and plans to earn WAIRE Points
- Copy of Initial Site Information Report
- Copies Annual WAIRE Report(s)
- Copy of any approved Custom WAIRE Plan(s)
- Fleet data (invoices, vehicle registration, model year, fuel type, license plate numbers)
- Information about any onsite energy generation equipment
- Information about any onsite alternative fueling station(s)
- Information about any onsite yard truck(s)
- Information on any air filter systems or filters installed or replaced for the surrounding community

- Copies of exemption documentation
- Copies of lease agreement

If South Coast AQMD staff identify a discrepancy in the warehouse operator's WAIRE Program reporting such as an issue with the truck trip counts, the reporting metrics submitted, or similar differences, the South Coast AQMD inspector will discuss the issue(s) with the warehouse operator to determine the cause of the issue(s) or require further documentation and enforcement action may be taken. For example, if the warehouse operator submits in the Annual WAIRE Report that there were 100 ZE tractor visits for the compliance period, and if after verifying the 100 tractor VINs the South Coast AQMD staff determines that only 50 of the truck visits were actually ZE tractors, more detail on the truck visits may be required or a further review of the method for accounting for ZE trucks would be needed. If sufficient proof cannot be provided to support the 100 ZE tractor visits reported, then the warehouse operator may need to obtain more WAIRE Points to satisfy their WPCO. Frequently updating and tabulating reporting metrics would limit discrepancies and provide more documentation to support submitted WAIRE Program reports.

APPENDIX A

WAIRE PROGRAM ONLINE PORTAL GUIDANCE

- Under Development -

APPENDIX B

WAIRE MENU TECHNICAL REPORT

OVERVIEW

This technical report describes the methodology used to determine how WAIRE Points are attributed to each of the actions on the WAIRE Menu provided in Rule 2305. Section 1 of this report presents an overview of how the Points are determined within the Menu, while all subsequent sections presents detailed methodologies for each Menu item.

SECTION 1) WAIRE Points Calculation Methodology

This section describes the general methodology used to determine how WAIRE Points are attributed to each of the actions on the WAIRE Menu. While this methodology is used to determine the value of each WAIRE Menu action during the rulemaking process, warehouse operators and/or owners will not need to use this calculation methodology document to determine how to comply with the rule. For compliance, warehouse operators (and in some cases owners if they choose to comply on behalf of their operator) will only need to consult the WAIRE Menu itself to determine how many actions, or how much of each action to complete for compliance.

WAIRE Points may be earned in two ways, through the purchase of near-zero (NZE) and zero emission (ZE) equipment or equipment that facilitates its use, and through the usage of NZE and ZE equipment. WAIRE Points are assigned based on three key parameters, cost, regional emissions reductions, and local emissions reduction. The cost parameter is based on the incrementally higher cost a warehouse operator faces when choosing to purchase NZE/ZE equipment (compared to conventional diesel technology). The regional emissions reduction parameter is based on the reduction in nitrogen oxides (NOx) emissions from using ZE/NZE equipment. The local emissions reduction parameter is based on the reduction in Diesel Particulate Matter (DPM)¹ from using ZE/NZE equipment.

In practice, the actual costs and emission reductions of each implemented action will likely vary for each warehouse operator. Calculating these unique values on a case-by-case basis would impose a considerable administrative burden to both the regulated community and to South Coast AQMD. In order to simplify compliance and administration of Rule 2305, WAIRE Points for each Menu action are determined using representative default values described in the calculation methodology summaries that follow.

Section 1a) WAIRE MENU ANNUALIZED UNITARY METRICS AND BINS

WAIRE Points values in the WAIRE Menu are determined for each action based on a single Annualized Unitary Metric (AUM). The AUM is the default level of implementation used for calculating each WAIRE Menu action's Points. For example, the AUM for the truck acquisition WAIRE Menu action is one truck acquired during the compliance year. The cost and regional and local emissions reductions are calculated for acquiring one truck and used to determine the

¹ DPM is both a component of the criteria pollutants PM10 and PM2.5, and a toxic air contaminant. Emissions of DPM from warehouse indirect sources can contribute to high-level, localized pollutant concentrations that can significantly affect air quality and public health for populations near warehouses.

default WAIRE Point value for that Menu action. Warehouse operators use these default Point values in the WAIRE Menu to determine how many Points they earned in total depending on their level of implementation. For example, the default Point value in the Menu for acquiring one ZE class 8 truck is 126 Points. If a warehouse operator acquired five ZE trucks, they would earn a total of 630 Points (126 Points for each truck acquisition). Similarly, for ZE class 8 truck visits, the AUM of 365 visits per year (one per day on average) yields 27 Points in the WAIRE Menu. If a warehouse operator only has 100 ZE class 8 truck visits during a compliance year, they would earn a total of 7.4 Points² $[(100 \div 365) \times 27 = 7.4]$. The AUM's for each WAIRE Menu action are described in the individual calculation methodology summaries that follow.

WAIRE Points are also calculated using a point binning system to simplify the merging of the cost, regional emission reduction, and local emissions reduction parameters. For the AUM, Points are earned for each \$25,000 incremental cost, 25-pound NO_x regional emission reduction, and 0.25-pound DPM local emission reduction. Once these three parameters are calculated, their binned points are summed to yield the total default WAIRE Points earned for that action.

Section 1b) COSTS:

The costs for each WAIRE Menu action are based on the annualized incremental costs difference between the new ZE/NZE technology and the costs of the conventional diesel equivalent. Due to existing statutory or regulatory prohibitions, most state incentive funding programs used to offset the higher purchase price of ZE/NZE vehicles and equipment cannot be used to aid in complying with state or federal law or South Coast AQMD rules or regulations³, and incentive funds are not considered in these costs. However, WAIRE Points may be earned from the usage of incentivized vehicles/equipment. For example, if a warehouse operator owns a fleet of trucks, and they want to purchase a ZE or NZE truck, they will need to decide among two options. First, they could purchase the truck at full price and receive WAIRE Points for that action. Second, they could instead choose to receive incentive funding for that purchase but not earn any WAIRE Points for the truck purchase. In both instances, they would be allowed to receive WAIRE Points for the visits that this truck makes to their warehouse.

² WAIRE Points are calculated to no more than one decimal place.

³ California Health and Safety Codes 44281(b), 44391.4(a), 44271(c), CCR Title 13, Ch. 8.2 Sec. 2353 (c)(4), Moyer Guidelines Ch. 2, CA Beneficiary Mitigation Plan

Section 1c) REGIONAL EMISSION REDUCTIONS:

Regional emission reductions are calculated in two ways. First, NOx reductions are calculated from using ZE/NZE vehicles and equipment for activities associated with the warehouse. Second, regional NOx emission reduction Points are calculated for WAIRE Menu items affiliated with the acquisition of ZE/NZE vehicles/equipment at a rate of \$100,000 per ton of NOx. This is the cost effectiveness threshold that South Coast AQMD utilizes in its Carl Moyer incentive funding program. These regional emission reduction Points are assigned to these acquisition Menu items because if a facility chose to pay that level of funding as a mitigation fee, South Coast AQMD would likely spend the funds using the same cost effectiveness threshold.

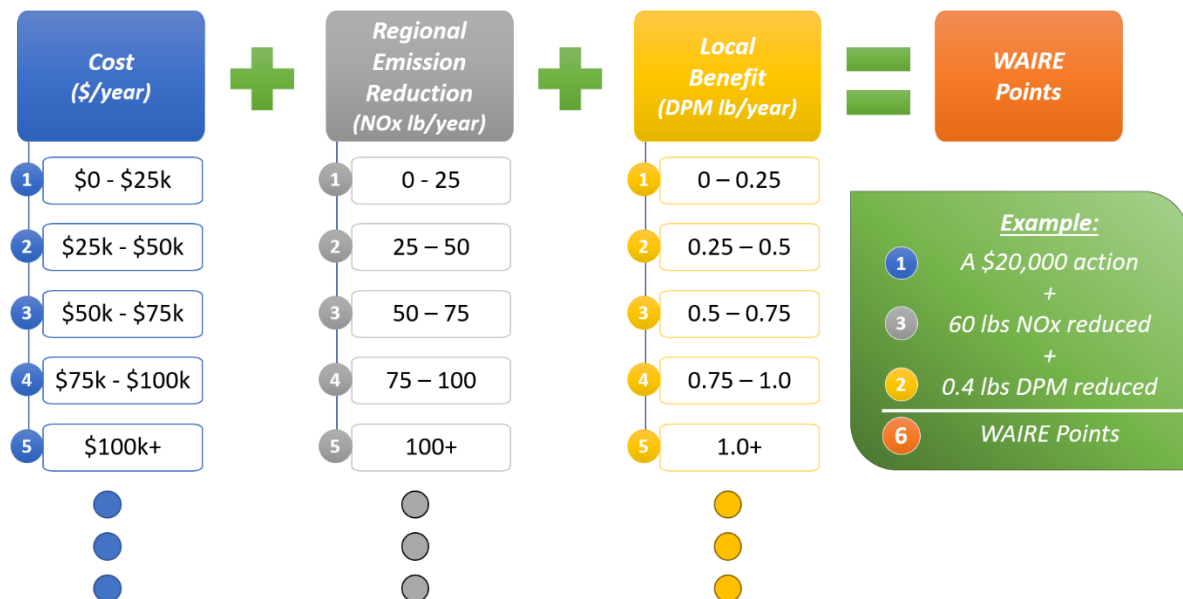
Section 1d) LOCAL EMISSION REDUCTIONS:

Local emission reductions are calculated in a similar manner as regional emission reductions, except that Diesel Particulate Matter (DPM) is used instead of NOx.

