

Demonstration of the New Improved Consolidated Point Sources Criteria, Toxics and GHG Annual Emissions Inventory System based on Device level reporting

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ABSTRACT

Under SCAQMD's Annual Emission Reporting (AER) Program, there are approximately 2,000 facilities that are required to report their annual criteria, toxics, and Air Toxics "Hot Spots" (AB 2588) program quadrennial toxics emissions inventory. The reported data provides the basis for the point source emissions inventory for the development of SIPs, control strategies, rules and regulations, public policy, and emission fees. SCAQMD has offered electronic reporting tools to facilities since 1996. Recently, a new improved consolidated AER web reporting tool has been developed by SCAQMD and Ecotek based on a more detailed reporting approach.

The new consolidated AER reporting tool is based on device level reporting and built around the SCAQMD's facilities permit profile structure to enhance data quality, data sharing and accessibility to SCAQMD's engineering, compliance, and planning divisions. The AER reporting tool's user friendly interface, for both reporting facilities and SCAQMD staff, contains easy-to-use screens to define, categorize, and report emission sources, calculation "wizards", built-in defaults for selected sources, reports, data validation, fees calculation, automatic assignment of SCCs, and "Import Last Year" data feature. Additionally, the new AER reporting tool has a separate module for SCAQMD staff to process, audit, generate reports, and export data to the California Air Resource Board's CEIDARS database which is ultimately submitted to EPA. Moreover, to reduce the burden of the new detailed reporting on a device level, a group reporting feature has been developed for combustion sources. This demonstration will illustrate the use of the new consolidated AER.

INTRODUCTION

Under SCAQMD's Annual Emission Reporting (AER) Program, there are approximately 2,000 facilities that are required to report their annual criteria, toxics, and Air Toxics "Hot Spots" (AB 2588) program quadrennial toxics emissions inventory. The reporting thresholds for the facilities subject to the AER program are 4 tons per year (tpy) or more of Volatile Organic Compounds (VOC), Specific Organic Gases (SPOG), Nitrogen Oxides (NO_x), Sulfur Oxides (SO_x), or Particulate Matter (PM), or 100 tpy or more of Carbon Monoxide (CO). Under SCAQMD Rule 301 facilities are required to report their annual emissions from permitted and non-permitted equipment and processes. Facilities are also required to pay emission fees for total emissions exceeding any of reporting thresholds for both criteria pollutants and 24 toxic air contaminants and ozone depleting compounds. The reported data provides the basis for the point source emissions inventory for the development of SIPs, control strategies, rules and regulations, public policy, and emission fees.

The revenues received through the annual emission fees are about \$ 20 million, which accounts for about 15 percent of SCAQMD's total annual revenues. These revenues are used to fund SCAQMD efforts to ensure compliance with Clean Air regulations, air quality monitoring, permit processing, rule development, technology advancement, business assistance, and air quality planning activities.

Therefore, it is important that the annual emissions reporting program is implemented in a timely, efficient, and accurate manner while adequate data quality and integrity are maintained.

The SCAQMD's AER program is responsible for development of consolidated criteria and toxics annual emissions inventories for stationary point and area sources, auditing of emission reports, assisting in development of Air Quality Management Plan (AQMP), and managing special inventory-related projects.

SCAQMD has offered electronic reporting tools to facilities since 1996 which have incorporated a number of upgrades since then. In 2014, a new improved consolidated AER web reporting tool, developed by SCAQMD and Ecotek (contractor), was released based on a more detailed reporting approach in order to provide more streamlined reporting and processing of emissions data to:

- report consolidated toxics and criteria emissions data to CARB and U.S. EPA without the need for data de-aggregation,
- report GHG emissions as an option (add a consolidated GHG calculator), and
- collect data in the new format to enhance data quality, data sharing and data accessibility to SCAQMD's engineering, compliance, and planning divisions.

SCAQMD CONSOLIDATED ANNUAL EMISSION REPORT TOOL

The new consolidated AER reporting tool is based on device level reporting and is developed around the SCAQMD's permit profile structure in order to enhance emissions data quality, data sharing and data accessibility to SCAQMD's engineering, compliance, and planning divisions. The AER reporting tool's user friendly interface, developed separately for reporting facilities and SCAQMD staff, contains easy-to-use screens to define, categorize, and report emission sources, calculation "wizards", built-in defaults for selected sources, summary reports, data validation, fees calculation, automatic assignment of SCCs, and "Import Last Year" data feature. Additionally, the new AER reporting tool has a separate module for SCAQMD staff to process, audit, generate reports, and export data to the California Air Resource Board's CEIDARS database which is subsequently submitted to EPA. Moreover, to reduce the burden of the new detailed reporting on a device level, a group reporting feature has been developed for identical combustion sources burning the same fuel type.

The new AER Tool has the following main sections:

- **Facility Information:** This section contains facility's general information such as business classification, business location, operating schedule and contact information. It also allows the facility to inform SCAQMD of any business operating status changes.
- **Build Reporting Structure:** This section is for specifying combustion fuels used in the facility as well as identifying and/or adding emission sources for facility to the pre-loaded facility permit profile. In this section, each operating emission source is classified into at least one of seven emission source categories to facilitate reporting.
- **Report Process/Emissions:** This section contains specific worksheets designed for each source category for reporting processes, throughput (usage of materials/fuels), emission factors, and other activity data, and calculating emissions for all emissions sources identified in "Build Reporting Structure".

- **Summaries:** This section allows the facility to review the resulting emissions calculated for the facility's permitted and non-permitted emission sources. This section also includes detailed report on criteria and toxics fees as well as the total fees due.
- **Data Validation:** This section displays errors (which have to be resolved before submitting) and warnings (reasonableness checks).
- **Report Submission:** Once all errors are resolved and warnings are checked, the report can be submitted to SCAQMD electronically. The AER tool will then generate a confirmation page which has to be mailed along with other summary forms and any fees due to SCAQMD.

