# TSI Link™ Report Creator – Spatial Analysis

Workbook Guide (US)

## Contents

## Overview

The Spatial Analysis workbook contains a set of worksheets for TSI Link™ Report Creator that support spatial visualization. In addition to traditional table-based data analysis, these worksheets allow you to overlay summary measurement data onto virtually any image, including:

- Building floorplan
- Hand sketch of a work area or building
- Photo
- Equipment diagram
- HVAC ductwork diagram
- Map

The templates in this workbook are designed to provide spatial context for your measurements. They allow you and your report recipients to clearly understand spatial context such as contaminant "hotspots', impact on surrounding areas, unsafe work areas, etc. You can also use Microsoft® Excel® software's annotation tools to further enhance your visualizations.

*Check out the* [Report Creator Product Page](#) *for guides, videos  and more resources including: setting up an account, installing the application, using the study manager, using the layout view, customizing report creator templates, etc.* This guide builds upon and supplements those guides.

# Worksheet Templates

The table below lists the worksheets available in the A-B comparison workbook.

| Worksheet | Supported Measurements | Supported Instruments | Applications |
|---|---|---|---|
| **IAQ Assessment** | CO (ppm)<br>$CO_2$ (ppm)<br>VOC (ppb)<br>PM 2.5 (ug/m$^3$)<br>PM 10 (ug/m$^3$) | OmniTrak™ Solution<br>Q-Trak™ XP Monitor | Air Quality testing around a public space, classroom, lab, commercial space, church, data center or other area. Helps to quickly visualize and analyze situations |
| **PM & Sound Array** | PM 2.5 (ug/m$^3$)<br>NC 0.3 – 0.5 um (#/m$^3$)<br>NC 0.5 – 1.0 um (#/m$^3$)<br>NC 1.0 – 2.5 um (#/m$^3$)<br>NC 2.5 – 4.0 um (#/m$^3$)<br>NC 4.0 – 10 um (#/m$^3$) | OmniTrak™ Solution<br>Casella™ 620 | Visualize the sounds and air quality on different points around a shop floor or around a construction site. Determine optimum placement of a portable air purifiers in a working area. Sound and IAQ in a concert hall or large meeting space |
| **PM & VOC Array** | VOC (ppb)<br>NC 0.3 – 0.5 um (#/m$^3$)<br>NC 0.5 – 1.0 um (#/m$^3$)<br>NC 1.0 – 2.5 um (#/m$^3$)<br>NC 2.5 – 4.0 um (#/m$^3$)<br>NC 4.0 – 10 um (#/m$^3$) | OmniTrak™ Solution | Trouble shooting sources of air pollution or irritants. Spot checking a garage, shop floor or production line. Checking a science lab area. |
| **Sound Map** | LCSmax (dB)<br>LCpeak (dB) | OmniTrak™ Solution<br>Casella™ 620 | Analyzing the sound around gathering or work area |
| **Spatial Report** | A parameters from [Appendix A](#) | Many different Instruments | Visualize any one of 69 parameters around a floor plan, school, lab, product plant or other area. |
| **Thermal Assessment** | Temperature (C)<br>Dew Point (C)<br>Wet Bulb (C)<br>RH (%)<br>Barometric Pressure (inHg) | Q-Trak™ XP Monitor<br>VelociCalc™ Meter | Optimize HVAC by measuring temperature gradient in an office, home, or manufacturing facility. Quickly take the measurements for the space and clearly visualization the dynamics |

**NOTES**:

1. The IAQ Assessment Worksheet is designed to display key indoor air quality gases and particulate matter measurements. The Thermal Assessment Worksheet does the same for temperature and humidity measurements. These two worksheet templates operate in a similar manner.

# Worksheet Steps

## Step 1 Select a Worksheet

The Spatial Analysis Workbook is one of many that are available. An overview of the workbooks available is on the Report Creator Product Page.

A list of the worksheet in this Spatial Analysis Workbook can be found the Worksheet Templates section.

## Step 2 Cover Sheet

This workbook contains a very simple Cover sheet that can be customized to suit your needs. See the *Customizing Report Creator Templates* to learn how. Other sheets can be added to your workbook, if desired.

The bottom of the Cover sheet includes information for the **Spatial Report Worksheet**. **If the Cover sheet is deleted from the workbook, the Spatial Report Worksheet will not function**.

## Step 3 Demographic Information

After you have created a blank worksheet, you can enter whatever demographic information you want into the report header. You may also change the "Location N" names to something more meaningful if desired.