Section 1e) EXAMPLE:

Figure 1, below, presents one example of how the calculation methods discussed above would yield the total WAIRE Points earned. In this example, an AUM would cost \$20,000 and result in a 60 lbs/year NOx reduction, and a 0.4 lbs/year DPM reduction. Combining the three together would result in a total of 6 WAIRE Points. Specific calculations for each WAIRE Menu action are included in the following sections.

Figure 1: WAIRE Points Calculation



SECTION 2) Zero and Near-Zero Emission Truck Visits and Truck Acquisitions

Description: Two key factors affect the analysis of ZE and NZE trucks – the definitions of ZE and NZE, and the truck class. In the context of Rule 2305, the definition of a ZE truck is the same as CARB’s Advanced Clean Trucks Regulation definition. At the time of this writing, CARB’s draft definition for ZE truck is one “*with a drivetrain that produces zero exhaust emission of any criteria pollutant (or precursor pollutant) or greenhouse gas under any possible operational modes or conditions.*” For Rule 2305 a NZE truck is one in which the engine meets CARB’s lowest Optional Low NOx standard at the time of manufacture, which is currently 0.02 g/hp-hr NOx.

In addition to drivetrain technology, trucks are commonly classified based on their Gross Vehicle Weight Rating (GVWR). Throughout this document Class 2b-7 refers to heavy duty trucks with GVWR of 8,501 – 33,000 lbs and Class 8 trucks with GVWR of greater than 33,000 lbs. Table 1 below presents truck classifications.

Table 1. Truck Classes

Truck Class	GVWR (lbs)
Class 2b	8,501 – 10,000
Class 3	10,001 – 14,000
Class 4	14,001 – 16,000
Class 5	16,001 – 19,500
Class 6	19,501 – 26,000
Class 7	26,001 – 33,000
Class 8	33,001 & over

Commercial Availability: The ZE truck market is beginning to grow rapidly with many models entering the commercial market today and many major manufacturers announcing plans for future commercialization of battery-electric and hydrogen fuel cell electric trucks.⁴ Some notable manufacturer announcements include: Daimler Class 8 eCascadia, Navistar battery-electric Class 8, Volvo battery-electric VNR Class 8, Tesla’s long range battery-electric tractor, BYD’s battery-electric Class 6 and 8, Nikola’s and Kenworth (in conjunction with Toyota) hydrogen fuel cell tractors, Sea Electric Class 4-8 battery-electric trucks, Lion Electric’s Class 6-8 battery-electric trucks, Amazon’s order of 100,000 Rivian’s battery electric trucks, etc. NZE engines are currently available in two sizes – 11.9 liter and 8.9 liter. Major truck manufacturers offer these engines in different truck classes, including for class 8 regional haul and/or drayage truck operations.

Operation: Trucks that visit warehouses may be owned by the warehouse operator, or by a motor carrier not affiliated with that warehouse. Arrangements for truck visits to the site to

⁴ A useful reference is the online ZETI tool. <https://globaldrivetozero.org/tools/zero-emission-technology-inventory/>

deliver or pick up goods is typically made by the owner of the goods, or someone acting on their behalf. As such, each individual truck visiting a warehouse can have a unique operating profile that may not be shared by any other truck visiting that site. One truck may travel 30 miles on the inbound trip, and only two miles on the outbound trip. Another truck may be loaded with goods from multiple warehouses or stores, and determining what portion of a trip to attribute to each warehouse would be impractical. Finally, trucks may idle their engines for short periods while at the warehouse before or after the trailer is dropped off/picked up. For the emissions and cost analyses presented below, input parameters are meant to be broadly applicable and may not reflect any one individual truck trip or truck acquisition.

SECTION 2a) ZE/NZE Truck Acquisitions⁵

ZE/NZE Truck Purchase Prices: Several key references were consulted to estimate incremental purchase prices for NZE and ZE trucks relative to conventional diesel trucks including: CARB's Advanced Clean Truck Regulation (ACT), Standardized Regulatory Impact Assessment (SRIA)⁶ and Total Cost of Ownership Discussion Documents⁷, California Energy Commission's Revised Transportation Demand Forecast⁸, the Ports' Feasibility Study⁹, ICF's Intensive Literature Review for Medium and Heavy-Duty Electrification in California¹⁰, NACFE's TCO Calculator¹¹, as well as data from South Coast AQMD's Carl Moyer Grant Program and CARB's HVIP program. While cost estimates vary somewhat among these references, the single point estimates shown in Table 2 below are consistent with these previous analyses.

Table 2. Incremental Costs for NZE and ZE Truck Purchases

WAIRE Menu Item		Annualized Unitary Metric	Incremental Cost (\$/metric)
Class 8 Truck	NZE	1 truck purchased	\$65,000
Class 4-7 Truck			\$30,000
Class 8 Truck	ZE		\$150,000

⁵ WAIRE Points can be earned from either truck purchases or truck leases. Points are calculated assuming trucks are purchased.

⁶ <https://ww3.arb.ca.gov/regact/2019/act2019/appc.pdf>

⁷ <https://ww3.arb.ca.gov/regact/2019/act2019/apph.pdf>

⁸ <https://efiling.energy.ca.gov/GetDocument.aspx?tn=230885&DocumentContentId=62525>

⁹ <https://cleanairactionplan.org/documents/final-drayage-truck-feasibility-assessment.pdf/>

¹⁰ https://caletc.com/wp-content/uploads/2019/01/Literature-Review_Final_December_2018.pdf

¹¹ <https://nacfe.org/future-technology/medium-duty-electric-trucks-cost-of-ownership/>

Class 4-7 Truck		\$80,000
Class 2b-3 Truck		\$16,000

WAIRE Points for ZE/NZE Truck Acquisitions: Acquisition of NZE Class 8 and Class 4-7 trucks earns 3 and 2 WAIRE Points, respectively. Similarly, the acquisition of ZE Class 8, Class 4-7, and Class 2b-3 trucks earns 6, 4, and 1 WAIRE Points, respectively. In addition, using a cost-effectiveness of \$100,000 per ton of NOx, WAIRE Points for regional emission reductions for Class 8 and 4-7 NZE truck acquisitions are 52 and 24 WAIRE Points, respectively. For ZE truck acquisitions, Class 8, 4-7, and 2b-3 earns 120, 64, and 13 WAIRE Points, respectively.

SECTION 2b) Truck Visits

Regional and Local Emission Reductions from ZE/NZE Truck Visits: Key parameters that can affect the emissions estimate from any one individual trip include: trip length, truck class, vehicle powertrain, and vehicle speed. Collecting all the necessary information to calculate precise emissions estimates for each trip is not feasible as it would require 1) instrumenting all trucks with telematics systems that report uniform data, 2) requiring detailed information reporting about truck loads (e.g., how much of the goods in each truck trailer is being transported to each location), and 3) conducting substantial data analysis to determine the emissions associated with each truck trip. Because of these challenges, various models are used to estimate emissions from trucking activity. In particular, CARB's EMFAC model and SCAG's Heavy-Duty Truck Regional Travel Demand model provide emissions estimates in the South Coast AQMD.

EMFAC2017 provides activity and emission rates for on-road vehicles that operate within California. EMFAC categories¹² and their relationship to truck class are shown in Table 3 below. EMFAC categorizes all truck types that are on the road, however the analysis presented here is limited to those categories that are most likely to deliver goods to and from warehouses.