The new tool also contains the following additional features:

- Ability to classify permitted and non-permitted emission sources,
- Option for GHG calculation (for combustion built-in Tier 1 defaults),
- Intuitive in converting and displaying combustion fuel throughputs,
- Displaying all emissions (Criteria, TAC/ODC and GHGs) on the same screen,
- Built-in parameters for unique emission calculation methodologies,
- Importing EPA TANK model results,
- Uploading supporting documentation,
- Data sorting,
- User comment fields,
- Saving of partial data,
- Unit conversion calculator: for conversions commonly used and not built into the worksheets,
- References for summaries,
- Printing,
- Uploading supporting documentation feature,
- Pdf reports for simplified overview and printing,
- Excel reports containing detail information about emissions sources, processes and emissions data, and
- Separate SCAQMD staff processing module including additional automatic QA/QC flags and procedures.

The new AER reporting system provides efficiencies that help reduce staff resources to administer the AER Program. It also improves SCAQMD's customer service by providing a more intuitive and user-friendly web interface for both facilities reporting emissions and internal users.

DEMO

This demonstration will illustrate the use of the new SCAQMD AER reporting software for consolidated reporting of criteria, toxic emissions and optional GHG emissions.

The **New** 2014 AER Reporting Tool Demonstration

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AER Home

New user: Complete a one time registration **Registered User: Login**

You are not logged in.

South Coast Air Quality Management District

Welcome to South Coast AQMD Annual Emissions Reporting (AER)

About AQMD Annual Emissions Reporting (AER)

The South Coast Air Quality Management District's (AQMD's) Annual Emission Reporting (AER) program was developed to track emissions of air contaminants from permitted facilities. Emission fees are also assessed based on reported data. The data collected by AER is used to update the comprehensive emissions inventory for the AQMD, which includes Orange County, the non-desert portions of Los Angeles and San Bernardino counties, and the Riverside county areas west of the Palo Verde Valley.

This annual emissions inventory of pollutants and source categories is essential to effectively design and evaluate clean air strategies to comply with state and federal public health standards.

The AER is required for all facilities subject to Rule 301(e) and 301(l)(10). Additional information on the AER Program can be found at www.aqmd.gov/aer/aer.html

User Login

Username:

Password:

Sign In

Forgot your username or password? [Click here to reset your password.](#)

New User? Complete a one-time registration process.

Register here

After establishing a user account, you can access and update the AERs for your facility(ies) using AQMD-assigned access pin codes.

Notice

All information entered on this computer system may be monitored, recorded, read, copied, and disclosed by and to authorized personnel for official purposes. Access or use of this computer system by any person, whether authorized or unauthorized, constitutes consent to these terms.

[AQMD web site Home](#) | [AER Web Site](#) | [Submit question/comment](#) | [Ecotek Web Site](#)

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User Registration

Complete User Registration and click on **Sign Up**.
You will receive an email to the registered address with a link that requires you to click to confirm your email and will automatically log you in.

The screenshot shows the 'User Registration' form within the 'AER Home - Access Facility' interface. The form is divided into three main sections: 'User Profile', 'Work Address', and 'Work Phone'. Each field is marked with a red asterisk to indicate it is mandatory. The 'User Profile' section includes fields for Username, E-mail, Title, First Name, Last Name, Password, and Confirm Password. The 'Work Address' section includes Company, Street Direction (dropdown), Street Number, Street Name, Street Suffix (dropdown), Suite, City, State (dropdown, currently set to California), Zip, and Zip Four. The 'Work Phone' section includes Phone Number and Fax Number, each with area code, number, and extension sub-fields. A 'Sign Up' button is located at the bottom left, and a 'Cancel' button is at the bottom right.

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Enter Facility ID & PIN

Once you are logged-in, the screen below will be displayed.
To access a facility, enter Facility ID and the PIN code provided by AQMD.

The screenshot shows the 'Access Facility' page within the 'AER Home - Access Facility' interface. The page header includes the South Coast AQMD logo and the text 'South Coast Air Quality Management District'. The user is logged in as 'test 2014' and has options for 'Logout' and 'Edit Profile'. The main content area is titled 'Access Facility' and contains instructions: 'Please enter a facility ID# and PIN code to access facility detail information. Alphanumeric PIN is issued by the SCAQMD to specific facility and must be typed exactly as presented.' It also provides contact information for assistance: 'If you need assistance on locating the PIN, please contact AER Support by email at aer@aqmd.gov or Hotline at (909)396-3660.' Below the text are input fields for 'Facility ID:' and 'Facility PIN:', followed by an 'Access Facility' button. The footer contains links: 'AQMD web site Home | AER Web Site | Submit question/comment | Ecotek Web Site | Report a Bug'.

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Select Reporting Year

Click **Open** to access selected facility and start the reporting process.

South Coast Air Quality Management District

test 2014
Logout | Edit Profile

AER Home Access Facility Facility Home

Select Reporting Year

You have successfully logged on to facility ID 999921

Facility Information
Facility ID: 999921
Facility name: ABC
Address: 123 1st
City: LOS ANGELES
ZIP: 90063

Please select a reporting year from the list below (by clicking on the "OPEN" button for desired reporting year) in order to begin using the AER Program.

If you do not see the reporting period you want to work on, please contact AQMD AER Hotline at 909-396-3660 or aer@aqmd.gov.

Year	Status	Deadline	Submittal Date	
2012	Available	3/5/2013		Open...
2013	Available	3/4/2014		Open...
2014	WorkInProgress	6/4/2015		Open...

Access Different Facility

Please enter a facility ID# and PIN code to access facility detail information. Alphanumeric PIN is issued by the SCAQMD to specific facility and must be typed exactly as presented.

If you need assistance on locating the PIN, please contact AER Support by email at aer@aqmd.gov or Hotline at (909)396-3660.

Facility ID:
Facility PIN:

[Access Facility](#)

[AQMD web site Home](#) | [AER Web Site](#) | [Submit question/comment](#) | [Ecotek Web Site](#) | [Report a Bug](#)

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AER Tool Main Sections

The AER Tool has 4 main sections that have to be completed in the following order:

1. Facility Information
2. Build Reporting Structure
3. Report Process/Emissions
4. Summaries

These sections are accessible from a menu on the left, and from "Facility Home" page.

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AER Report Overview

- 1) To start the reporting process, first provide general Facility Information in **“Facility Information”** section.
- 2) Next, specify the combustion fuels used at your facility and set-up emission sources in **“Build Reporting Structure”** section, prior to identifying your processes and reporting your emissions.
- 3) Then, proceed to **“Report Process/Emissions”** section to enter throughput data and calculate emissions for each device and process.
- 4) Finally, select **“Summaries”** to view emissions results and associated fees.