You can also add or edit target maximum limits for each gas/PM in Row 12. (The Thermal worksheet includes *both* minimum and maximum targets.) If you do not want to display a target limit, simply leave the cell blank.

### NOTICE

You can also enter target limits into the worksheet templates if you want to make them static and avoid re-entering them. Refer to *Customizing Report Creator Templates* on the Report Creator product page.

### For General Spatial Report, Select Desired Parameter

The TSI® instrument portfolio can generate a wide range of measurements. It would be impractical to create templates for all possible permutations. The *General A-B Report* provides a way for you to define an A-B comparison for any three measurements you like.

After you have created a blank A-B General Report worksheet, you can choose the parameters desired.

**You must select between one and three parameters, Before importing any measurement data.** The Parameter row is colored red to remind you of this.

# Step 4 Load Study Data

Import up to ten studies using the [Study Manager](#) or *File Import. Make sure the study names match the labels you added above. Swap them if necessary. When ready, click* **Add Data** *to import data into the worksheet. The measurement data is loaded further down the sheet and* the statistical summary table is compiled with the calculated maximum, average, and minimum values.

The Spatial Analysis workbook can load **up to 10 studies** in each worksheet. The two conditions can be described in the free text fields at the top of the sheet.

# Step 5 Analyze Data

The data analysis sections differ between worksheets, as shown in the following examples.
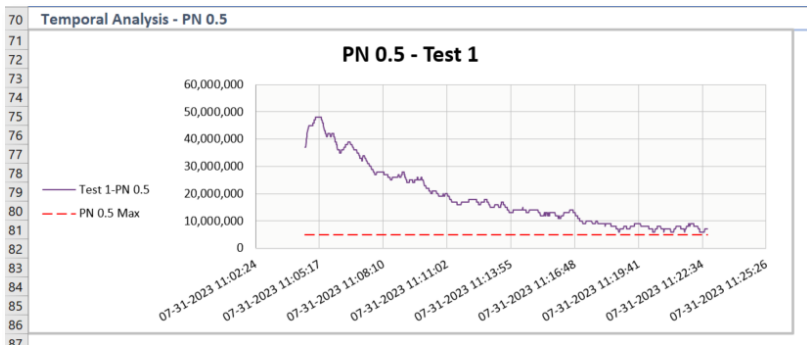
## Spatial Report Analysis

This versatile workbook template enables customers to compare data from two different types of sensors, for example:

- Comparing Ozone and VOC monitors together around an area using Q-Trak™ Monitor or OmniTrak™ Solution.

- Comparing the PM 2.5 and PM 10 reading that in a simple and clear way. Could be from OmniTrak™ Solution or DustTrak™ Monitor.



## Target Limits

**Set Target limits** as desired to the maximum values, as highlighted below. These limits will be displayed on the chart to provide context. The different types of measurements have different target limits, of course, but they are all managed in similar ways. **Each measure and the target limit are displayed in a chart**, along with the target limits defined in the data summary table.

## IAQ Assessment and Thermal Assessment Analyses

The Test Results section includes a table to show key IAQ measurements. If you have added a target limit, the summary measurement will turn red if the target was exceeded.

