SOOFIE Dashboard User Guide

May 2021

Table of Contents

1. Getting started and logging in

After receiving an email from Amazon Web Services (AWS), create your username and password and sign in at https://scientificaviation.com/dashboard.

2. Geolocating facility components

The SOOFIE system requires high-precision latitude-longitude data as a KML file for all the SOOFIE sensors and all the potential leak sources at a site to be monitored. Sensor locations are typically entered into the database via the SOOFIE iOS app during the installation process on site. There are two ways to enter the source locations, either by using the iOS app during installation on site, or by using Google Earth. The advantage of using Google Earth is that the KML file can actually provide polygons surrounding the major components (e.g. tank battery) where the iOS app will only identify a single point for each source. We recommend using Google Earth to enter potential leak source locations, according to the instructions below. This step does not need a physical presence on site.

*Note that the commercial satellite imagery in Google Earth can be years out-of-date and may not show recently installed infrastructure; accurate customer input of **ALL** site component locations is required to complete this essential step.*

1. Using the Google Earth app, zoom in to view the site in the map.

2. In the View menu, select Reset > Tilt to ensure an accurate top-down view of the site.

3. Under the "Places" tab, right click on "Temporary Places", select Add > Folder, and enter the site name as defined in the SOOFIE iOS app during instrument installation.

4. To define a **point source** component like a flare: in the Add menu, select "Placemark" (or click the yellow push-pin icon in the tool bar) and drag the icon to mark a component location on the map. *Remember that Google Earth uses the pointed tip, not the center of the default pin icon, to mark the location!* Enter a specific name for this component, e.g., "Low-pressure flare" and click OK to add the point source component to the <site name> folder. You can edit this component by right-clicking on its name and selecting "Get Info".

5. To define an **area source** component like a tank battery: in the Add menu, select "Polygon" (or click the polygon icon in the tool bar) and enter a specific component name, e.g., "Tank Battery", "Gas Skids", etc. Click in the Google Earth map at three or more points to draw a polygon around the area source component location. For better visibility, make the polygon transparent by clicking on the "Style, Color" tab and choosing "Area > Outlined". Click and drag on existing points to reshape the polygon as needed. Click OK to add the polygon component to the <site name> folder. You can edit this component by right-clicking on its name and selecting "Get Info".

6. Repeat steps 4 and 5 above until all the site components have been identified.

7. When finished, right click on the <site name> folder and select "Save Place As > Save As Type > Change KMZ to KML". Email the KML file to SOOFIE@scientificaviation.com so that it can be entered automatically in the system.

3. Viewing data in the dashboard

The following description introduces you to the functionality of the SOOFIE dashboard interface. The image below is the general overview of the dashboard.

The landing page shows your recent SOOFIE data in tabular and graphic form. Customized searches allow you to define which sites and time periods are displayed. To get here, Kibana >Kibana - Visualize and analyze > Dashboard > Methane Dashboard.
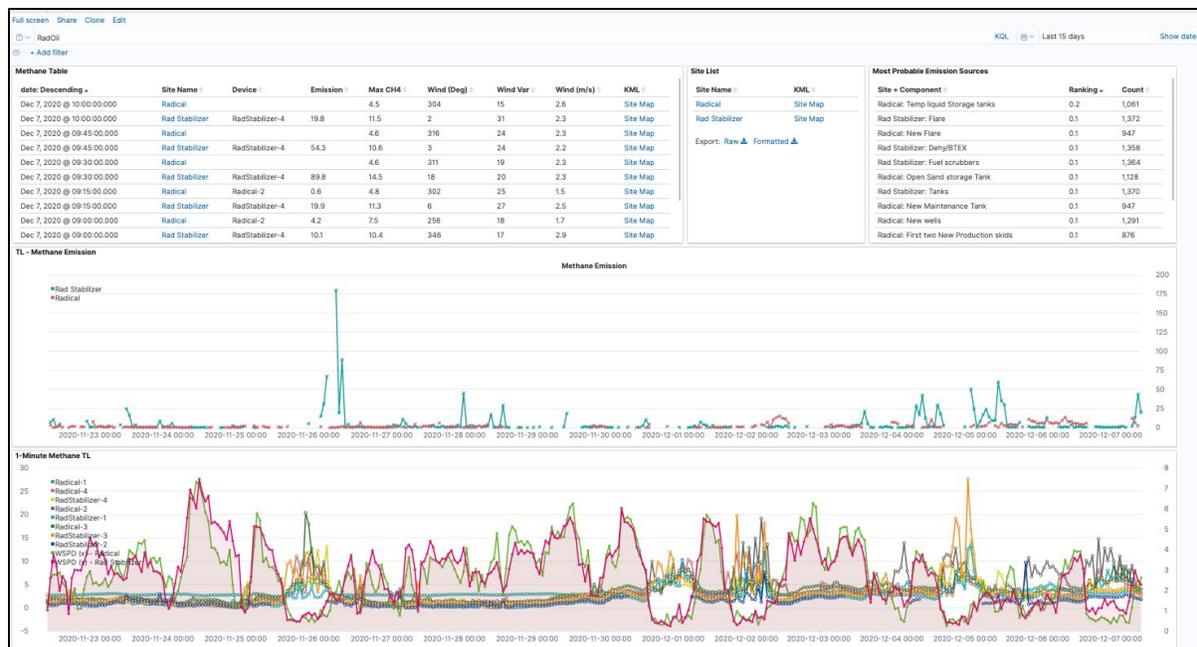
3.1 Tables