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AER Report Overview Cont.

- 5) Run **“Data Validation”** and make sure there are no Errors
 - If errors displayed, click on the link provided to resolve errors
 - If warning displayed, click on the link provided to check the data entered
- 6) Upload supporting documentation if desired
- 7) Submit the report through **“Report Submission”**
- 8) Print Submittal forms (including Submittal Conformation) to be sent to AQMD
- 9) Sign Signature Sheet, attach other submittal forms and check for fee due (if any), and mail to AQMD

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Facility Home Page

Click on **Start Here** button to start reporting

test 2014
Logout | Edit Profile

South Coast
AQMD Air Quality Management District

AER Home Access Facility Facility Home

Facility ID: 999921 - ABC - Reporting period: 2014

This is the Facility Home Page which specifies the main elements of the AER Program. For detail Instructions please click on Help icon. The main AER elements are accessible on menu on the left, and on this page by clicking on Section name below.

[Import last year](#)

STEP 1) Facility Information OPEN

This section contains your facility's general information such as business classification, business location, operating schedule and contact information. You can also inform AQMD about your business operating status changes. **Start Here**

STEP 2) Build Reporting Structure OPEN

This section is for specifying combustion fuels used in your facility as well as identifying and/or adding emission sources for your facility to the pre-loaded facility permit profile.

STEP 3) Report Process / Emissions OPEN

This section contains worksheets for reporting your processes, throughput (usage of materials/fuels), emission factors, and other activity data, and calculating emissions for all emissions sources identified in "Set-up Reporting Structure".

STEP 4) Summaries OPEN

This section allows you to review the resulting emissions from your facility's permitted and non-permitted emission sources. This section also includes detailed report on all fees and amount due.

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Facility Home Page (cont.)

Or click on **"Import Last year"** link to import most of the data if you used this tool last year

test 2014
Logout | Edit Profile

South Coast
AQMD Air Quality Management District

AER Home Access Facility Facility Home

Facility ID: 999921 - ABC - Reporting period: 2014

This is the Facility Home Page which specifies the main elements of the AER Program. For detail Instructions please click on Help icon. The main AER elements are accessible on menu on the left, and on this page by clicking on Section name below.

[Import last year](#)

STEP 1) Facility Information OPEN

This section contains your facility's general information such as business classification, business location, operating schedule and contact information. You can also inform AQMD about your business operating status changes. **Start Here**

STEP 2) Build Reporting Structure OPEN

This section is for specifying combustion fuels used in your facility as well as identifying and/or adding emission sources for your facility to the pre-loaded facility permit profile.

STEP 3) Report Process / Emissions OPEN

This section contains worksheets for reporting your processes, throughput (usage of materials/fuels), emission factors, and other activity data, and calculating emissions for all emissions sources identified in "Set-up Reporting Structure".

STEP 4) Summaries OPEN

This section allows you to review the resulting emissions from your facility's permitted and non-permitted emission sources. This section also includes detailed report on all fees and amount due.

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Facility General Information

South Coast
Air Quality Management District

test 2014
[Logout](#) | [Edit Profile](#)

AER Home Access Facility Facility Home

Facility ID: 999921 · ABC · Reporting period: 2014

Facility ID: 999921

Facility Information

[General](#)

[Address](#)

[Other Information](#)

[Contacts](#)

[Operating Schedule](#)

[Status Update](#)

Build Reporting Structure

[Combustion Fuels](#)

[Emission Sources \(ES\)](#)

Report Process/Emissions Summaries

[Data Validation](#)

[Print Facility Report](#)

[Excel Reports](#)

[Report Submission](#)

Facility Information

This section contains your facility's general information such as business classification, business location, operating schedule and contact information. You can also inform AQMD about your business operating status changes, such as location address change, provide status update, or request an exemption from future emission reports.

General Facility Info

Facility ID	999921
Reporting Year	2014
RECLAIM	<input checked="" type="checkbox"/>
RECLAIM Designation	RIN
Title V	<input checked="" type="checkbox"/>
AB2588	<input checked="" type="checkbox"/>
- AB2588 Phase	1A
- AB2588 Reporting Year	<input type="checkbox"/>

County:

Air Basin:

Latitude:

Longitude:

Address

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Facility General Information Cont.

Facility ID: 999921

Facility Information

[General](#)

[Address](#)

[Other Information](#)

[Contacts](#)

[Operating Schedule](#)

[GHG Additional Info](#)

[Status Update](#)

Build Reporting Structure

[Combustion Fuels](#)

[Emission Sources \(ES\)](#)

Report Process/Emissions Summaries

[Data Validation](#)

[Print Facility Report](#)

[Excel Reports](#)

[Report Submission](#)

Check here to include GHG

ARB GHG ID:

EPA GHG ID:

Check here if your facility produces electricity

Check here to report fugitive emissions subject to Rule 1173 and/or 1176.

Check here for Small Business as defined in Rule 102.

Check this box to report non-routine emissions such as Upsets, Break-down, Spills, Start-up, Shut-down, and Turn-around.

Contacts

Main Contact

First Name	<input type="text" value="John"/>
Last Name	<input type="text" value="Smith"/>
Title	<input type="text" value="VP"/>
Telephone #	<input type="text" value="(111) 111-1111 * Ext. 11"/>
Fax #	<input type="text" value="(111) 111-1112"/>
Email	<input type="text" value="111@abc.com"/>

Preparer

Same as Main Contact

Authorized Facility Representative

Same as Main Contact

Operating Schedule

Average Hours Per Day	<input type="text" value="8"/>
Average Days Per Week	<input type="text" value="5"/>
Average Weeks Per Year	<input type="text" value="52"/>

Additional GHG Information

No additional information is required.

Save updated information

You must click the following button if changes in this form should be saved.

Click on **Save**, then **Next** and continue until you have completed all *sections* of "Facility Information" including "Status Update"

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Facility General Information Cont.

South Coast AQMD Air Quality Management District

test 2014
Logout | Edit Profile

AER Home Access Facility Facility Home

Facility ID: 999921

Form data is successfully saved.