Table 3. EMFAC Truck Categories

EMFAC Category	Description	Truck Class
LHD1 - DSL	Light-Heavy-Duty Trucks (GVWR 8,501-10,000 lbs)	Class 2b-3
LHD1 - GAS		
LHD2 - DSL	Light-Heavy-Duty Trucks (GVWR 8,501-10,000 lbs)	
LHD2 - GAS		
T6 CAIRP Small	Light-Heavy-Duty Trucks (GVWR 10,001-14,000 lbs)	Class 4-6
T6 Instate Small	Medium-Heavy Duty Diesel Instate Truck with GVWR≤26,000 lbs	
T6 OOS Small	Medium-Heavy Duty Diesel Out-of-State Truck with GVWR≤26,000 lbs	
T6 CAIRP Heavy	Medium-Heavy Duty Diesel CA International Registration Plan Truck with GVWR>26,000 lbs	Class 7
T6 Instate Heavy		

¹² <https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf> (Table 6.1-1)

T6 OOS Heavy	Medium-Heavy Duty Diesel Out-of-State Truck with GVWR>26,000 lbs	Class 8
T7 CAIRP	Heavy-Heavy Duty Diesel CA International Registration Plan Truck with GVWR>33,000 lbs	
T7 NNOOS	Heavy-Heavy Duty Diesel Non-Neighboring Out-of-State Truck with GVWR>33,000 lbs	
T7 NOOS	Heavy-Heavy Duty Diesel Neighboring Out-of-State Truck with GVWR>33,000 lbs	
T7 POLA	Heavy-Heavy Duty Diesel Drayage Truck in South Coast with GVWR>33,000 lbs	
T7 Tractor	Heavy-Heavy Duty Diesel Tractor Truck with GVWR>33,000 lbs	

Baseline weighted averages of NOx and PM10 emission rates¹³ for calendar year 2023 for running exhaust (RUNEX), exhaust from engine startups (STREX), and idling exhaust (IDLEX) of the above-mentioned truck categories are presented below.

Table 4. Weighted average emission rates (g/mi for RUNEX, g/trip for STREX, g/vehicle/day for IDLEX)

Truck Class	NOx			DPM			Mile/trip ¹⁴	Trip/day/truck ¹⁵
	RUNEX	IDLEX	STREX	RUNEX	IDLEX	STREX		
Class 2b-3	0.727	0.888	0.290	0.008	0.013	0	15.3	1.3
Class 4-7	1.079	2.855	2.117	0.007	0.001	0	14.2	5.9
Class 8	2.372	76.203	2.028	0.020	0.027	0	39.9	5.2

13 VMT-weighted, population-weighted and number of starts-weighted averages were computed to equalize the frequency of the values for RUNEX, IDLEX and STREX emission rates, respectively, in the data set by multiplication of each truck category emission rates to its corresponding VMT, population or number of starts and then dividing by the sum of total VMT, population or number of starts.

14 SCAG 2016 RTP mileage rates for medium-heavy (Class 4-7) and heavy-heavy trucks (Class 8)

15 Truck populations from EMFAC and trips/day from SCAG 2016 RTP. A trip is a one-way trip, while a ‘visit’ to a warehouse includes the incoming trip and the outgoing trip.

The regional and local emission reductions achieved by switching to ZE trucks relative to baseline emissions are calculated using Equation 1 below. While regional emission reductions from switching to NZE trucks is assumed to equal 90% of the reduction compared to ZE trucks, local emission reductions are assumed to be the same between ZE and NZE as NZE trucks are fueled by natural gas and do not emit DPM.

Equation [1]:

$$\begin{aligned}
 & \text{Emission Reduction } \left(\frac{\text{lb}}{\text{trip}} \right) \\
 &= \left[\left(\text{RUNEX} \left(\frac{\text{g}}{\text{mi}} \right) \times \frac{\text{mi}}{\text{trip}} \right) + \left(\text{STREX} \left(\frac{\text{g}}{\text{trip}} \right) \right) + \left(\frac{\text{IDLEX} \left(\frac{\text{g}}{\text{day.truck}} \right)}{\frac{\text{trip}}{\text{day.truck}}} \right) \right] \\
 &\times \frac{1 \text{ lb}}{453.592 \text{ g}}
 \end{aligned}$$

Results of the calculation for the two truck class categories are presented in Table 5 below.

Table 5. NOx and DPM emission reductions for a single truck trip

Truck Class	ZE Truck		NZE Truck	
	NOx lb/trip	DPM lb/trip	NOx lb/trip	DPM lb/trip
Class 2b-3	0.027	0.0003	N/A	N/A
Class 4-7	0.040	0.0002	0.036	0.0002
Class 8	0.247	0.002	0.222	0.002

Table 6 below illustrates the method used in determining point values based on regional and local emissions reductions using results in Table 5.

Table 6. NOx and DPM emission reductions for the Annualized Unitary Metric

WAIRE Menu Item		Annualized Unitary Metric (AUM)	Annualized Regional Emission Reductions (lb NOx/AUM)	Annualized Local Emission Reductions (lb DPM/AUM)
Class 8 Truck	NZE	365 truck visits	$0.9 \times 180.3 = 162.3$	1.3
Class 4-7 Truck			$0.9 \times 29.2 = 26.3$	0.1
Class 8 Truck	ZE		$0.247 \times 2 \times 365 = 180.3$	$0.002 \times 2 \times 365 = 1.3$

Class 4-7 Truck			$0.040 \times 2 \times 365 = 29.2$	$0.0002 \times 2 \times 365 = 0.1$
Class 2b-3	ZE		$0.027 \times 2 \times 365 = 19.7$	$0.0003 \times 2 \times 365 = 0.2$

WAIRE Points from ZE/NZE Truck Visit Emission Reductions: For the annualized regional NOx emission reductions, 365 truck visits from Class 8 ZE and NZE trucks will earn 8 and 7 WAIRE Points. Similarly, Class 4-7 ZE and NZE will earn 2 WAIRE Points, and Class 2b-3 ZE will earn 1 WAIRE Point. The associated local DPM emission reductions will earn 6 WAIRE Points for both ZE and NZE Class 8 truck visits, 1 WAIRE Point for both ZE and NZE Class 4-7 truck visits, and 1 WAIRE Point for ZE Class 2b-3.

Costs from ZE/NZE Truck Visits: The incremental cost of a truck visit used in the WAIRE Menu is based on the total cost of ownership of a ZE or NZE truck compared to an equivalent conventional diesel truck, taking into account the estimated total number of trips that truck will take in its useful life. The total cost of ownership (TCO), assuming a 12-year life, for Class 3, 4, 6 and 8 conventional diesel, battery electric, and hydrogen fuel cell trucks were obtained from CARB's Advanced Clean Truck Total Cost of Ownership Discussion Documents. The key components of the TCO include:

- (1) Capital cost: vehicle capital cost, taxes associated with the vehicle purchase, financing costs for the vehicle
- (2) Fuel cost¹⁶: The cost of the fuel
- (3) Other cost: maintenance costs, midlife costs¹⁷, vehicle registration, and residual values at the end of the truck's operating life

Tables 7, 8, 9, and 10 below present the base TCO data used in this analysis for Class 3, 4, 6, and 8 diesel, battery-electric, and hydrogen fuel cell trucks. The total cost of ownership for Class 6 CNG shown in Table 8 was estimated using a similar approach as Table 9, with modifications made to the incremental purchase cost, fuel cost¹⁸ and fuel economy^{19,20}. Maintenance cost of natural gas vehicles were assumed to be about one to two cents per mile greater than for diesel

¹⁶ Low Carbon Fuel Standard credits were not included in the analysis presented here.

¹⁷ Midlife costs are the cost of rebuilding or replacing major propulsion components due to wear or deterioration. For diesel vehicles, this would be a midlife engine rebuild, for battery-electric vehicles this would be a battery replacement, and for a hydrogen fuel-cell vehicle this would be a fuel cell stack refurbishment.

¹⁸ <https://nacfe.org/future-technology/medium-duty-electric-trucks-cost-of-ownership/>

¹⁹ https://afdc.energy.gov/files/u/publication/ng_regional_transport_trucks.pdf (Figure 5)

²⁰ https://www.energy.gov/sites/prod/files/2014/03/f8/deer12_kargul.pdf

vehicles due to more frequent oil changes and inspections, and higher replacement costs for spark plugs and injectors²¹. A summary of the analyses in Tables 7, 8, 9, and 10 is shown in Table 11.

²¹https://ww3.arb.ca.gov/msprog/tech/techreport/ng_tech_report.pdf

Table 7. Base TCO data for Class 3 trucks²²

	Diesel	Battery Electric	Hydrogen Fuel Cell	Natural Gas NZE
Annual Miles	15,000	15,000	15,000	TCO information was not found in the literature (Most NZE trucks in this Class are conversions)
Operating Years	12	12	12	
Energy Storage	-	38 kWh	10 kWh/10 kg	
Total Capital Cost	\$53,110	\$86,568	\$306,673	
Average Fuel Cost	\$3.74/gal	\$0.18/kWh	\$8.00/kg	
Average Fuel Economy	23.2 mpg	1.79 mi/kWh	58 mi/kg	
Total Fuel Cost	\$20,817	\$13,142	\$25,986	
Lifetime Maintenance Cost	\$23,731	\$17,779	\$23,731	
Midlife Cost	\$0	\$0	\$42,982	
Registration Fees	\$8,331	\$7,509	\$13,919	
Residual Values	(\$8,207)	(\$4,104)	(\$2,052)	
Total Other Cost	\$23,855	\$21,204	\$78,580	
Total	\$97,782	\$113,657	\$410,258	

²² <https://nacfe.org/future-technology/medium-duty-electric-trucks-cost-of-ownership/>