The **Methane Table**, **Site List**, and **Most Probable Emissions Sources** tables display basic compilations of your site data. Each table can be sorted by clicking on the different column names.

In the **Methane Table**, **Device** indicates which SOOFIE sensor at a site registered the leak. **Emission** is the release rate of methane in kilograms of CH_4 per hour, averaged over the 15-minute period beginning at the date and time specified in column 1 (**date**). **Max CH₄** is the maximum 1-minute averaged CH_4 value in ppm for that 15-minute period. **Wind (deg)** and **Wind Var** are the wind direction and its 1-sigma variability in degrees. **Wind (m/s)** is the wind speed in meters per second, averaged over that 15-minute period.

Methane Table									
date: Descending	Site Name	Device	Emission	Max CH4	Wind (Deg)	Wind Var	Wind (m/s)	KML	
Dec 10, 2020 @ 09:00:00.000	Radical	Radical-4	0.2	2.8	118	17	1.5	Site Map	
Dec 10, 2020 @ 09:00:00.000	Rad Stabilizer	RadStabilizer-1	2.4	3.7	176	9	3.6	Site Map	
Dec 10, 2020 @ 08:45:00.000	Radical	Radical-4	0.3	3.2	109	16	1.4	Site Map	
Dec 10, 2020 @ 08:45:00.000	Rad Stabilizer	RadStabilizer-2	0.7	2.3	178	8	3	Site Map	
Dec 10, 2020 @ 08:30:00.000	Radical			5.8	136	9	1.7	Site Map	
Dec 10, 2020 @ 08:30:00.000	Rad Stabilizer	RadStabilizer-1	0.2	2.7	180	7	2.6	Site Map	
Dec 10, 2020 @ 08:00:00.000	Radical			5	79	25	0.9	Site Map	
Dec 10, 2020 @ 08:00:00.000	Rad Stabilizer	RadStabilizer-2	0.7	2.7	178	7	2.3	Site Map	
Dec 10, 2020 @	Radical			4.7	65	20	0.7	Site Map	

Site List	
Site Name	KML
Radical	Site Map
Rad Stabilizer	Site Map
Export: Raw	Formatted

| Most Probable Emission Sources		
Site + Component	Ranking	Count
Rad Stabilizer: Flare	0.3	203
Radical: Open Sand storage Tank	0.1	219
Radical: New wells	0.1	212
Radical: New Flare	0.1	155
Radical: Old well	0.1	199
Radical: Temp liquid Storage tanks	0.1	157
Radical: New Maintenance Tank	0.1	157
Radical: Second two New Production Skids	0.1	100
Rad Stabilizer: Tanks	0.1	245
Radical: Old Production Skids	0.1	212

Export: Raw Formatted

Table features to note: Hovering the mouse over certain fields will show small "magnifying glass" icons that, when clicked, will filter for value (+) or filter out value (-). This is an easy way to show data from a single site.

3.2 Graphs

The **TL-Methane Emission** and **1-Minute Methane TL** graphs show time series plots of your data.

TL-Methane Emission displays the 15-minute average emissions (in kg CH4 per hour) for each site; these traces will have gaps when no leaks are reported, or when wind speeds drop below the specified minimum limit.