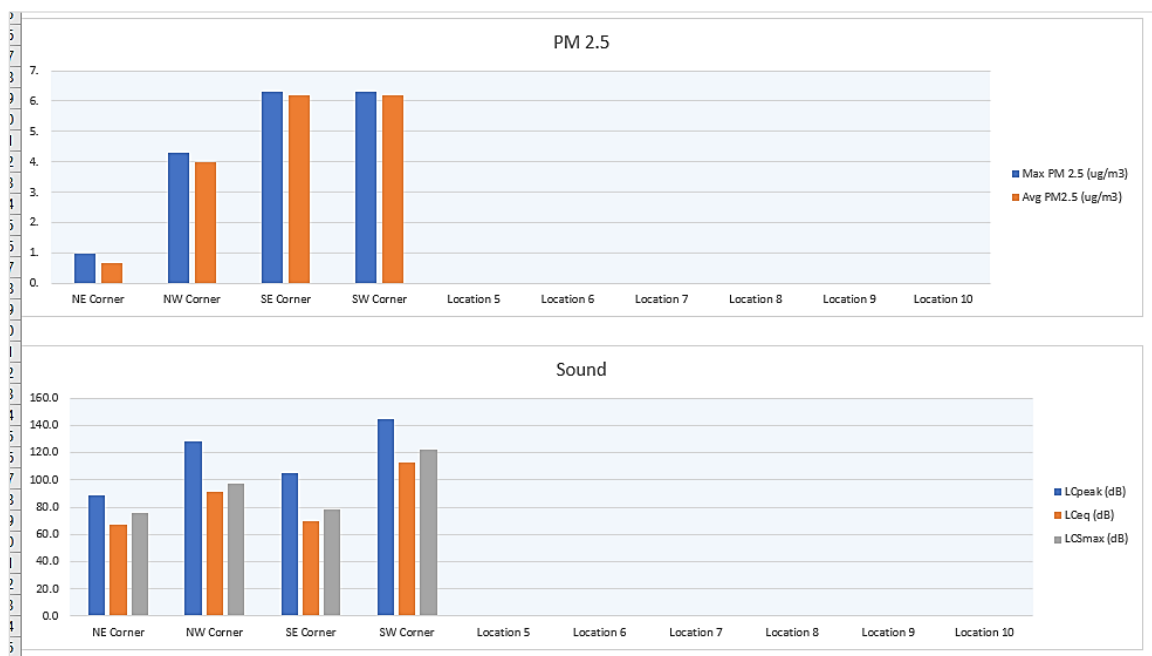| | Target Names | Max CO Limit | CO2 Limit | VOC Limit | PM2.5 Limit | Avg PM2.5 Limit | PM10 Limit |
|---|---|---|---|---|---|---|---|
| | Target Limits | | 1200 | | 15 | | |
| | Location | Max CO (ppm) | Max CO2 (ppm) | Max VOC (ppb) | Max PM2.5 (ug/m3) | Avg PM2.5 (ug/m3) | Max PM10 (ug/m3) |
| 14 | Break Room | 2. | 408. | 0. | 14. | 14. | 0. |
| 15 | Conference Room 3 | 1. | 768. | 100. | 127. | 127. | 21. |
| 16 | Board Room | 0. | 1843. | 0. | 13. | 13. | 2. |
| 17 | East Stairwell | 0. | 553. | 800. | 64. | 64. | 14. |
| 18 | West Stairwell | 6. | 412. | 0. | 12. | 12. | 1. |
| 19 | Northeast Cubes | 3. | 1210. | 200. | 37. | 37. | 9. |
| 20 | North Cubes | 3. | 708. | 0. | 7. | 7. | 0. |
| 21 | Northwest Cubes | 2. | 817. | 0. | 6. | 6. | 0. |
| 22 | Team Room | 1. | 633. | 0. | 5. | 5. | 0. |
| 23 | Restrooms | 0. | 633. | 0. | 5. | 5. | 0. |