Table 8. Base TCO data for Class 4 trucks²³

	Diesel	Battery Electric	Hydrogen Fuel Cell	Natural Gas NZE
Annual Miles	15,000	15,000	Class 4 H2 trucks are not expected in the near future	TCO information was not found in the literature
Operating Years	12	12		
Energy Storage	-	120 kWh		
Total Capital Cost	50,000	100,000		
Average Fuel Cost	\$3.74/gal	\$0.17/kWh		
Average Fuel Economy	10 mpg			
Total Fuel Cost				
Lifetime Maintenance Cost				
Midlife Cost				
Registration Fees				
Residual Values	\$500	\$5,000		
Total Other Cost				
Total	\$124,229	\$177,345		

Table 9. Base TCO data for Class 6 trucks²⁴

	Diesel	Battery Electric	Hydrogen Fuel Cell	Natural Gas NZE
Annual Miles	24,000	24,000	24,000	24,000
Operating Years	12	12	12	12
Energy Storage	-	104 kWh	50 kWh/20 kg	-
Total Capital Cost	\$88,705	\$172,225	\$330,967	\$118,705

²³ <https://nacfe.org/future-technology/medium-duty-electric-trucks-cost-of-ownership/>

²⁴ <https://nacfe.org/future-technology/medium-duty-electric-trucks-cost-of-ownership/>

Interest Rate	5%			
Financed Period	5 years			
Average Fuel Cost	\$3.74/gal	\$0.17/kWh	\$8.00/kg	\$2.42/GGE
Average Fuel Economy	7.4 mpg	1.04 mi/kWh	14.1 mi/kg	6.3 mpg
Total Fuel Cost	\$104,349	\$33,472	\$171,398	\$110,629
Lifetime Maintenance Cost	\$49,138	\$36,853	\$49,138	\$54,898
Midlife Cost	\$0	\$0	\$32,237	\$0
Registration Fees	\$11,592	\$10,860	\$15,482	\$11,000
Residual Values	(\$10,477)	(\$5,239)	(\$2,619)	(\$10,477)
Total Other Cost	\$50,252	\$42,474	\$94,237	\$55,421
Total	\$243,306	\$248,171	\$596,603	\$340,176

Table 10. Base TCO data for Class 8 trucks²⁵

	Diesel	Battery Electric	Hydrogen Fuel Cell	Natural Gas NZE
Annual Miles	54,000	54,000	54,000	68,383
Operating Years	12	12	12	12
Energy Storage	-	510 kWh	10 kWh/10 kg	-
Total Capital Cost	\$167,500	\$593,662	\$786,486	\$192,710
Interest Rate	5%			12.5%
Financed Period	5 years			
Average Fuel Cost	\$3.74/gal	\$0.15/kWh	\$8.00/kg	\$2.92/DGE
Average Fuel Economy	5.9 mpg	0.48	11.2 mi/kg	5.1 mi/DGE
Total Fuel Cost	\$296,381	\$152,074	\$486,820	\$469,831

²⁵ <https://nacfe.org/future-technology/medium-duty-electric-trucks-cost-of-ownership/>

Lifetime Maintenance Cost	\$95,484	\$71,613	\$95,484	
Midlife Cost	\$0	\$42,949	\$94,023	
Registration Fees	\$27,545	\$21,472	\$26,548	
Residual Values	(\$15,453)	(\$7,727)	(\$3,863)	
Total Other Cost	\$107,576	\$128,308	\$212,192	
Total	\$571,456	\$874,044	\$1,485,498	\$624,925

Table 11. Summary of TCO Analyses from Literature Review

Truck Class	Ownership period	Annual Mileage	Diesel	Low-NOx CNG	Battery-Electric	Hydrogen Fuel Cell
Class 3	12	15,000	\$97,782		\$113,657	\$410,258
Class 4	12	15,000	\$124,229 ¹		\$177,345 ¹	
Class 6	12	24,000	\$243,306 ²	\$340,176	\$248,171 ²	\$596,603 ²
Class 8 (Ports Study)	12	68,383	\$598,122 ³	\$624,925 ³	\$1,063,000 ³	
Class 8 (CARB TCO)	12	54,000	\$571,456 ²		\$874,044 ²	\$1,485,498 ²

1. <https://nacfe.org/future-technology/medium-duty-electric-trucks-cost-of-ownership/>
2. <https://ww3.arb.ca.gov/regact/2019/act2019/apph.pdf>
3. <https://cleanairactionplan.org/documents/final-drayage-truck-feasibility-assessment.pdf/>

Using the reported annual mileages shown in Table 11, costs were calculated on a dollar per mile basis, as shown in Equation 2.

Equation [2]:

$$TCO \left(\frac{\$}{mi} \right) = \frac{TCO (\$)}{12 (yr) * Annual Mileage \left(\frac{mi}{yr} \right)}$$

Table 12. Total Cost of Ownership calculated as \$/mi

Truck Class	Diesel	Low-NOx CNG	Battery-Electric	Hydrogen Fuel Cell
Class 3	0.54		0.67	2.28
Class 4	0.69		0.99	
Class 6	0.84	1.18	0.86	2.07
Class 8 (Ports Study)	0.73	0.76	1.30	
Class 8 (CARB TCO)	0.88		1.35	2.29

SCAG’s Heavy-Duty Truck Regional Travel Demand model provides an estimate of heavy-duty truck activities within South Coast Air Basin. TCO values on a dollar per trip basis are estimated using SCAG’s VMT and trip rates in Table 13.

Table 13. Truck activity data from SCAG’s Heavy-Duty Truck Regional Travel Demand Model

Truck Class	VMT (mi/day)	Trips (trip/day)	Mile/trip
Class 2b-3	7,456,000	488,000	15.3
Class 4-7	7,744,000	544,000	14.2
Class 8	12,060,000	302,000	39.9

Equation 3 below illustrates the method used to determine TCOs on a dollar per trip basis using the TCOs (\$/mi) in Table 12 and SCAG’s mileage rates in Table 13, with results shown in Table 13 equation [3]:

$$TCO \left(\frac{\$}{trip} \right) = TCO \left(\frac{\$}{mi} \right) \times \frac{mi}{trip}$$

Table 14. Total Cost of Ownership (\$/trip)

Truck Class	Diesel	Low-NOx CNG	Battery-Electric	Hydrogen Fuel Cell
Class 3	8.31		10.28	34.96

Class 4	9.80		13.99	
Class 6	12.00	16.77	12.24	29.42
Class 8 (Ports Study)	29.08	30.39	51.69	
Class 8 (CARB TCO)	35.19		53.82	91.47

Although the TCO analyses above assume a 12-year useful life for a truck, motor carriers may require shorter periods over which they absorb the incrementally higher costs of ZE or NZE trucks compared to diesel. The analysis here therefore assumes that this incremental cost is absorbed over a 3-year period, instead of the full 12-year useful life. The incremental cost is therefore multiplied by four ($12 \div 3 = 4$) to determine the default cost for truck visits.

Table 15. Annualized Incremental Costs

Truck Class		Annualized Unitary Metric	Annualized Incremental Cost (\$/metric)
Class 8	NZE	365 truck visits**	$(\$30.39 - \$29.08) \times 4 \times 2 \times 365 = \$3,825$
Class 4-7*			$(\$16.77 - \$12.00) \times 4 \times 2 \times 365 = \$13,928$
Class 8	ZE		$(\$53.82 - \$35.19) \times 4 \times 2 \times 365 = \$54,400$
Class 4-7*			$(\$12.24 - \$12.00) \times 4 \times 2 \times 365 = \701
Class 2b-3			$(\$10.28 - \$8.31) \times 4 \times 2 \times 365 = \$5,752$

*In this analysis, Class 6 TCOs were used for the Class 4-7 category in the WAIRE Menu

** One visit equals two one-way trips

WAIRE Points for ZE/NZE Truck Visit Costs: Based on the costs presented in Table 15, the number of WAIRE Points earned for ZE Class 8, Class 4-7, and Class 2b-3 truck visits are 3, 1, and 1, respectively. One WAIRE Point is earned for both NZE Class 8 and Class 4-7 truck visits.

Total WAIRE Points for ZE/NZE Truck Visits: The total WAIRE Points for truck visits includes Points from the cost, regional emission reductions, and local emission reductions. In addition, because most of the emissions associated with warehouses comes from trucks visits, a multiplier of three is applied to the summed Points to encourage operators to choose this option, and to promote a more rapid return on investment for the purchase of ZE/NZE trucks. For example, for 365 class 8 ZE truck visits, a warehouse would earn: 8 Points for regional, 6 Points for Local, and 3 Points for cost, with a sub-total of 17 Points. The final total for this Menu item would be 51 Points (17×3).