1-Minute Methane displays the 1-minute average methane mixing ratios (in parts per million, ppm) reported from each SOOFIE sensor on the left-hand axis, and the 1-minute average wind speed (in meters per second) at each site on the right-hand axis.
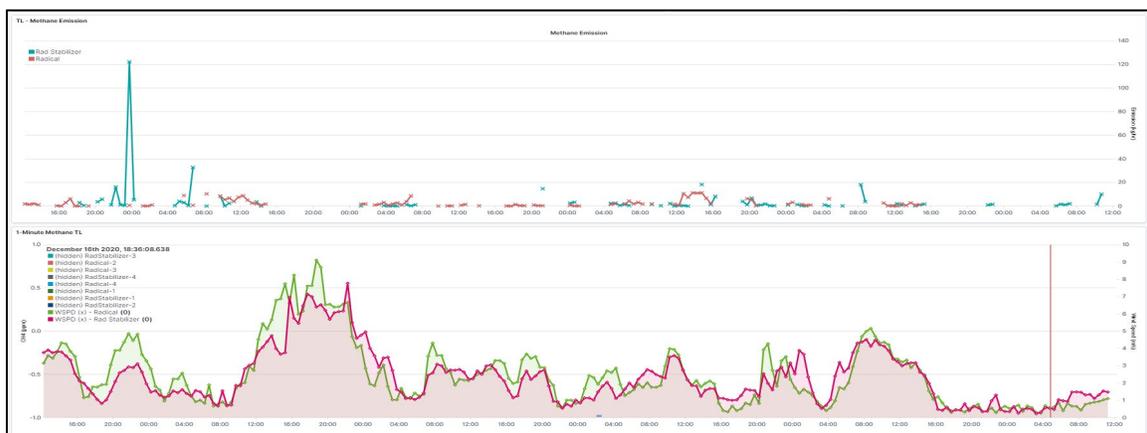
Graph features to note: Hovering the mouse over a site name or a sensor name in the legend will show data from just that site or sensor. Clicking on a name in the legend will hide the data from a single site or sensor; click again to toggle it back on. Hovering the mouse over a point on the TL-

Methane Emission graph (upper graph) will display numerical values of emissions in kg/hr (beside the site name in bold parentheses). Hovering over a point on the 1-Minute Methane TL graph (lower graph) will provide a numerical value for the CH_4 mixing ratio in ppm and wind speed in m/s.

Graph y-axes are auto scaled to show the full range of data. Averaged leak rate or CH_4 mixing ratio values are shown and depend on the time range selected. Clicking and dragging in a graph will zoom in to a specific time range; you can specify precise times by clicking in the "Show dates" field in the upper-right corner of the dashboard. Choose starting and ending times, either absolute or relative, and click "Refresh" to update the display.

3.3 Data queries

The "Search" field allows you more control over what is displayed on the Methane Dashboard page. The query syntax in the "Search" field is case-sensitive and is very specific about formatting; pull-down menus will prompt for filter criteria. The "Add filter" field allows further customization of query terms to narrow your search. Active filters are listed below the "Search" field and can be deselected to broaden your search.