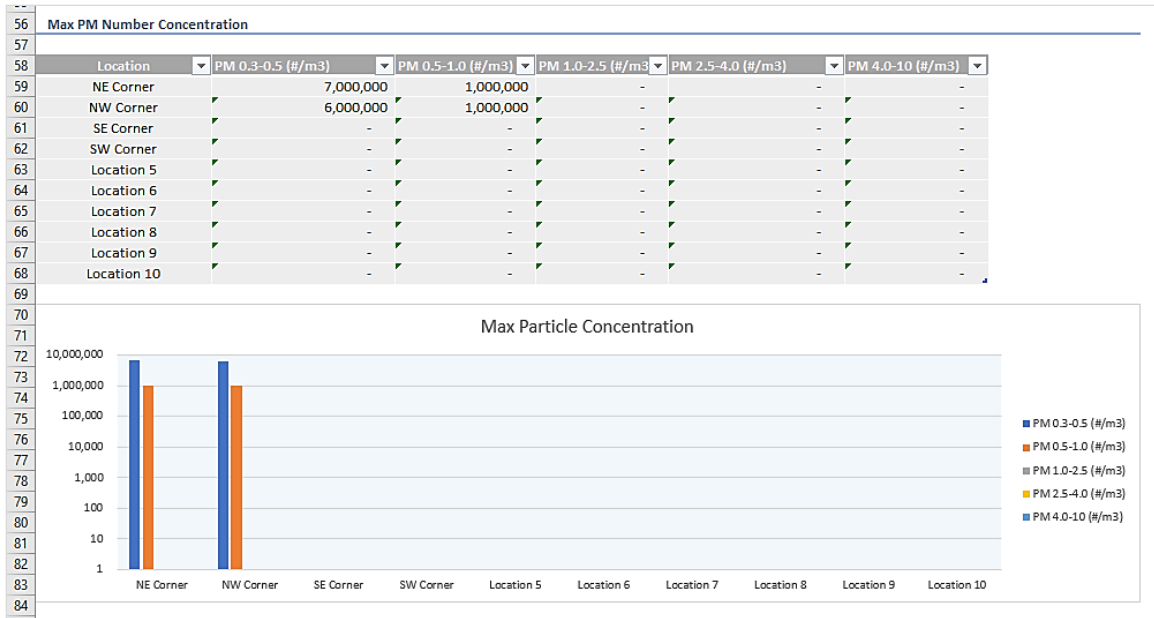## PM & Sound Array Analysis

> **NOTICE**
>
> The *PM & Sound Array* worksheet combines data files from two different instruments. Each location name has two prefixes – "PM:" and "Sound:". When you import studies, it is important that you select the proper prefix with the location.

The Test Results section includes a summary table that combines both the sound and PM measurements for each location. If you have added a target limit, the summary measurement will turn red if the target was exceeded. A column chart helps visually compares these measurements.

**PM2.5 & Sound Level**

| | Location | LCSmax Limit / LCSmax (dB) | Lcpeak Limit / LCpeak (dB) | Lceq Limit / LCeq (dB) | PM 2.5 Study | Max PM2.5 Limit / Max PM 2.5 (ug/m3) | Avg PM2.5 Limit / Avg PM2.5 (ug/m3) |
|---|---|---|---|---|---|---|---|
| 14 | NE Corner | 75.6 | 88.5 | 67.3 | | 1. | 0.7 |
| 15 | NW Corner | 97.0 | 128.0 | 91.0 | | 4.3 | 4.0 |
| 16 | SE Corner | 78.6 | 104.8 | 69.4 | | 6.3 | 6.2 |
| 17 | SW Corner | 122.2 | 144.5 | 112.8 | | 6.3 | 6.2 |
| | Location 5 | 0.0 | 0.0 | 0.0 | | 0. | |

The particle number concentration is also shown in both tabular form and log-scale column chart.