SECTION 3) Electric Charger Usage and Installation

Description: ZE battery electric trucks require specialized charging infrastructure. Installing this infrastructure can require facility electrical upgrades, dedication of space for electrical equipment and vehicle parking, permitting with local authorities, and plans to optimize charger usage. The charging stations themselves range in size and are typically rated based on the amount of kW that can be dispensed. Higher powered charging stations (≥ 350 kW) are just now entering the market, and may require significant construction. On the usage side, the cost of the electricity can vary depending on the time of day when trucks are charged, the kW charging level, and the level of demand charges. Utilities are introducing new rate structures for the use of these stations to address this new market need. Trucks that would use charging infrastructure at a warehouse are likely to travel to destinations unrelated to the warehouse itself, and providing this infrastructure can facilitate greater usage of ZE trucks.

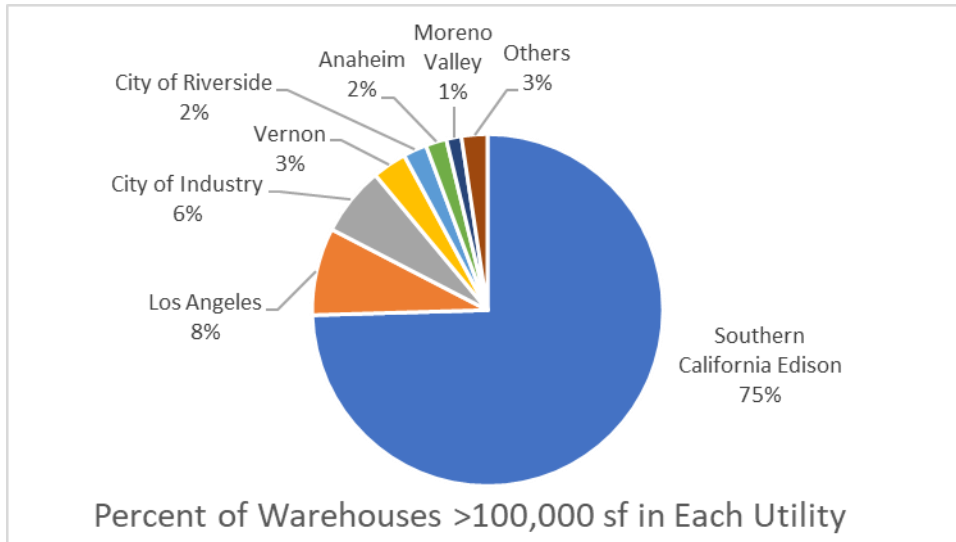
Commercial Availability: Several different manufacturers sell EVSE at a variety of power levels (e.g., Level 2, higher rate chargers, etc.), including with optional power management software that govern how trucks are charged. At the current early stage of commercialization and demonstration of electric trucks, the higher power chargers used for heavy duty vehicle charging have not yet followed a common standard, and proprietary charging systems are commonly tailored to each vehicle. This is expected to change in the near future with the development of a common High Power Charging for Commercial Vehicles standard by the CharIN²⁶ organization. In addition, local utilities and land use agencies are developing programs specifically focused on charging infrastructure upgrades. Notable examples include the Charge Ready Transport program from Southern California Edison (SCE)²⁷, the Commercial EV Charging Station Rebate Program from the Los Angeles Department of Water and Power (LADWP)²⁸, and permit streamlining efforts from many local permitting agencies²⁹. SCE and LADWP collectively provide power to $>80\%$ of warehouses that may be included in Rule 2305 (see chart).

26 <http://www.charinev.org/hpccv> - CharIN members include most major vehicle manufacturers as well as many major energy and charging infrastructure companies.

27 <https://www.sce.com/business/electric-cars/charge-ready-transport>

28 www.ladwp.com/ladwp/faces/ladwp/commercial/c-savemoney/c-sm-rebatesandprograms/c-sm-rp-commevstation

29 <http://www.business.ca.gov/ZEVReadiness>



SECTION 3a) Charger Usage

Emissions: While charging infrastructure on its own does not reduce emissions, this equipment does facilitate emissions reductions by providing additional locations for electric vehicles to obtain power and making it possible for their increased use. However, similar to the calculations for truck acquisitions, regional emission WAIRE Points are earned at a \$100,000 per ton of NO_x cost effectiveness level. Both regional and local emission reductions Points are earned when charging stations are used. The amount of regional NO_x emissions reductions is tied to the total amount of dispensed electricity, using default electric vehicle efficiencies and emission rates. The amount of local DPM emissions reductions is set equal to six miles of travel for every charging event³⁰. The Annualized Unitary Metric (AUM) is set at 165,000 kWh, equal to about 450 kWh per day, or enough for five separate two hour-long charging events per day on a 50 kW charger, or to recharge one truck with a 500 kWh battery.

The tables and equations below illustrate the methods used to determine Point values based on regional and local emissions reductions.

Table 16. Electric Vehicle Efficiencies³¹, Emission Rates³², and Emissions Reductions

Truck Category	Efficiency	Emission Rate	Emissions Reductions
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31 CARB Advanced Clean Truck – Draft Standardized Regulatory Impact Assessment (SRIA), 8/8/2019 <https://ww3.arb.ca.gov/regact/2019/act2019/appc.pdf>

32 <https://www.arb.ca.gov/emfac/2017/>, emission rates are from calendar year 2023

	mile/kWh	NOx g/mile	DPM g/mile	lb NOx/kWh	lb DPM/kWh
Class 4-5	1.26	1.08	0.007	0.003	0.00002
Class 6-7	0.8	1.08	0.007	0.002	0.00001
Class 8	0.62	2.37	0.02	0.003	0.00003

Equation [4]: NOx reductions = (mile/kWh) × (g/mile) × 165,000 kWh/yr ÷ 453.59 (g/lb)

Equation 1 (Class 4-5): $1.26 \times 1.08 \times 165,000 \div 453.59 = 495 \text{ lb NOx}$

Equation 1 (Class 6-7): $0.8 \times 1.08 \times 165,000 \div 453.59 = 314 \text{ lb NOx}$

Equation 1 (Class 8): $0.62 \times 2.37 \times 165,000 \div 453.59 = 535 \text{ lb NOx}$

Equation [5]: DPM reductions = (mile/kWh) × (g/mile) × 165,000 kWh/yr ÷ 453.59 (g/lb)

Equation 2 (Class 4-5): $1.26 \times 0.007 \times 165,000 \div 453.59 = 3.2 \text{ lb DPM}$

Equation 2 (Class 6-7): $0.8 \times 0.007 \times 165,000 \div 453.59 = 2.0 \text{ lb DPM}$

Equation 2 (Class 8): $0.62 \times 0.02 \times 165,000 \div 453.59 = 4.5 \text{ lb DPM}$

WAIRE Points from Charging Station Usage Emission Reductions: Emission reductions vary for each class of truck. For the WAIRE Menu, the regional and local emission reductions from class 8 trucks are used. Regional emission reductions therefore result in 22 WAIRE Points, while local emission reductions result in 18 WAIRE Points.

Costs of Using Charging Stations: Over the past year staff worked closely with multiple utilities to understand their new commercial EV charging rate structures and developed estimates of the average cost of electricity per kWh. As noted above, about three quarters of all warehouses potentially subject to the rule are located within SCE’s jurisdiction. For this analysis, multiple scenarios were evaluated for a five concurrent two hour long charging events per day on a 50 kW chargers. Table 17 reflects the expected charging rate and the average electricity rate for two most appropriate SCE rate schedule for heavy-duty EV charging. The average cost assumes an equal amount of charging in each time window.

Table 17. Annual Average Cost of Electricity* – Two Key SCE Rate Schedules for Charging Stations South Coast AQMD Staff Analysis

Charging Window	SCE TOU-EV-9	SCE TOU-8-RTP
	\$/kWh *	\$/kWh **
On-Peak	0.34	0.28
Mid-peak	0.16	0.25
Off-peak	0.14	0.23

* Demand charges and voltage discount are zero for TOU-EV-9

**Demand charges contributes to 40% of total annual electricity cost – Voltage discount included

***These costs do not account for any LCFS revenue that a facility may receive. The LCFS value may vary depending on market conditions but can be more than \$0.10/kWh.³³

In LADWP jurisdiction the electricity rate can range between \$0.11-0.3 \$/kWh for charging heavy-duty vehicles depending on load factor, daily charging hours, and charging capacity. The provided range by LADWP staff is consistent with the rates provided in Table 5.

Using the \$0.21 \$/kWh rate above, and AUM of 165,000 kWh per year for a charging station, the total annual cost of electricity for the warehouse is \$34,650, equal to two WAIRE Points.

SECTION 3b) Charger Installation

Costs to Install Charging Stations: Charging infrastructure costs can vary greatly from site to site. The analysis presented here was informed by staff discussions with charger providers, utilities, other industry stakeholders, data from current South Coast AQMD funded projects, and multiple studies (referenced below). Table 18 presents a summary of the range of costs for purchasing and installing different EVSEs.