Facility ID: 999921 - ABC - Reporting period: 2014

Facility Information

Status Update

Facility ID: 999921

Facility Shutdown

Change of Ownership

Change in Equipment Location

Emissions are zero for this year's report, or emissions reduced by 50%

Exemption Request

Use of Alternative Calculation methodology

Other

Refund Request

Refund Amount: \$ 1,500.00

Explanation:

Save updated information

You must click the following button if changes in this form should be saved.

[Save](#) [Next](#)

The **Next** button on "Status Update" page will take you to "Combustion Fuels" in "Build Reporting Structure"

Combustion Fuels

Select all combustion fuels used in your facility on this screen.
To add a fuel, click on [Add New Fuel](#).

South Coast AQMD Air Quality Management District

test 2014
Logout | Edit Profile

AER Home Access Facility Facility Home

Facility ID: 999921 - ABC - Reporting period: 2014

Facility ID: 999921

Form data is successfully saved.

Combustion Fuels Specification

Specify all the combustion fuels (fuels being burned) used in your facility during the reporting year (do not include fuels used exclusively in vehicles).

[Add New Fuel](#)

Action	Fuel Name	HHV	Default	Comment	Data Source Name
Open	Distillate Fuel Oil No. 2	138.00	YES		
Open	Propane	91.00	YES		

[Next](#)

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Adding Combustion Fuel

South Coast AQMD Air Quality Management District

test 2014
Logout | Edit Profile

AER Home Access Facility Facility Home

Facility ID: 999921 · ABC · Reporting period: 2014

Facility ID: 999921

Edit Combustion Fuel Data

Fuel	Propane
HHV	<input checked="" type="checkbox"/> Use Default 91.00 mmBtu/1000 gallon
Comment	

[Save](#) or [Cancel](#)

[AQMD web site Home](#) | [AER Web Site](#) | [Submit question/comment](#) | [Ecotek Web Site](#) | [Report a Bug](#)

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Emission Sources (ES)

- The New AER reporting system is based on “Device” level as Emission Source (ES):
 - For example: A permitted unit (1 A/N) consisting of a dryer and a printing press has to be reported as 2 devices (2 ES).
- List of permits and if available devices will be preloaded for each facility. If list of devices is not available in the AQMD database, the user has to enter the devices (if permitted appropriate permit and application number).

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Emission Sources (ES)

This screen displays a list of Application Numbers, and Devices if available from AQMD permitting Database. Each device has been assigned Emission Source (ES) ID.

To add a new Emission Source, Click on **Add New Emission Source**

ES Cont.

To define each pre-loaded Emission Source Click on **Open**

ES Cont.

South Coast AQMD Air Quality Management District

test 2014
Logout | Edit Profile

AER Home Access Facility Facility Home

Facility ID: 999921

Facility ID: 999921 - ABC - Reporting period: 2014

Edit Emission Source

Providing correct information and proper selection categories would help to classify emission source.

Permitted

A/N 312183

Permit No D96650

Permit Device ID

AER Device ID will be assigned upon saving

ES Name Boiler #2

Operating ES Status

Comment

Emission Source Category **Categorize Emission Source**

Design Capacity 8.00 MILLION BTU PER HOUR

Save and return to List of Emission Sources or Save and proceed to Process Reporting or Cancel

Optional: Save and Mark as Completed

AQMD web site Home | AER Web Site | Submit question/comment | Ecotek Web Site | Report a Bug

Provide a Name for the ES. Then select "ES Status" to specify the operating status. Click on **Categorize Emission Source** (See Next Slide)

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ES Cont.

South Coast AQMD Air Quality Management District

Logout | Edit Profile

AER Home Access Facility Facility Home

Facility ID: 999921

Facility ID: 999921 - ABC - Reporting period: 2014

Categorize Emission Source

Permitted	A/N	Permit No	Permit Device ID	Permit Equipment Description	AER Device ID	ES Name
Yes	312183	D96650				Boiler #2

1. External Combustion Equipment (e.g., boiler, dryer, oven, furnace, heater, afterburner, flare, kiln or incinerator) [click here](#) to select one of the following Equipment:

Boiler <10 MMBTU/HR

Boiler 10-100 MMBTU/HR

Boiler >100 MMBTU/HR

Oven <10 MMBTU/HR

Oven 10-100 MMBTU/HR

Oven >100 MMBTU/HR

Dryer <10 MMBTU/HR

Dryer 10-100 MMBTU/HR

Dryer >100 MMBTU/HR

Furnace <10 MMBTU/HR

Furnace 10-100 MMBTU/HR

Furnace >100 MMBTU/HR

Heater <10 MMBTU/HR

Heater 10-100 MMBTU/HR

Heater >100 MMBTU/HR

Space/Water heater - not related to a process <10 MMBTU/HR

Afterburner <10 MMBTU/HR

Afterburner 10-100 MMBTU/HR

Afterburner >100 MMBTU/HR

Kilns

Incinerator

Flare

Save Cancel

Optional: Save and Mark as Completed

Click on the applicable Emission Source Group Type for each ES and select the applicable equipment type then **Save**

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ES Cont.

South Coast Air Quality Management District

test 2014
Logout | Edit Profile

AER Home Access Facility Facility Home

Facility ID: 999921 - ABC - Reporting period: 2014

Edit Emission Source

Providing correct information and proper selection categories would help to classify emission source.

Permitted

A/N 312183 312183

Permit No D96650

Permit Device ID

AER Device ID will be assigned upon saving

ES Name Boiler #2

Operating ES Status Normal Operation

Comment

Emission Source Category External Combustion
Categorize Emission Source

Design Capacity 8.00 MILLION BTU PER HOUR

Save and return to List of Emission Sources | Save and proceed to Process Reporting or Cancel

Optional: Save and Mark as Completed

To choose to define all Emission Sources prior to reporting emissions (Navigation path #1), click on **Save and Return to List of Emission Sources**

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ES Cont.

South Coast Air Quality Management District

test 2014
Logout | Edit Profile

AER Home Access Facility Facility Home

Facility ID: 999921 - ABC - Reporting period: 2014

Form data is successfully saved.

Build Reporting Structure

Emission Sources (ES) Classification

This section contains facility permit profile. Please make sure that every device has a specified Emission Source (ES). New emission sources can also be added.

EPA TANKS Software DATA IMPORT - [Click here](#) for more instructions.

Displaying 36 emission sources. You can use filter to narrow down selection.