**Max PM Number Concentration**

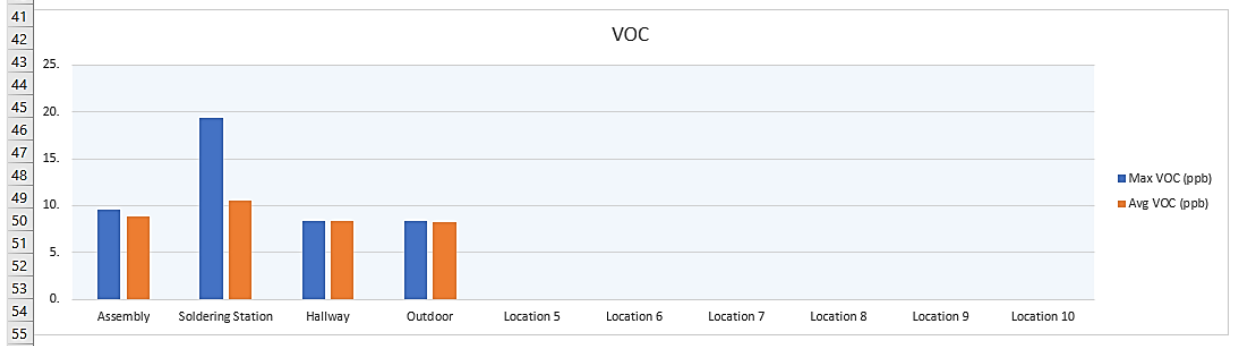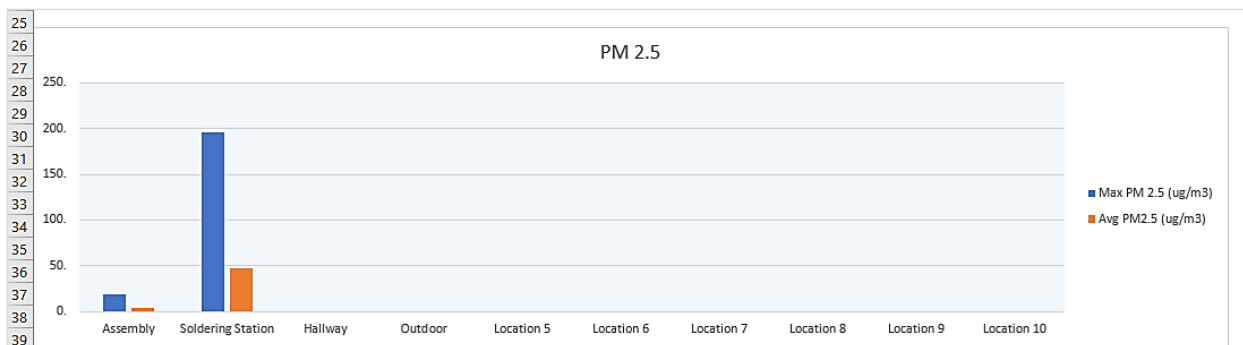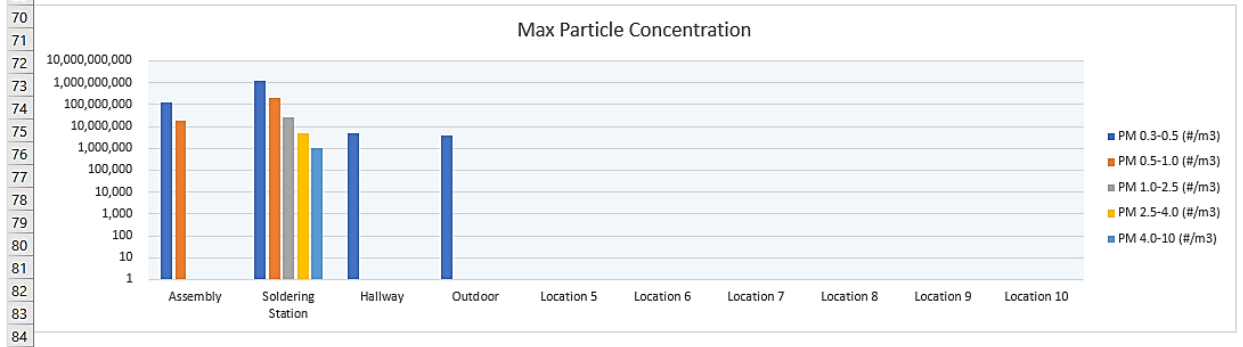| Location | PM 0.3-0.5 (#/m3) | PM 0.5-1.0 (#/m3) | PM 1.0-2.5 (#/m3) | PM 2.5-4.0 (#/m3) | PM 4.0-10 (#/m3) |
|---|---|---|---|---|---|
| NE Corner | 7,000,000 | 1,000,000 | - | - | - |
| NW Corner | 6,000,000 | 1,000,000 | - | - | - |
| SE Corner | - | - | - | - | - |
| SW Corner | - | - | - | - | - |
| Location 5 | - | - | - | - | - |
| Location 6 | - | - | - | - | - |
| Location 7 | - | - | - | - | - |
| Location 8 | - | - | - | - | - |
| Location 9 | - | - | - | - | - |
| Location 10 | - | - | - | - | - |



Max Particle Concentration

## PM & VOC Array Analysis

The Test Results section includes a summary table that displays both Particulate Matter and VOC measurements. If you have added a target limit, the summary measurement will turn red if the target was exceeded. A column chart helps visually to compare these measurements.

**VOC & PM2.5**

| Target Names | VOC Study | Peak VOC Limit | Avg VOC Limit | PM 2.5 Study | Peak PM2.5 Limit | Avg PM2.5 Limit |
|---|---|---|---|---|---|---|
| Target Limits | | 10 | | | 30 | 15 |
| Location | VOC Study | Max VOC (ppb) | Avg VOC (ppb) | PM 2.5 Study | Max PM 2.5 (ug/m3) | Avg PM2.5 (ug/m3) |
| Assembly | | 9.6 | 8.9 | | 19. | 3.5 |
| Soldering Station | | 19.4 | 10.5 | | 196. | 47.7 |
| Hallway | | 8.4 | 8.3 | | 0. | 0.0 |
| Outdoor | | 8.3 | 8.3 | | 0. | 0.0 |
| Location 5 | | 0. | | | 0. | |

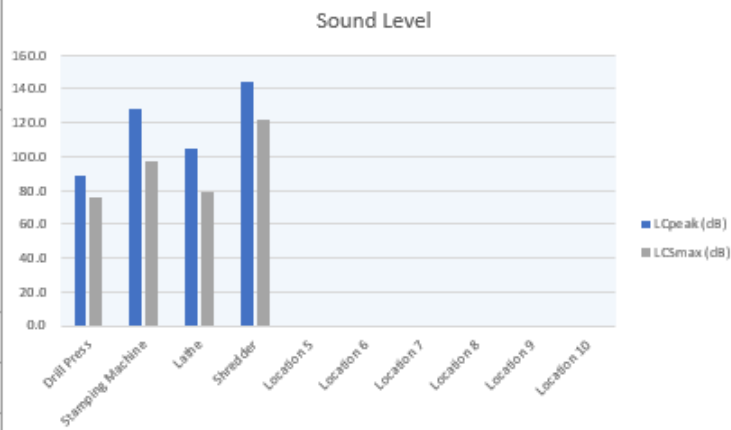The particle number concentration is also shown in both tabular form and log-scale column chart.