Electrification projects require site-specific planning and sometimes can take more than one year to implement. Because of this potentially extended period, the charging infrastructure installation WAIRE Menu item includes project milestones to allow warehouses to earn Points for partial completion of charger installation during a compliance year. Three milestones that are common to all charging station projects include purchasing the Electric Vehicle Supply Equipment (EVSE), construction mobilization, and final permit sign off & charger energization. In order to account for splitting charger installations into two separate milestones, it is assumed that the

³³ <https://ww3.arb.ca.gov/regact/2019/act2019/appc.pdf>

construction mobilization milestone will require up to \$10,000 of the total installation cost, and the remaining cost is incurred during construction and prior to final permit sign-off.

Table 18. Charging Infrastructure Installation Cost Ranges, and Key Incentives/Rebates Programs

Charging Installation Activity	Charger Ranges	Cost Range ^{A-D}
		\$ per charger
EVSE Purchase	150-350 kW	60,000 – 140,000
	51-149 kW	30,000 – 60,000
	19.2-50 kW	10,000 – 30,000
	Up to 19.2 kW	3,000 – 5,000
Charger Installation ¹	19.2-350 kW	10,000 – 80,000
	Level 2	5,000 – 10,000

Notes:

1. Installation cost for one charger includes electrical service extension, permitting, labor costs, and trenching to lay cables

References:

- A. Charging the Future: Challenges and Opportunities for Electric Vehicle Adoption, Henry Lee and Alex Clark, August 2018
- B. Estimating Electric Vehicle Charging Infrastructure Costs across Major U.S. Metropolitan Areas. Michael Nicolas, August 2019
- C. Rocky Mountain Institute Report, <https://www.greenbiz.com/blog/2014/05/07/rmi-whats-true-cost-ev-charging-stations>, 2019
- D. CARB Advanced Clean Truck - Standardized Regulatory Impact Assessment (SRIA), August 2019

WAIRE Points from Charging Station Installations: Table 19 below summarizes the Points that a warehouse would earn for purchasing an EVSE and installing it. Similar to truck acquisitions, regional emission Points are assigned at a \$100,000 per ton of NOx cost effectiveness.

Table 19. Summary of WAIRE Points Earned for Installing Charging Infrastructure

Charger Installation Activity	Cost Points	Regional Emissions Points	Total WAIRE Points
1 EVSE Purchased	6	112	118
	3	48	51
	2	24	26
	1	4	5
1 construction project/ Construction Mobilization	1	8	9
	1	48	5
1 construction project/ Final Permit Sign Off & Charger Energization	3	56	59
	1	48	59

SECTION 4) Hydrogen Fueling Station Installation and Usage

Description: Hydrogen refueling stations (HRS) are used to supply fuel to vehicles with hydrogen fuel cell drivetrains. An HRS is composed of storage and dispensing units and can sometimes include a production unit if the hydrogen is produced on site. If the hydrogen is produced on site or delivered to the station at an intermediary pressure or in liquid state, intermediary storage is also needed along with a compression system.

Commercial Availability: While construction of hydrogen fueling stations has been increasing, with 43 now operating in the state³⁴, they are primarily focused on the light duty vehicle market, or in some cases for transit buses. However, some Class 8 truck manufacturers are actively pursuing the development and commercialization of hydrogen fuel cell trucks over the next few years, including Toyota, Kenworth, Hyundai, and Nikola. Fueling infrastructure will be a critical component to facilitate these new ZE trucks.

Hydrogen Station Installation Costs: Hydrogen prices are influenced by the cost of production, distribution, and sales, among other factors. In addition to AB 8 and CARB's Scoping Plan, the recently-updated Low Carbon Fuel Standard, Executive Orders B-16-2012 and B-48-18 provide strong policy drivers for accelerating commercialization of fuel cell vehicles and their associated hydrogen fuel station network.

Table 20 below presents a summary of costs associated with developing a hydrogen fueling station from literature review and discussion with stakeholders. In this context, total capital cost includes site design and engineering, permitting, equipment, project management, and labor costs.

34 www.veloz.org

Table 20. Hydrogen Fueling Station Costs

	Capacity (kg/day)	Cost (\$)	\$/Capacity (\$/kg/day)	Source
			5000- 10,000	CARB Total Cost of ownership Discussion Documents ³⁵
Gaseous H2 LDV fueling system at 700 bar	250	1,725,000	6,900	Moyer Granted Project for Sunline Transit- EPC Design
Gaseous H2 Station- 700 bar Cascade dispensing	700	3,065,724	4,380	Argonne National Lab Heavy
Gaseous H2 Station- 700 bar Booster compressor	700	3,140,211	4,486	Duty Refueling Model, (2016 Dollar) ³⁶
Gaseous H2 Station- 350 bar Cascade dispensing	700	2,029,488	2,899	
Liquid H2 Station- 700 bar via vaporization/compression	700	2,421,134	3,459	Argonne National Lab Heavy Duty Refueling Station Model,
Liquid H2 Station- 350 bar via vaporization/compression	700	1,430,748	2,044	(2016 Dollars) ²
Liquid H2 Station- 700 bar via LH2 pump/vaporization	700	1,541,243	2,202	
Liquid H2 Station- 350 bar via LH2 pump/vaporization	700	1,145,634	1,637	
Onsite H2 Production	7257.5	16,500,000	2,274	Industry stakeholder input
Onsite H2 Production	600	5,000,000	8,333	Industry stakeholder input

³⁵ <https://ww3.arb.ca.gov/regact/2019/act2019/apph.pdf>

³⁶ <https://hdsam.es.anl.gov/index.php?content=hdsam>

WAIRE Points for Hydrogen Station Installation: For the WAIRE Menu an onsite hydrogen fueling station with a capacity of 700kg/day with delivered hydrogen was assumed to cost \$2 million. This would yield 80 WAIRE Points. At a cost effectiveness of \$100,000 per ton of NOx, an additional 1600 Points are earned for regional emissions.

Emission Reductions from Hydrogen Usage: Annualized regional NOx emission reductions and local DPM emission reductions were set to be same as the reductions achieved by usage of onsite electric charger stations at 535 lb NOx/yr and 4.5 lb DPM/yr. Details of the calculation can be found in Section 3 of this report.

Hydrogen Fuel Costs: To determine the annualized unitary metric (AUM) for dispensed hydrogen, a back calculation was conducted based on the amount of regional NOx emissions:

Equation [6]:

$$\begin{aligned} \text{Total kg of Dispensed } H_2 &= 535 \left(\frac{lb}{yr} \right) \times 453.59 \left(\frac{gr}{lb} \right) \times \frac{1}{2.372 \left(\frac{g}{mi} \right) \times 16.63 \left(\frac{mi}{kg H_2} \right)} \\ &= 6,152 \frac{kg}{yr} \end{aligned}$$

Where, 2.372 (g/mi) is the VMT weighted average of NOx running exhaust emission rate of Class 8 trucks considered in this analysis including T7 CAIRP, T7 NNOOS, T7 NOOS, T7 POLA and T7 Tractor. 16.63 (mi/kg) is the reported fuel economy for a class 8 fuel cell truck³⁷. Given the total kg of dispensed hydrogen calculated above and a retail price of \$10/kg, the annual cost will be \$61,520.

WAIRE Points for Dispensed Hydrogen: Based on the emission reductions stated above, 22 and 18 Points are earned respectively for regional NOx and local DPM. Cost Points would contribute another 3 Points, for a total of 43 Points for 6,152 kg of H₂ dispensed.

SECTION 5) Zero Emissions Yard Truck Acquisition and Usage

Description: Yard trucks (also called yard tractors, terminal trucks, hostlers, yard jockeys, or yard goats) move trailers and containers around warehouse facilities. Most yard trucks at

³⁷ <https://ww3.arb.ca.gov/regact/2019/act2019/appc.pdf>

warehouse facilities are diesel fueled and emit NO_x, DPM, and other pollutants. Duty cycles for yard trucks vary depending on use, with heavier use at railyards and port facilities and lighter use typically at warehouses and manufacturing plants, as defined by hours of use and diesel consumption rates. CARB has limited population data for about 1,100 yard tractors operating statewide through its DOORS reporting program for off-road vehicles, but it is unclear how many of these operate at warehouses in South Coast AQMD. In addition, many yard tractors can be on-road vehicles, which are not required to be reported through the DOORS system. For example, about two thirds of the roughly 1,600 yard tractors at the ports of Los Angeles and Long Beach are on-road vehicles.

Commercial Availability: Many battery-electric yard tractor demonstration projects have taken place in the past several years, including in the South Coast AQMD. Following these efforts, multiple manufacturers have begun offering battery-electric ZE yard trucks for sale commercially including OrangeEV, Kalmar Ottawa, and BYD.

Operation: Operation of yard trucks can be tracked by hours of use, with hourly usage varying from <1,000 hours/year up to 6,000 hours/year. The diesel reductions were calculated by using the horse power, hours of use, the load factor, and the pollutant emission factor.