A/N Permit NO Permit Device ID Permit Device ID

AER Device ID Permit NO Permit Device ID

Search Emission Sources

Add New Emission Source

Search: Print Preview

Action	A/N	Permit NO	Permit Device ID	Permit Equipment Description	AER Device ID	ES Name	Source Category	Has Emissions	Equipment	ES Status	Process Reference
Open	537024	0123	022	TANK CHROME PLATING HEXAVALENT	ES36	External Combustion	Y	Boiler #10	MMBTUHR	Work in progress	Reference

Based on the Information provided in previous 2 screens, the application will populate the overview table to initiate the reporting process on the emissions worksheets. You can either continue defining the rest of your emission sources or ...

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ES Cont.

Facility ID: 999921

Facility Information

Build Reporting Structure

Combustion Fuels

Emission Sources (ES)

Report Process/Emissions Summaries

Data Validation

Print Facility Report

Excel Reports

Report Submission

Facility ID: 999921 - ABC - Reporting period: 2014

Edit Emission Source

Providing correct information and proper selection categories would help to classify emission source.

Permitted

A/N 537024

Permit No G123

Permit Device ID D22

Permit Equipment Description TANK CHROME PLATING HEXAVALENT

AER Device ID ES36

ES Name Boiler #2

Operating ES Status Normal Operation

Comment

Emission Source Category External Combustion

Categorize Emission Source

Design Capacity 8.00 MILLION BTU PER HOUR

Save and return to List of Emission Sources or **Save and proceed to Process Reporting** or Cancel

Optional: Save and Mark as Completed

If you choose to report your process emissions immediately after defining each ES (Navigation path #2), click on **Save and Proceed to Process Reporting**

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ES Cont.

Facility ID: 999921

Form data is successfully saved.

Build Reporting Structure

Combustion Fuels

Emission Sources (ES)

Emission Sources (ES) Classification

Process References

A/N	Permit NO	Permit Device ID	Permit Device Description	AER Device ID	ES Name	Source Group	Emissions?	Equipment	ES Status
537024	G123	D22	TANK CHROME PLATING HEXAVALENT	ES36	Boiler #2	External Combustion	y	Boiler <10 MMBTUHR	Work in progress

Process ID P1

Source Group External Combustion

Process Name

Process Status Work in progress

Operation Type routine

Add Process

OK

Click to open the initiated Process to Report Emissions (see next slide)

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Switch from ES to Process

test 2014
Logout | Edit Profile

South Coast AQMD Air Quality Management District

AER Home Access Facility Facility Home

Facility ID: 999921 - ABC - Reporting period: 2014

Facility ID: 999921

Back to Emission Source Process Reference

External Combustion

Please provide specific information for every process associated with your external combustion Emission Sources including usage, emission factor and control efficiency (if any). You must select Fuel and throughput units before reporting emissions. Detail instructions are available by clicking on Help icon in the tool bar.

Optional: Mark as Completed

Step 1: Process

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Equipment	Fuel
Open ES36	D22	537024	P1		Boiler <10 MMBTU/HR	

Click here to delete this process.

Step 2: Throughput

Annual Throughput	Criteria/Toxic Throughput	GHG Throughput
Open		

Step 3: Criteria Emissions (lbs) Use Default Emission Factors if available.

Pollutant	EF	Unit	EF Data Source	Emissions
Open VOC		lbs /		
Open NOx		lbs /		
Open SOx		lbs /		
Open CO		lbs /		
Open PM		lbs /		

Step 4: Toxic (TAC/ODC) Emissions (lbs)

TAC/ODC Group	CAS #	EF	Unit	EF Data Source	Emissions

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Access Emissions Worksheets

Click on "Report Process/Emissions" to see a list of all worksheets that were assigned based on information provided on Emission Sources section

test 2014
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South Coast AQMD Air Quality Management District

AER Home Access Facility Facility Home

Facility ID: 999921 - ABC - Reporting period: 2014

Facility ID: 999921

Report Process/Emissions

This section contains worksheets for reporting your processes, throughput (usage of materials/fuels), emission factors, and other activity data, and calculating emissions for all emissions sources identified in "Set-up Reporting Structure".

External Combustion (1) OPEN

Internal Combustion (1) OPEN

Other Processes (1) OPEN

Click on the worksheet you want to work on. If you click on Internal Combustion... (see next slide)

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Internal Combustion Process List

By clicking on each worksheet name, a list of all processes for the worksheet will be displayed.

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AER Home Access Facility Facility Home

Facility ID: 999921 - ABC - Reporting period: 2014

Facility ID: 999921

Internal Combustion

Please provide specific information for every process associated with your internal combustion Emission Sources including usage, emission factor, and control efficiency (if any). You must select Fuel and throughput units before reporting emissions. Detailed instructions are available by clicking on Help icon in the tool bar.

Internal Combustion Process List Overview

Add New Print Preview

	AER Device ID	Permit Device ID	A/N	Process ID	Status	Equipment	Fuel
Open	ES35	D21	309722	P1	Work in Progress	Stationary I.C. Engines, 4 Stroke-Rich Burn	
Open	ES13	D8	555555	P1	Work in Progress	Stationary I.C. Engines, 4 Stroke-Rich Burn	Distillate Fuel Oil No. 2

Search:

Click "Open" to open the Process you want to work on

Worksheet Organization

Each worksheet has the following that need to be completed in this order:

- 1) First Complete the Process (select fuel or activity or material type),
- 2) Enter fuel usage or throughput and specify units,
- 3) For combustion worksheets, toxic defaults are automatically assigned (after you select fuel type). For criteria and GHG defaults, you have to click on "Use Default Emission Factors..."
- 4) For other worksheets, select pollutant and enter Emission Factor and Emission Factor Data Source
- 5) Emissions will be calculated and displayed for each process.
- 6) Review Summaries in summary tables

Worksheet Main Sections

Facility ID: 999921

Internal Combustion

Please provide specific information for every process associated with your internal combustion Emission Sources including usage, emission factor, and control efficiency (if any). You must select Fuel and throughput units before reporting emissions. Detailed instructions are available by clicking on Help icon in the tool bar.

Step 1: Process Optional: Mark as Completed

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Equipment	Fuel
Open ES13	D8	555555	P1	1470	Stationary I.C. Engines, 4 Stroke-Rich Burn	Distillate Fuel Oil No. 2

Click here to [delete](#) this process.