4. Viewing leak footprints in Google Earth

Clicking on a **Site Map** in the **KML** column for a specific date/time row in the **Methane Table** will download a file called "<site name>.kml" to your computer. This file opens Google Earth (you will need the Google Earth App installed) to show a satellite image of the selected site with locations of all the sensors (red circles) and site components (black squares) that were identified during SOOFIE installation using the iOS app. An upwind "footprint" (red triangle) shows the area sampled by the sensor during that 15-minute period. Typically the number 1 sensor would equipped with sonic anemometer. In the example below, showing winds from the northeast, SOOFIE had correctly identified "Compressor East" within the upwind "footprint" as the most likely source location for the leak.
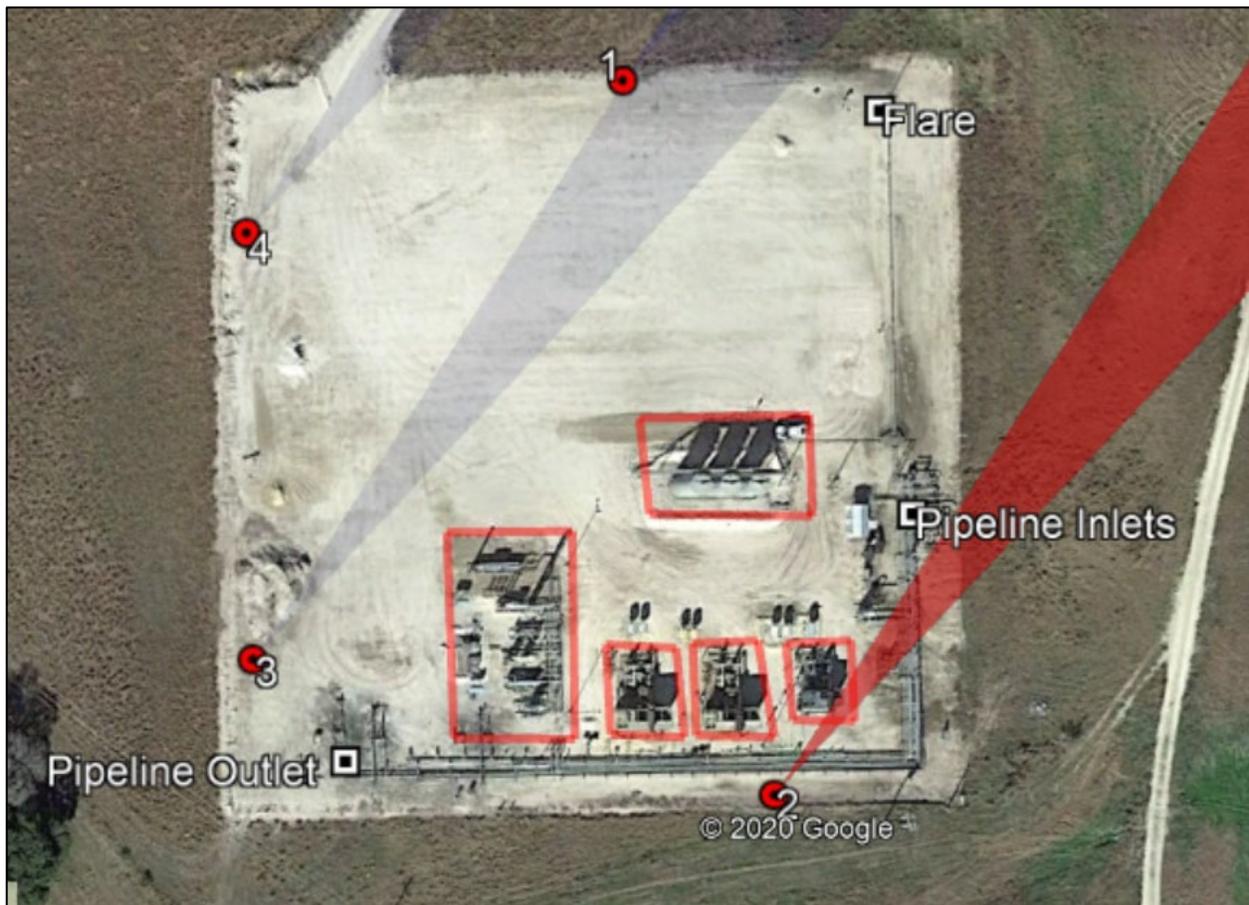
5. Downloading 15-minute averaged CH₄ emissions data