**Max PM Number Concentration**

| Location | PM 0.3-0.5 (#/m3) | PM 0.5-1.0 (#/m3) | PM 1.0-2.5 (#/m3) | PM 2.5-4.0 (#/m3) | PM 4.0-10 (#/m3) |
|---|---|---|---|---|---|
| Assembly | 125,000,000 | 19,000,000 | - | - | - |
| Soldering Station | 1,264,000,000 | 202,000,000 | 26,000,000 | 5,000,000 | 1,000,000 |
| Hallway | 5,000,000 | - | - | - | - |
| Outdoor | 4,000,000 | - | - | - | - |
| Location 5 | - | - | - | - | - |
| Location 6 | - | - | - | - | - |
| Location 7 | - | - | - | - | - |
| Location 8 | - | - | - | - | - |
| Location 9 | - | - | - | - | - |
| Location 10 | - | - | - | - | - |



Max Particle Concentration



PM 2.5



VOC

## Sound Map Analysis

Two key sound level measurements are displayed in the table. These same measurements are displayed in a column chart below it. To help educate the work staff, a CDC-developed sound level guide is also shown.

| Location | LCSmax (dB) | LCpeak (dB) |
|---|---|---|
| Drill Press | 75.6 | 88.5 |
| Stamping Machine | 97.0 | 128.0 |
| Lathe | 78.6 | 104.8 |
| Shredder | 122.2 | 144.5 |
| Location 5 | | |
| Location 6 | | |
| Location 7 | | |
| Location 8 | | |
| Location 9 | | |
| Location 10 | | |

**CDC Reference**

| Everyday Sounds | Average Sound Level (dB) | Typical Response (after routine or repeated exposure) |
|---|---|---|
| Softest sound that can be heard | 0 | Sounds at these dB levels typically don't cause any hearing damage |
| Normal breathing | 10 | |
| Ticking watch | 20 | |
| Soft whisper | 30 | |
| Refrigerator hum | 40 | |
| Normal conversation, air conditioner | 60 | |
| Washing machine, dishwasher | 70 | You may feel annoyed by the noise |
| City traffic (inside the car) | 80–85 | You may feel very annoyed |
| Gas-powered lawnmowers and leaf blowers | 80–85 | Damage to hearing possible after 2 hours of exposure |
| Motorcycle | 95 | Damage to hearing possible after about 50 minutes of exposure |
| Approaching subway train, car horn at 16 feet (5 meters), and sporting events (such as hockey playoffs and football games) | 100 | Hearing loss possible after 15 minutes |
| The maximum volume level for personal listening devices; a very loud radio, stereo, or television; and loud entertainment venues (such as nightclubs, bars, and rock concerts) | 105–110 | Hearing loss possible in less than 5 minutes |
| Shouting or barking in the ear | 110 | Hearing loss possible in less than 2 minutes |
| Standing beside or near sirens | 120 | Pain and ear injury |
| Firecrackers | 140–150 | Pain and ear injury |

### Sound Level

## Layout View

You can now use the summary data created above and provide a spatial visualization of it. You can overlay any desired measurements onto a floorplan, photo, or other image. Click Layout View in Report Creator. Then click the **Add** icon (see image A).