Step 2: Throughput

Annual Throughput	Criteria/Toxic Throughput	GHG Throughput
Open 2,000.00000000 bbl	84.00 M gal	84,000.00 gal

Use [Default Emission Factors](#) if available.

Step 3: Criteria Emissions (lbs)

Pollutant	EF	Unit	EF Data Source	Emissions
Open VOC	37.500000	lbs / M gal	AQMD default	3,150.00
Open NOx	469.000000	lbs / M gal	AQMD default	39,396.00
Open SOx	0.210000	lbs / M gal	AQMD default	17.64
Open CO	102.000000	lbs / M gal	AQMD default	8,568.00
Open PM	33.500000	lbs / M gal	AQMD default	2,814.00

Step 1) Process Info: Click Open to complete

Step 2) Throughput Info: Click Open to complete

Step 3) Default Emission Factors will assign criteria and GHG defaults (if available)

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Process Information

Edit Emission Process - Internal Combustion

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Equipment	Fuel
ES13	D8	555555	P1	1470	Stationary I.C. Engines, 4 Stroke-Rich Burn	Distillate Fuel Oil No. 2

AER Device ID: ES13 AER Device Name: ICE #1

PERMITTED AN: 555555 Permit Device ID: D8

Process ID: P1 Process Name: Primary Fuel

Process Comment: _____

Fuel: **Distillate Fuel Oil No. 2** * [* Add Rule](#)

Rule #: 1470

Equipment: Stationary I.C. Engines, 4 Stroke-Rich Burn

Save **Cancel**

The drop list consists of the fuels listed in the [Combustion Fuels](#) section. Select fuel type before you proceed (fuel type determines corresponding throughput units and assigns default EFs).

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Throughput

Based on fuels selected, different options for throughput units will be offered:

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Equipment	Fuel
ES13	D8	55555	P1	1470	Stationary I.C. Engines, 4 Stroke-Rich Burn	Distillate Fuel Oil No. 2
Annual Throughput		Criteria/Toxic Throughput			GHG Throughput	
2,000.00000000 bbl		84.00 M gal			84,000.00 gal	
Fuel Usage (Annual Throughput)						
Throughput Type		Input *			* bbl *	
Fuel Usage Comment						
Optional Comment						
						Save Cancel

You have to list throughput and throughput units, then save.

You can also provide optional data.

Application will automatically convert throughput to units needed to calculate criteria and GHG emissions.

Throughput

	Annual Throughput	Criteria/Toxic Throughput	GHG Throughput
Open	2,000.0 bbl	84.0 M gal	84,000.0 gal

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Using Criteria & GHG Defaults

South Coast AQMD
Air Quality Management District

Facility ID: 999921

Internal Combustion

Step 1: Process

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Equipment	Fuel
Open	ES13	D8	55555	P1	1470	Stationary I.C. Engines, 4 Stroke-Rich Burn

Step 2: Throughput

Annual Throughput	Criteria/Toxic Throughput	GHG Throughput	
Open	2,000.00000000 bbl	84.00 M gal	84,000.00 gal

Step 3: Criteria Emissions (lbs)

Pollutant	EF	Unit	EF Data Source	Emissions
Open	VOC	37.500000 lbs / M gal	AQMD default	3,150.00
Open	NOx	469.000000 lbs / M gal	AQMD default	39,396.00
Open	SOx	0.210000 lbs / M gal	AQMD default	17.64
Open	CO	102.000000 lbs / M gal	AQMD default	8,568.00
Open	PM	33.500000 lbs / M gal	AQMD default	2,814.00

South Coast AQMD Air Quality Management District

Facility ID: 999921 - ABC - Reporting period: 2014

Internal Combustion

Please provide specific information for every process associated with your internal combustion Emission Sources including usage, emission factor, and control efficiency (if any). You must select Fuel and throughput units before reporting emissions. Detailed instructions are available by clicking on Help icon in the tool bar.

Optional: Mark as Completed

Use [Default Emission Factors](#) if available.

Click on Default Emission Factors to populate criteria and GHG defaults, if available.

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Entering Site Specific EF

To enter specific EF, select pollutant, un-check Use Default, enter specific EF value and select Emissions Factor Data Source. The other data fields are optional.

Open Criteria Emission Information - Internal Combustion

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Equipment	Fuel
ES13	D8	555555	P1	1470	Stationary I.C. Engines, 4 Stroke-Rich Burn	Distillate Fuel Oil No. 2
Annual Throughput		Criteria/Toxic Throughput			GHG Throughput	
2,000.00000000 bbl		84.00 M gal			84,000.00 gal	

Throughput used to calculate emissions: 84.00 M gal

Pollutant: **NOx - Nitrogen Oxides**

Emission Factor (EF): **395.000000** * lbs/M gal

Use default
 RECLAIM

Emission Factor Comment:

Emission Factor Data Source: **Source Test**

Emissions: 33,180.00 lbs

Save **Cancel**

Emissions are automatically calculated and transferred to summaries.

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Choose Different Worksheets

South Coast Air Quality Management District

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AER Home Access Facility Facility Home

Facility ID: 999921 · ABC · Reporting period: 2014

Other Processes

This reporting screen is for reporting activity data for other processes used in your facility which were not covered in previous reporting screens. Please provide specific information for every associated emission source. You must select Activity and throughput units before reporting emissions. If the operation of such sources involves burning fuels, make sure emissions generated from burning fuels are reported separately. Combined emissions can also be reported here; however, it must be substantiated to avoid double reporting. Detailed instructions are available by clicking on Help icon in the tool bar.

Other Process Emissions Process List Overview

Other Processes

AER Device ID	Permit Device ID	A/N	Process ID	Status	Activity	Throughput	Units
Open	ES34	D20	398104	P1	Work in Progress	0	

Search:

Select different worksheet from the left menu. To select process, click on **Open**.

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General Worksheet Approach

Facility ID: 999921

Facility Information
Build Reporting Structure
Combustion Fuels
Emission Sources (E5)
Report Process/Emissions

Combustion
External Combustion
Internal Combustion

Use of organics
Spray Coating/Spray Booth
Other Use of Organics

Storage Tanks
Fugitive Components

Other Processes
Process Upset

Summaries
Data Validation
Print Facility Report
Excel Reports
Report Submission

Facility ID: 999921 - ABC - Reporting period: 2014

Other Processes

This reporting screen is for reporting activity data for other processes used in your facility which were not covered in previous reporting screens. Please provide specific information for every associated emission source. You must select Activity and throughput units before reporting emissions. If the operation of such sources involves burning fuels, make sure emissions generated from burning fuels are reported separately. Combined emissions can also be reported here; however, it ~~must~~ be substantiated to avoid double reporting. Detailed instructions are available by clicking on Help icon in the tool bar.