SECTION 5a) ZE Yard Truck Acquisition

WAIRE Points from ZE Yard Truck Acquisition: ZE yard trucks currently cost about \$310,000 while their diesel equivalent costs about \$100,000³⁸. This incremental cost of \$210,000 would earn nine WAIRE Points per ZE yard truck purchased. Similar to the methods used for on-road truck acquisitions, at \$100,000 per ton cost effectiveness, a ZE yard truck acquisition would earn 168 Points for regional emission reductions.

³⁸ <https://cleanairactionplan.org/documents/final-cargo-handling-equipment-che-feasibility-assessment.pdf/>

SECTION 5b) ZE Yard Truck Usage

Emissions: From the DOORS data, the most common yard trucks operate a 175 hp, Tier 3 engine. Table 21 below shows the emission factors from the Carl Moyer Guidelines³⁹ for this type of yard truck. Assuming that this type of yard truck operates 1,000 hours per year, and has operated for ten years, the emission reductions from switching to a ZE yard truck are shown in Equation 7 below.

Table 21. Emission Factors for a Tier 3 Yard Truck

Pollutant	Emission Factor (EF) g/hp-hr	Deterioration Rate (DR) g/hp-hr-hr	Load Factor (LF)
NOx	2.32	0.00003	0.39
DPM	0.088	0.0000044	

Equation [7]

$$\text{Emissions} = (hp) \times (LF) \times [((\text{total hrs of use}) \times (DR)) + (EF)] \times (\text{hrs of use}) \div 453.59 \left(\frac{g}{lb}\right)$$

$$\text{Equation 7 NOx: } 175 \times 0.39 \times [((10 \times 1,000) \times 0.00003) + 2.32] \times 1,000 \div 453.59 = 394 \text{ lbs}$$

$$\text{Equation 7 DPM: } 175 \times 0.39 \times [((10 \times 1,000) \times 0.0000044) + 0.088] \times 1,000 \div 453.59 = 19.9 \text{ lbs}$$

Costs: Although purchase prices for ZE yard trucks are higher than their diesel equivalent, once purchased the operational costs are expected to be lower. An analysis by the ports of Long Beach and Los Angeles evaluated the Total Cost of Ownership (TCO) for battery-electric ZE yard trucks in comparison to diesel⁴⁰. This analysis found a TCO for ZE yard trucks to be about \$450,000 (not including infrastructure costs) while equivalent diesel had a TCO of about

³⁹ <https://ww3.arb.ca.gov/msprog/moyer/guidelines/current.htm>

⁴⁰ <https://cleanairactionplan.org/documents/final-cargo-handling-equipment-che-feasibility-assessment.pdf/>

\$375,000. Assuming a ~12,000 useful life of a yard truck, the annual incremental cost of operating a ZE yard truck for 1,000 hours is shown in Equation 8.

Equation [8]: $(\$450,000 - \$375,000) \times 1,000 \text{ hrs} \div 12,000 \text{ hrs} = \$6,250$

WAIRE Points from Using ZE Yard Trucks: Following the results from Equation 6, using a ZE yard truck would earn 16 Points for regional emission reductions and 80 Points for local emission reductions. One cost Point would be earned following the results of Equation 7. Similar to the approach for on-road truck visits, a multiplier of three is applied to the sum of cost, regional, and local Points. Therefore the total Points for 1,000 hours of ZE yard truck usage is: $(16 + 80 + 1) \times 3 = 291$ Points.

SECTION 6) Transport Refrigeration Unit Plug (TRU) Acquisition and Usage

Description:

TRUs are truck or trailer installed refrigeration systems used at cold storage and distribution center warehouses to transport and temporarily store perishable goods and products. Most of the 7,400 truck and 166,000 trailer TRUs that operate in California are powered by diesel-fueled internal combustion engines (ICEs)⁴¹ which emit about 5.5 tons of NO_x and 0.2 tons of diesel particulate matter (DPM) daily⁴². Newer TRU technology allow zero emission operations by plugging hybrid and battery electric models into TRU charging infrastructure at warehouses and other destinations. CARB is currently developing a new truck TRU regulation as well as a separate trailer TRU regulation which, among other requirements, could mandate:

- installation of charging infrastructure, and
- truck TRU fleets to annually turn over a portion of their fleet to full ZE technology.

WAIRE Points may only be earned for actions beyond any adopted rules and regulations from U.S. EPA, CARB, or South Coast AQMD. If CARB's previously proposed truck TRU regulation is adopted in the coming years,⁴³ WAIRE Points could only be earned for the installation of TRU plug infrastructure and TRU plug usage beyond CARB requirements, or potentially through a Custom WAIRE Plan thereafter that would demonstrate how actions taken go beyond CARB rules.

Commercial Availability:

Current zero emission operation capable TRUs are: plug-in and hybrid (eTRU); battery-electric; cryogenic; and hydrogen fuel cell. All except the hydrogen fuel cell technologies are commercially available, and are offered for sale commercially by such manufacturers as Advanced Energy Machines, Air Liquide, Boreas, Carrier, Electric Reefer Solutions, and

41 <https://ww2.arb.ca.gov/sites/default/files/classic/cc/cold-storage/documents/slidesworkshop82019.pdf>

42 <https://ww2.arb.ca.gov/resources/documents/2020-mobile-source-strategy>

43 CARB has proposed bifurcating the TRU regulation, with rulemaking in 2021 focusing on TRU trucks, and new emission standards, and later rulemaking focusing on ZE trailers.

Thermo King. Additionally, there are manufacturers and firms that focus solely on the electric plug-in infrastructure such CleanFutures and Shorepower Technologies⁴⁴.

Operation: Electric zero emission trailer TRUs and truck TRUs operate using an onboard battery, or via power from the electrical grid if they are plugged into a charger. Hybrid trailer TRUs may operate via a diesel engine when in transit, and in zero emissions mode while plugged into a charger. Charger operators may claim LCFS credits for the electricity dispensed for TRUs, potentially at a level that fully offsets the cost of electricity.⁴⁵ Charger operators are therefore expected to track the total amount of kWh of charger usage for TRUs when they obtain LCFS credits. Plug usage can be tracked by hours of use, 1,460 hours of annual usage or approximately 4 hours per day of TRU plug usage was determined from the 2023 baseline of the TRU ATCM. The 4 hour average use is attributed to truck dwell time at warehouses or delivery destinations. Diesel emission reductions were calculated by using the horse power, annual hours of use, the load factor, and the pollutant emission factor⁴⁶.

SECTION 6a) TRU Plug Acquisition and Installation

WAIRE Points from TRU Plug Acquisition and Installation: A TRU plug installation costs approximately \$13,600 which includes a Level 2 charger, equipment, design, construction, and installation costs⁴⁷. Using a similar methodology as is described for installing chargers for vehicles in this document, acquisition and installation of a single TRU plug could earn a total of 15 WAIRE Points, with 1 Point for each TRU plug purchased, beginning construction, and receiving final permit sign-off/charger energization. Similar to truck acquisitions, regional emission Points are assigned at a \$100,000 per ton of NOx cost effectiveness, resulting in an additional 12 Points.

44 https://ww2.arb.ca.gov/sites/default/files/classic/cc/cold-storage/documents/clean_tru_technology_webinar_slides_handout.pdf

45 <https://ww2.arb.ca.gov/sites/default/files/2020-08/Preliminary%20TRU%20Cost%20Doc%2008202020.pdf>

46 https://ww2.arb.ca.gov/sites/default/files/classic/cc/cold-storage/documents/tru_healthanalysisisslidesworkshop10312019.pdf

47 <https://ww2.arb.ca.gov/sites/default/files/2020-08/Preliminary%20TRU%20Cost%20Doc%2008202020.pdf>

SECTION 6b) TRU Plug Usage

Emissions: The 2023 calendar year weighted average emission factors for the South Coast AQMD was used in Equation 1, to calculate the default annual NO_x and DPM emission reductions from trailer and truck eTRUs plugging in. The AUM is set at 10,658 kWh, equal to an eTRU plugged in 4 hours per day for 365 days and drawing 7.3 kW of power.⁴⁸

Equation [1]

$$\text{Emissions} = (\text{annual hours of use}) \times (\text{Pollutant Emission factor}) \div 453.59 \left(\frac{g}{lb}\right)$$

$$\text{Equation 1 NO}_x: \quad 1,460 \times 12.60 \div 453.59 = 40.6 \text{ lbs}$$

$$\text{Equation 1 DPM:} \quad 1,460 \times 0.53 \div 453.59 = 1.7 \text{ lbs}$$

Costs: Using the AUM of 10,658 kWh, and the \$0.18/kWh rate for electricity calculated for charging station usage in this document (and not considering any potential offset from LCFS credits), the average annual cost to operate a TRU plug is shown in Equation 2.

$$\text{Equation [2]:} \quad (\$0.21 / \text{kWh}) \times 10,658 \text{ kWh} = \$2,238.18$$

WAIRE Points from Using ZE TRUs: Following the results from Equation 1, using a TRU plug would earn 2 Points for regional emission reductions and 7 Points for local emission reductions. One cost Point would be earned following the results of Equation 2. Similar to the approach for other WAIRE action usage or visits, for replacing diesel-fueled equipment/vehicles, a multiplier of three is applied to the sum of cost, regional, and local Points. Therefore, the total Points for 10,658 kWh from TRU charging is: $(2 + 7 + 1) = 10$ Points.