The Layout View tool then opens (image B). If you wish, you can change the default name of the picture. Then click **Import Image** (image C). Navigate to the folder that contains your image and select it.
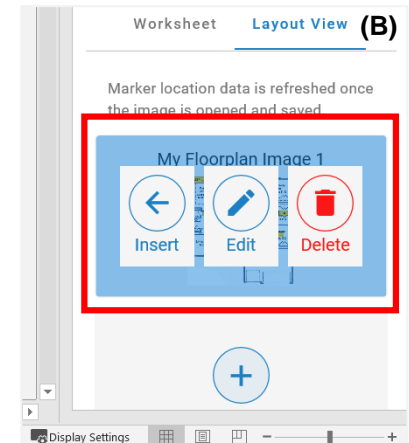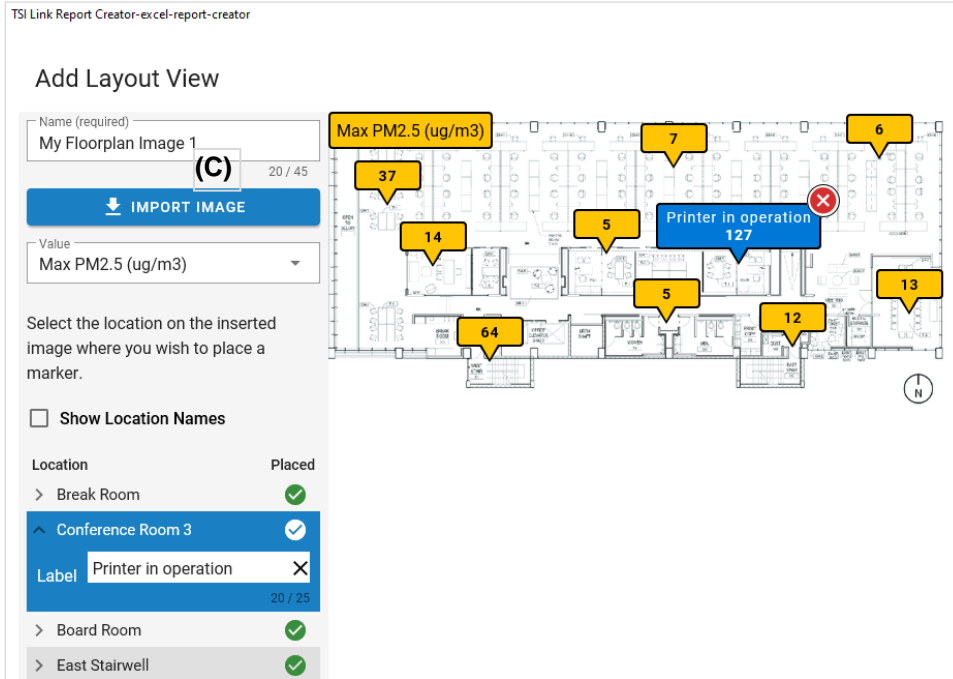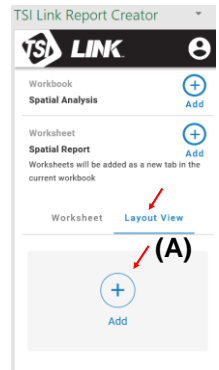


You now have to mark the measurement locations on your image. The first location in the list is automatically highlighted in blue. Click this location on the map. The Layout Tool advances to the next location. Repeat the location marking process until all locations are placed.

If you need to change a marked location, click the bubble annotation and drag it to the correct spot. (If you click the red X, that location will become unmarked.)

Now select which measurement you would like to display in your report. Also, if you wish to display the location names along with the measurement, check that box.

You can also add a label to any of the measurements by clicking the bubble annotation and expanding the location in the left column. Type in the label text.

When finished, click **DONE**.

A thumbnail of your image will now be displayed in Report Creator. To add it to the report, first click the destination cell in the worksheet that you want to place the image. Then hover over the thumbnail image in Report Creator and click **Insert**.

If you want to show additional measurement diagrams in your report, hover over the thumbnail and click **Edit**. Change the display value and click **DONE**. Click the destination cell in the worksheet and repeat the insertion process. With your images inserted into the report, you can now add additional annotations using Microsoft® Excel® software's tools. You may find either of these tools useful:

1. Click **Insert** in the Microsoft® Excel® ribbon. Click the **Shapes** icon and select a callout. Drag and size the callout block. Move the pointer as desired and enter in the text.

2. Click **Draw** in the Microsoft® Excel® ribbon. Select the desired pen color. Circle areas of the image and draw lines to a cell. Add comments in the cell.