Step 1: Process Optional: Mark as Completed

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES34	D20	398164	P1		

Click here to ~~delete~~ this process.

Step 2: Throughput

Annual Throughput

Step 3: Criteria Emissions (lbs)

Pollutant	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
Add New						

Step 4: Toxic (TAC/ODC) Emissions (lbs)

TAC/ODC Group	CAS #	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
Add New							

Step 5: GHG Emissions (kilograms)

Pollutant	EF	Unit	EF Data Source	EF Methodology	Emissions	Units	GWP	CO2e
Add New								

Step 1) Process info: Click **Open** to complete

Step 2) Throughput info: Click **Open** to complete

Step 3) Emissions: Click **Add New** to select pollutant or TAC and complete. For example: select VOC for pollutant and enter data for VOC

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Entering VOC Data

Select pollutant, enter EF, EF Data Source, and Overall Control Efficiency, if any. Emissions will be automatically calculated and transferred.

Open Criteria Emission Information - Other Processes

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity
ES34	D20	398164	P1		

Annual Throughput

Pollutant: **VOC** *

Emission Factor (EF): **1.2000** * lbs/
 Controlled EF value
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency: **0.80000**

Emission Factor Comment:

Emission Factor Data Source: **MSDS** *

Emissions: 0.00 lbs

Save **Cancel**

Review Summaries

Facility ID: 999921 · ABC · Reporting period: 2014

Facility ID: 999921

- Facility Information
- Build Reporting Structure
- Combustion Fuels
- Emission Sources (ES)
- Report Process/Emissions
- Summaries

Criteria Pollutants

- Toxic (TAC/ODC) Pollutants
- GHG Pollutants
- Fees
- Data Validation
- Print Facility Report
- Excel Reports
- Report Submission

Criteria Pollutants Summary

Permitted Emissions Summary

	VOC (tons)	SPOG (tons)	NOx (tons)	NOx RECLAIM (tons)	SOx (tons)	SOx RECLAIM (tons)	CO (tons)	PM (tons)
External Combustion								
Internal Combustion	1.58			19.70	0.01		4.28	1.41
Spray Coating / Spray Booth								
Other Use of Organics								
Storage Tanks								
Fugitive Components								
Other Process Emissions								
Shutdown/Startup/Turnaround and Upsets								
Total Permitted Emissions	1.58	0.00	0.00	19.70	0.01	0.00	4.28	1.41

Non-Permitted Emissions Summary

	VOC (tons)	SPOG (tons)	NOx (tons)	NOx RECLAIM (tons)	SOx (tons)	SOx RECLAIM (tons)	CO (tons)	PM (tons)
External Combustion								
Internal Combustion								
Spray Coating / Spray Booth								
Other Use of Organics								
Storage Tanks								
Fugitive Components								
Other Process Emissions								
Shutdown/Startup/Turnaround and Upsets								
Total Non-Permitted Emissions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Summaries Cont.

Facility ID: 999921

- Facility Information
- Build Reporting Structure
- Combustion Fuels
- Emission Sources (ES)
- Report Process/Emissions
- Summaries

Toxic (TAC/ODC) Pollutants

- GHG Pollutants
- Fees
- Data Validation
- Print Facility Report
- Excel Reports
- Report Submission

TAC/ODC Pollutants Summary

Toxic Air Contaminants (TAC) / Ozone Depleting Compounds (ODC) Emissions and Fees Summary

TAC Group	TAC / ODC	Reference	Annual Emissions (lbs)	Emissions Subject to Fee (lbs)	Fee Rates (\$/lbs)	Fee Due
32	Ammonia	Reference	2.436e+2	244	0.03	7.32
1	Asbestos	Reference	1.565e+1	16	2.00	32.00
2	Benzene	Reference	1.825e+1	18	5.94	106.92
3	Beryllium	Reference	1.260e-1	0	5.94	0.00
4	Butadiene [1,3]	Reference				
5	Cadmium	Reference				
6	Carbon tetrachloride					
7	Chlorinated dioxins and dibenzofurans					
8	1,4-Dioxane					
9	Ethylene dibromide [1,2-Dibromoethane]					
10	Ethylene dichloride [1,2-Dichloroethane]					
11	Ethylene oxide	Reference	1.450e+2	145	0.44	63.80
12	Formaldehyde	Reference	8.400e-3	0	7.91	0.00
13	Chromium, hexavalent (and compounds)	Reference	1.344e-1	0	5.94	0.00
14	Arsenic and Compounds (Inorganic)	Reference	6.972e-1	1	2.00	2.00
15	Lead compounds (inorganic)	Reference				
16	Methylene chloride [Dichloromethane]					
17	Nickel	Reference	3.276e-1	0	3.94	0.00
18	Perchloroethylene [Tetrachloroethene]					
19	PAHs [PAH, POM]	Reference	4.656e+0	5	5.94	29.70
20	Trichloroethylene					
21	Vinyl chloride					
22	Fluorocarbons (chlorinated)					
23	Methyl chloroform [1,1,1-Trichloroethane]					
Fees due total (\$)						241.74

References

Reference	Process Type	Emissions (lbs)
EST3	Internal Combustion	1.565e+1

OK

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Summaries Cont.



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AER Home Access Facility Facility Home






Facility ID: 999921 - ABC - Reporting period: 2014

Facility ID: 999921

Facility Information

Build Reporting Structure

Combustion Fuels

Emission Sources (E5)

Report Process/Emissions

Summaries

Criteria Pollutants

Toxic (TAC/ODC) Pollutants

GHG Pollutants

Fees

Data Validation

Print Facility Report

Excel Reports

Report Submission

GHG Pollutants Summary

	CO2 (excluding biogenic) [metric ton]	CH4 [metric ton]	N2O [metric ton]	CO2e (excluding biogenic) [metric ton]	CO2b (biogenic) [metric ton]
External Combustion					
Internal Combustion	857.4	0.03	0.010	860.2	
Spray Coating / Spray Booth					
Other Use of Organics					
Storage Tanks					
Fugitive Components					
Other Process Emissions					
Shutdown / Startup / Turnaround and Upsets					
Total Emissions	857.4	0.03	0.010	860.2	0.0

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Summaries Cont.