48 <https://ww2.arb.ca.gov/sites/default/files/2020-08/Preliminary%20TRU%20Cost%20Doc%2008202020.pdf>

SECTION 7) Solar Panel System Acquisition and Usage

Description:

Solar panel systems are electric energy generation systems that are composed of the solar panels which collect and convert solar radiation to direct current (DC) power, the racking system which mount the panels and equipment to a rooftop or carport, and the inverter which convert the DC power to alternating current (AC) power. The installations of solar panel systems on warehouse rooftops and carports is an increasing trend which provide renewable power for both warehouse usage and for sale back to the grid. Many commercial buildings with significant rooftop or parking area spaces are incorporating solar panel systems into their operations for financial savings. California is leading the nation with over 600,000 commercial buildings being equipped with solar panel systems, with a solar market penetration of about 2.5%⁴⁹. In the last several years, there have been many technology advancements in solar panels that have made them lighter, more efficient, and more flexible which allows for them to be installed in more applications that have led to a decrease in overall installation costs.

Commercial Availability:

Solar panel systems have wide commercially available throughout California with hundreds of manufacturers and installers who offer a range options for system sizes and component configurations.

Operation:

To analyze the installation and use of solar panel systems, the median solar panel system size was set at 100 kW based on a literature review of Lawrence Berkeley National Laboratory's (LBNL) annual Tracking the Sun Report⁵⁰. The 100 kW solar system parameter was inputted into the National Renewable Energy Laboratory's (NREL) PVWatts⁵¹ calculator specifying a region in the South Coast AQMD jurisdiction which resulted in an annual estimated electrical generation of 165,000 kWh. The 100 kW solar panel system and the 165,000 kWh estimated electrical generation serve as the annual unitary metric (AUM) for solar panel system installation and usage, respectively.

49 <https://emp.lbl.gov/webinar/commercial-rooftop-solar-energy-market>

50 <https://emp.lbl.gov/tracking-the-sun>

51 <https://pvwatts.nrel.gov/>

SECTION 7a) Solar Panel System Acquisition and Installation

WAIRE Points from Solar Panel System Acquisition and Installation: Based on LBNL's Tracking the Sun study⁵² the price per kW for a rooftop solar panel system was \$2.60 per kW and a carport solar panel system was estimated to cost \$3.74⁵³. Carport solar panel systems have higher costs due to structural costs to elevate the solar panels to provide the carport or truck shade structure. WAIRE Points are calculated based on the total cost of the installation of the 100 kW solar panel system. Applying the \$2.60 per Watt costs for rooftop installation for the 100 kW solar panel system results in a total acquisition and installation cost of \$260,000. For carport solar panel system installation, the \$3.74 per Watt for carport solar panel system installation for the 100 kW solar panel system which results in a total acquisition and installation cost of \$374,000. Using a similar methodology as is described for installing chargers for vehicles in this document, acquisition and installation of a rooftop solar panel system could earn 15 WAIRE Points for a 100 kW rooftop solar panel system, and 19 WAIRE Points for a 100 kW carport solar panel systems.

SECTION 7b) Solar Panel System Usage

Emissions: Using emissions data from local power plants which potentially provide power to warehouses within the South Coast AQMD jurisdiction, a peak rate NOx emission factor of 0.087 lbs/MWh was calculated⁵⁴. The combustion of natural gas at the local power plants do not generate DPM so only NOx is considered in this analysis. The calculated NOx emission factor is used with the AUM of the estimated generation of 165,000 kWh for a 100 kW solar panel system installed on a structure in the South Coast AQMD jurisdiction. Equation 1 shows the calculated the default annual NOx emission reductions from solar panel system usage.

Equation [1]

$$\text{Emissions} = (\text{Power Plant NOx Emission Factor lbs/MWh}) \times (\text{Total Estimated KWh generated}) / 1,000$$

52 https://eta-publications.lbl.gov/sites/default/files/tracking_the_sun_2018_briefing.pdf

53 Based on a confidential data obtained from industry source that requested non-attribution.

54 Power plant emission calculations were derived from CEMS, eGRID, and EIA data to calculate for the South Coast AQMD jurisdiction

Equation 1 NOx: $0.087 \times 165,000 \div 1,000 = 14.3$ lbs

Costs: No cost is considered for the operation of the solar panel system. After the initial installation costs, the minimal maintenance costs are negligible considering the cost saving from solar electric power generation in comparison to purchasing grid power.

WAIRE Points from Solar Panel System Usage: Following the results from Equation 1, using a solar panel system would earn 1 Point for regional emission reductions. There are no cost or local benefit WAIRE Points contributions.

SECTION 8) Installation of Air Filter Systems or Air Filters in Community Facilities

Description:

The installation of air filter systems or the installation/replacement of air filters is provided on the WAIRE Menu to provide a community benefit in reducing exposure for the communities near warehouses. Air filters have been shown to successfully remove black carbon (BC) and particulate matter (PM) which include ultrafine particles (UFP) (particles with a diameter < 0.1µm), diesel particulate matter (DPM), PM2.5 (particles with a diameter < 2.5µm), and PM10 (particles with a diameter < 10µm) of outdoor particles formed from the combustion of fossil fuels that permeate into the indoors.⁵⁵ Exposure to PM contaminants may lead to potential health hazards such as asthma, lung inflammation allergies, and other respiratory or cardiovascular problems⁵⁶. DPM is an air toxin and classified human carcinogen which account for more than 80% of the total cancer risk from air toxics in the south coast air basin (SCAB)⁵⁷. Air filters can be integrated to a heating, ventilation, and air conditioning (HVAC) system or standalone, where the use of high- performance panel filters (HP-PF) resulted in up to 90% removal of UFP, DPM, PM2.5, and PM10, where HP-PF used were minimum efficiency reporting value 16 (MERV 16) filters⁵⁸. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers defines MERV 16 as filters used for HVAC units that remove at least 95% of particles 0.3 microns or larger.

Commercial Availability:

Air filter systems and air filters have wide commercially available throughout California with numerous manufacturers and installers who offer a range options for system sizes and air filter types.

Operation:

55 Polidori A, Fine PM, White V, Kwon PS. Pilot study of high-performance air filtration for classroom applications. *Indoor Air*. 2013

56 Liu, L., Poon, R., Chen, L., Frescura, A.M., Montuschi, P., Ciabattoni, G., Wheeler, A. and Dales, R. (2009) Acute Effects of Air Pollution on Pulmonary Function, Airway Inflammation, and Oxidative Stress in Asthmatic Children, *Environ. Health Perspect.*, 117, 668–674.

57 MATES III Study; South Coast Air Quality Management District, 2008

58 Polidori A, Fine PM, White V, Kwon PS. Pilot study of high-performance air filtration for classroom applications. *Indoor Air*. 2013

Air filters can be installed on existing HVAC units or as standalone units at residences, schools, daycares, hospitals, community centers, and other community locations. The integration of air filters with HVAC units does lead to a decrease in the HVAC pressure as caused by the increased resistance of the filters that captures particles. In time the air filter media becomes saturated with particles leading to further HVAC pressure decreases and decreased particle capture efficiency. For standalone systems that uses its own fan the energy demand to operate at top speed is 100 watts/hr or about 5 kWh for 10 hours of operation for a 5 day week⁵⁹. General service maintenance on the air filters involves replacement, on a set interval period or depending on the activity at the location the filters are installed.

WAIRE Points from Air Filter or Air Filter System Installation:

With the emission reductions from the installation of air filter systems or the replacement of air filters being much less than the emission reductions associated with truck purchase, the regional WAIRE Points are related the cost effort considering the same cost effectiveness. The annual metric for the number of air filter systems with MERV 16 air filters installed is 25 systems, and the annual metric for the replacement of air filters is 200 MERV 16 air filters. With the annual metrics and the estimated emission reduction, the installation of 25 air filter systems with MERV 16 air filters equates to 55 WAIRE Points, and the installation/replacement of 200 MERV 16 air filters equates to 51 WAIRE Points.

Costs: The costs for air filter systems with MERV 16 air filters were obtained from vendors and contractors that South Coast AQMD has worked with to install air filter systems and air filters at schools and other facilities as part of mitigation and settlement projects. The estimated costs analyzed for the installation of 25 air filter systems with MERV 16 air filters is \$65,000 and cost for the replacement/installation of 200 MERV 16 air filters is \$60,000. Using the \$0.21 \$/kWh electricity rate that is used in other WAIRE Menu actions and assuming 10 hours of use each day for 365 days, the estimated electricity costs for a standalone air filter system for 365 kWh would be \$76.65.

⁵⁹ Energy draw is based on a vendor estimate for a school installation (Email dated October 11, 2019 to Victor Juan)