This is what the drawing tools produce:
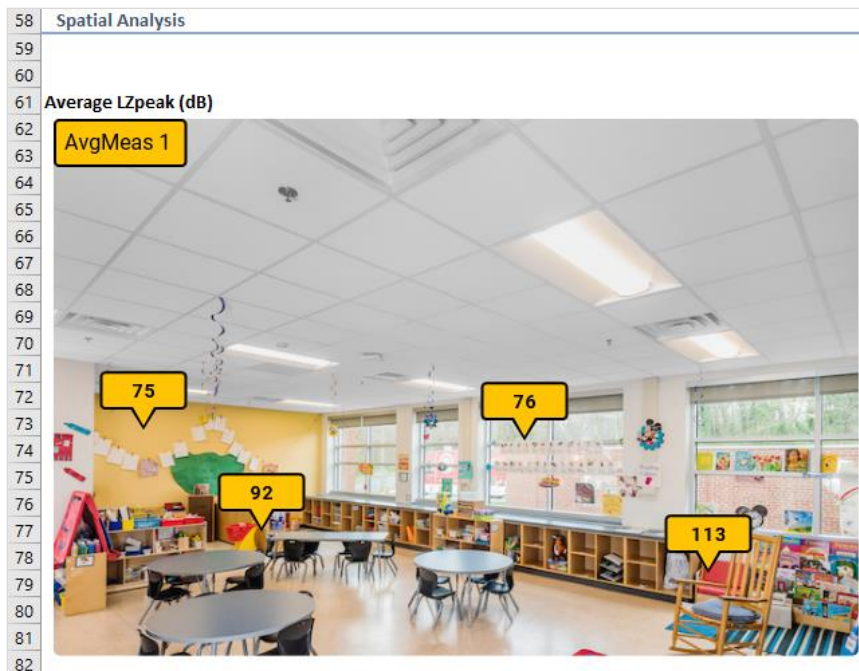


# Step 6 Complete the Assessment

To complete the report, you can add recommendations under the Conclusions section.

The print layout for this sheet does not include the measurement data in the blue tables at the bottom of the sheet. They will not appear in a PDF export either.

# Appendix A – Configuration Sheet Parameters

Below is a list of parameters available for the Spatial Report Worksheet.

| Metric | Units |
|---|---|
| PM 1.0 (ug/m$^3$) | MICROGRAMS_PER_CUBIC_METER |
| PM 2.5 (ug/m$^3$) | MICROGRAMS_PER_CUBIC_METER |
| PM RESP (ug/m$^3$) | MICROGRAMS_PER_CUBIC_METER |
| PM 10 (ug/m$^3$) | MICROGRAMS_PER_CUBIC_METER |
| PM Total (ug/m$^3$) | MICROGRAMS_PER_CUBIC_METER |
| PM 1.0 (mg/m$^3$) | MILLIGRAMS_PER_CUBIC_METER |
| PM 2.5 (mg/m$^3$) | MILLIGRAMS_PER_CUBIC_METER |
| PM RESP (mg/m$^3$) | MILLIGRAMS_PER_CUBIC_METER |
| PM 10 (mg/m$^3$) | MILLIGRAMS_PER_CUBIC_METER |
| PM Total (mg/m$^3$) | MILLIGRAMS_PER_CUBIC_METER |
| NC 0.3 - 0.5 (#/m$^3$) | COUNT_PER_CUBIC_METER |
| NC 0.5 - 1.0 (#/m$^3$) | COUNT_PER_CUBIC_METER |
| NC 1.0 - 2.5 (#/m$^3$) | COUNT_PER_CUBIC_METER |
| NC 2.5 - 4.0 (#/m$^3$) | COUNT_PER_CUBIC_METER |
| NC 4.0 - 10 (#/m$^3$) | COUNT_PER_CUBIC_METER |
| NC 0.3 - 0.5 (#/ft$^3$) | COUNT_PER_CUBIC_FOOT |
| NC 0.5 - 1.0 (#/ft$^3$) | COUNT_PER_CUBIC_FOOT |
| NC 1.0 - 2.5 (#/ft$^3$) | COUNT_PER_CUBIC_FOOT |
| NC 2.5 - 4.0 (#/ft$^3$) | COUNT_PER_CUBIC_FOOT |
| NC 4.0 - 10 (#/ft$^3$) | COUNT_PER_CUBIC_FOOT |
| $CO_2$ (ppm) | PARTS_PER_MILLION |
| Formaldehyde (ppb) | PARTS_PER_BILLION |
| CO (ppm) | PARTS_PER_MILLION |
| $SO_2$ (ppb) | PARTS_PER_BILLION |
| Ozone (ppb) | PARTS_PER_BILLION |
| $NO_2$ (ppb) | PARTS_PER_BILLION |
| CL (ppm) | PARTS_PER_MILLION |
| $NH_3$ (ppm) | PARTS_PER_MILLION |
| VOC (ppm) | PARTS_PER_MILLION |
| VOC (ppb) | PARTS_PER_BILLION |

**TSI**  Knowledge Beyond Measure.