Facility ID: 999921

Facility Information

Build Reporting Structure

Combustion Fuels

Emission Sources (E5)

Report Process/Emissions

Summaries

Criteria Pollutants

Toxic (TAC/ODC) Pollutants

GHG Pollutants

Fees

Data Validation

Print Facility Report

Excel Reports

Report Submission

Fees

Total Emissions and Fees

	Total Permitted Emissions (tons)	Total Non-Permitted Emissions (tons)	Total RECLAIM Emissions (tons)	Total Emissions (tons)	Total Emissions Subject to Fees (tons)	Emission Fees Due
Organic Gasses	1.58	0.00	0.00	1.58	0	\$ 0.00
Specific Organics	0.00	0.00	0.00	0.00	0	\$ 0.00
Nitrogen Oxides	0.00	0.00	19.70	19.70	20	\$ 5,649.95
Sulfur Oxides	0.01	0.00	0.00	0.01	0	\$ 0.00
Carbon Monoxide	4.28	0.00	0.00	4.28	0	\$ 0.00
Particulate Matter	1.41	0.00	0.00	1.41	0	\$ 0.00

1. Total emission fees for all criteria pollutants	\$ 5,649.95
2. Toxic air contaminants/ ozone depleter fees	\$ 241.74
3. Total fees due	\$ 5,891.69
4. Installments Paid For 2014 (if any): All Criteria Pollutants	\$ 1,000.00
5. Installments Paid For 2014 (if any): Toxic Air Contaminants/Ozone Depleters	\$ 500.00
6. Balance Due (Line 3 - Line 4 - Line 5)	\$ 4,391.69
7. Late Payment Surcharge (enter the postmark date to calculate the late payment surcharge)	Report Deadline 6/4/2015
Days Late Surcharge	Postmark Date (MM/DD/YYYY) 03/03/2015
< 30 Days 5%	Late Payment Surcharge \$ 0.00
30 to 90 Days 15%	
91 Days to 1 Year 25%	
> 1 year 50%	
8. Amount Due (Line 6 + Line 7) Please write AER Facility ID#(s) and 2014 AER on the check	\$ 4,391.69

Save

Data Validation

South Coast AQMD Air Quality Management District

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AER Home Browse Facilities Access Facility Facility Home

Facility ID: 999915 · ABC · Reporting period: 2014

Facility ID: 999915

Data Validation

Rule	ES/Process	Type of Errors or Warnings
V03	Facility	Error: No emissions are reported, please return to the Status Update and provide an explanation for no emissions.
V01	ES1	Error: This field is mandatory, but is missing. (Equipment)
V02	ES1	Error: No emissions were reported for this Emission Source, report the emissions OR if this source does not have emissions: correct Emission Source Status Code.

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Submit Report

South Coast AQMD Air Quality Management District

test 2014
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AER Home Browse Facilities Access Facility Facility Home

Facility ID: 999917 · ABC · Reporting period: 2014

Facility ID: 999917

Report Submission

- Validation check:
 - Errors: 0
 - Warnings: 0
- Please review the [Summary](#) before submitting your report.
- Submittal Date (MM/DD/YYYY):
 - Today: 1/6/2015
 - Facility Report Deadline: 6/4/2015
- [Submit Report](#)

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Print Submittal Forms

Please print the submittal forms, sign the Signature Sheet (a check for fees due, if applicable) and mail to the SCAQMD.

The screenshot displays the South Coast AQMD Air Quality Management District website interface. At the top, the logo and name 'South Coast AQMD Air Quality Management District' are visible, along with a user profile section for 'test 2014' with 'Logout' and 'Edit Profile' options. A navigation bar includes links for 'AER Home', 'Browse Facilities', 'Access Facility', and 'Facility Home', alongside icons for user profile, calendar, printer, home, and help. A status bar indicates 'Submitted · Facility ID: 999917 · ABC · Reporting period: 2014'. The main content area is titled 'Facility ID: 999917' and 'Report Submission'. A left sidebar lists navigation options: 'Facility Dashboard', 'Reported Summaries', 'Facility Information', 'Build Reporting Structure', 'Combustion Fuels', 'Emission Sources (ES)', 'Report Process/Emissions', 'Summaries', 'Data Validation', 'Print Facility Report', 'Excel Reports', and 'Report Submission' (which is highlighted). The main text area states 'Successfully submitted. Please remember that if any changes are needed, the Amendment needs to be submitted.' and 'Please Print the submittal forms:'. A numbered list follows: 1. [Signature Sheet \(Form X\)](#) (Sign the Signature Sheet and be sure to mail them on time.), 2. [Facility Status Update](#), 3. [Fees Due Summary](#), 4. [Toxic Air Contaminants and Ozone Depletes Emissions/Fee Summary](#), if applicable Other Toxic Air Contaminants Emissions Summary (only applicable to AB2588 facilities for their quadrennial report), and 5. [Confirmation](#). A final note states: 'Please remember that all records and calculations used in completing this report are recommended to be retained for a minimum of five years. Please make a copy of complete submittal including supporting documentations and complete printout.' The footer contains links: 'AQMD web site Home | AER Web Site | Submit question/comment | Ecotek Web Site | Report a Bug'.

CONCLUSION

The new AER Tool has resulted in a more improved, optimized and integrated emission inventory.

The overall efficiency of the SCAQMD's consolidated Annual Emission Reporting Program has greatly improved through the new AER Tool and automated data processing and auditing procedures. The new AER reporting software reduces errors, improves the data quality and accuracy, and assists the users with the transition to the more detailed device reporting level. The new user-friendly AER Tool was instrumental in providing a simplified reporting option for linking and integrating the criteria and toxic, and optionally GHG, emissions data.

KEY WORDS

Point Source Emission Inventory, Criteria Emissions, Toxic Emissions, GHG Emissions, Consolidated Criteria, Toxic and GHG Reporting, Software Reporting, Data management, Device reporting

ACKNOWLEDGEMENTS

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