Archived 15-minute-averaged emissions data are accessed by selecting the "Analytics > Discover" tab under the Menu ▤ icon in the top left-hand side of the dashboard landing page. Select "Methanemizer*" from the pull-down menu found just below the "Search" and "Add filter" fields. Click on "Add filter" and from the pull-down menus select "Field: emission", "Operator: exists", and click the Save button. The Discover page will look something like this:
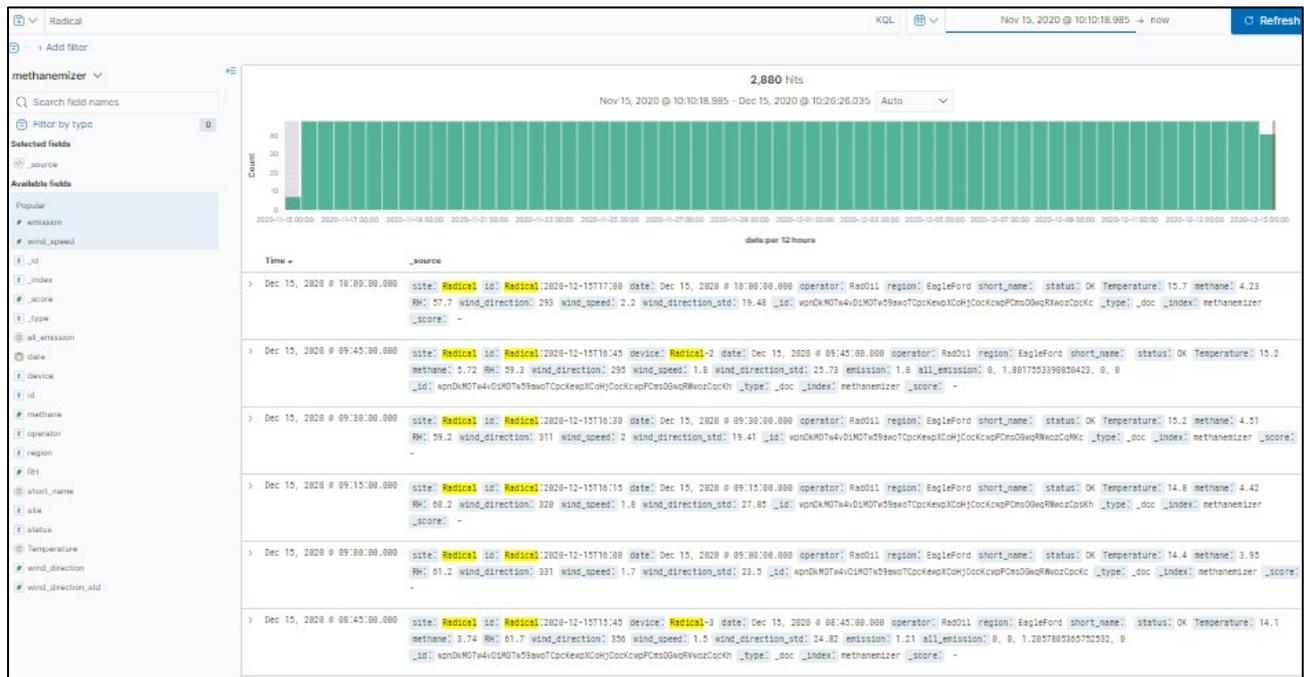
At first, all 15-minute averaged emissions data records from all your sites will be displayed. Use the "Search" and "Show dates" fields to narrow your selection. Click on the "Save" button above the "Search" field, enter a name for this particular query (e.g., *Emission results*") and click on the "Save" button. Then, click on the "Share" button, select "CSV Reports", and click on "Generate CSV". After several seconds (depending on the size of the file to be generated) a pop-up window with a "Download report" button will appear. Clicking on that button will download a comma-separated text file called "*Emission_results.csv*" to your computer.

You can also access these files for download later by selecting the Menu icon, scrolling down and selecting "Management > Stack Management", and then selecting "Alerts and Insights > Reporting" to show a complete list of saved searches.

6. Downloading 1-minute averaged CH$_4$ mixing ratio data

Archived 1-minute-averaged CH$_4$ mixing ratio data are similarly accessed by selecting the "Kibana > Discover" tab under the Menu ≡ icon in the top left-hand side of the dashboard landing page. At this point, click on the Change Index Pattern field near the top left-hand side of the page and select "readings*" to display the 1-minute data files.

After this, follow the same procedure defined in section 4 above: Use the "Search" and "Show dates" fields to narrow your selection; about a month of data from a single site with four SOOFIE sensors results in a manageable file size. Click on the "Save" button above the "Search" field, enter a name for this particular query (e.g., *Mixing_ratio_results*") and click on "Save" again. Then, click on the "Share" button, select "CSV Reports", and click on "Generate CSV". After several seconds (depending on the size of the file to be generated) a pop-up window with a "Download reports" button will appear. Clicking on that button will download a comma-separated text file called "*Mixing_ratio_results.csv*" to your computer.

You can also access these files for download later by selecting the Menu icon, scrolling down and selecting "Management > Stack Management", and then selecting "Alerts and Insights > Reporting" to show a complete list of saved searches.

Note that 1-minute CH$_4$ data queries can generate large files; a 3-week-long record from a site with 4 SOOFIE sensors is roughly 25Mb.