

**DRAFT**



# Palo Verde Elementary School

Palo Alto Unified School District

School Reopening Report  
Evaluation Date: October 29, 2020  
Report Date: December 10, 2020

**Prepared By:**

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## 1.0 Executive Summary

### 1.1 Overview

Ecology Action performed functional testing of the HVAC units at Palo Verde Elementary School on 10/29/2020 to focus on whether sufficient outside air ventilation was being supplied to occupied spaces. The evaluation was to determine if the occupied spaces were meeting the minimum indoor air quality (IAQ) guidelines set by PAUSD, referencing CDC, ASHRAE, and Title 24 code.

The following people were involved in the process:

1. Mike Diep, PE  
*Sr. Mechanical Engineer*
2. Aaron Worthy  
*Project Manager*
3. Randy Arenas  
*PAUSD HVAC Technician*

### 1.2 Process

The following steps were taken to evaluate the occupied spaces at school.

#### Specifications

1. Room dimensions were measured using laser distance measurements to calculate room area (sq. ft.) as well as volume (cu. ft.)
2. Make and model of HVAC equipment noted
3. Visual verification of filter and filter size

#### Measurements

1. All windows and doors were closed during testing
2. Outside air (OA) dampers were commanded to minimum position
3. Airflow measurements were taken with flow hood anemometers as well as hot wire anemometer if required. Flows were measured in the occupied space and were as follows:
  - a. Supply air
  - b. Return air
  - c. Outside air
    - i. Calculated based on difference between supply, return, and exhaust
    - ii. Directly measured at HVAC unit when required due to access issue at return air

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## 1.3 Inspection

1. Outside air dampers were inspected for functionality and position
2. Each outside air damper was commanded to open 100% through the BMS, then returned to its minimum position. If there were issues, they were noted and often repaired on site by districts HVAC technician

## 2.0 Qualifications

There are 3 main qualifications to determine whether the system is sufficient for reopening.

1. Air filter
  - a. Min. MERV 13 per CASH Covid-19 recommendation
2. Ventilation
  - a. Requires minimum 30 cfm/person per PAUSD agreement to double Title 24 requirements of 15 cfm/person
  - b. Total outside air cfm is based on district determined occupancy in the space.
    - i. Example: If the space is limited to 15 people, then the total outside air cfm required is 450 cfm (30 cfm/person x 15 people)
3. Mechanical Functionality
  - a. The functionality of the mechanical system is important to remotely control the OA dampers if needed. Although, the minimum position is evaluated to determine if sufficient OA is delivered whenever the unit is operating.

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## 3.0 Results

Results are presented in a table outlining the measurement and evaluation of each room.

To better help understand the table, here are a few items to note:

- i. 3-color ranking – Rows for each room will be highlighted in the following colors to determine performance
  - a. GREEN – No attention required. IAQ and mechanical is sufficient
  - b. YELLOW – Minor attention required. IAQ may still be sufficient
  - c. RED – Major attention required. May not be suitable for occupancy based on IAQ without further filtration or reduction in occupancy
- ii. Actual Room Capacity – This is based on 15 occupants per 1,000 sq. feet of floor space.
  - a. Space dimensions and occupancy quantities that should be noted are highlighted in red text. This may be to show that the area was smaller or larger than the typical room. Also, the room capacity may be modified for the Administration building.
- iii. Sufficient columns – These columns will be highlighted in green if sufficient and red if not.
  - a. MERV Rating
    - i. Based on actual air filters installed
  - b. Ventilation
    - i. Based on Ventilation Required (CFM) column which calculates the minimum cfm based on the Actual Room Capacity.
      1. A “N” will be shown if the measured OA cfm is below the ventilation required cfm.
  - c. Mechanical
    - i. This is to evaluate the operation of the HVAC unit
      1. If the OA damper was functioning based on BMS command and it was set to the appropriate minimum OA damper position, a “Y” will be noted.
      2. A “N” is provided if there is an issue with the mechanical operation. However, the OA damper position can be locked into a minimum position and therefore still pass the OA cfm requirements.
- iv. Air Changes
  - a. Fresh Air Changes per Hour
    - i. Number of air changes per hour of fresh air
  - b. Total Air Changes per Hour
    - i. Number of air changes per hour of total air through filter

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School	Palo Verde
Evaluation Date	10/29/2020
Report Date	12/10/2020

Color Legend

GREEN	No attention required. IAQ and mechanical is sufficient.
YELLOW	Minor attention required. IAQ may still be sufficient.
Portable	Major attention required. May not be suitable for occupancy based on IAQ without further filtration or reduction in occupancy

30	Cfm/person
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Room ID	Equipment Tag	Type	Manufacturer	Model Number	Filter		Ventilation			Room Specifications				Sufficient?	
					Size (inches)	Currently Installed Rating	Supply (CFM)	Return (CFM)	Outside Air (CFM) <sup>5</sup>	Floor Area (ft2)	Room Volume (ft3)	Actual Room Capacity (Occupant qty)	Ventilation Required (CFM)	MERV Rating <sup>1</sup>	Ventilation <sup>2</sup>
1	Address 14	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,180	n/a	507	1,152	13,824	15	450	Y	Y
2	Address 13	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,170	n/a	618	1,152	13,824	15	450	Y	Y
3	Address 12	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,151	n/a	585	1,152	13,824	15	450	Y	Y
4	Address 11	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,266	n/a	637	1,152	13,824	15	450	Y	Y
5	Address 10	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,252	n/a	582	1,152	13,824	15	450	Y	Y
6	Address 9	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,328	n/a	585	1,152	13,824	15	450	Y	Y
7	Address 8	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,172	n/a	596	1,152	13,824	15	450	Y	Y
8	Address 7	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,215	n/a	670	1,152	13,824	15	450	Y	Y
9	Address 1	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	745	n/a	455	471	6,123	7	210	Y	Y
10	Address 18	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	712	n/a	481	471	6,123	7	210	Y	Y
11	Address 2	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,154	n/a	586	960	12,480	15	450	Y	Y
12	Address 3	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,079	n/a	510	960	12,480	15	450	Y	Y
13	Address 4	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,108	n/a	470	960	12,480	15	450	Y	Y
14	Address 5	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,137	n/a	560	960	12,480	15	450	Y	Y
15	Address 6	Furnace	Comfortmaker	Enviroplus 80	20x25x2	MERV 13	1,185	n/a	584	960	12,480	15	450	Y	Y
16	HF17	Furnace	Comfortmaker	Enviroplus 80	16x35.5x2	MERV 13	1,442	n/a	544	1,249	16,239	15	450	Y	Y
Portable 17		Bard	QTEC		16x35.5x2	MERV 13	1,167	-1,125	42	1,365	12,285	15	450	Y	N
Portable 18		Bard	QTEC		16x35.5x2	MERV 13	1,174	-1,090	84	1,365	12,285	15	450	Y	N
Portable 19		Bard	QTEC		16x35.5x2	MERV 13	1,303	-1,135	168	1,365	12,285	15	450	Y	N
Portable 20		Bard	QTEC		16x35.5x2	MERV 13	803	-675	128	1,365	12,285	15	450	Y	N
Library	HF16	Furnace	Comfortmaker	Enviroplus 80	16x25x1	MERV 13	n/a	n/a	567	2,200	28,595	15	450	Y	Y
Psychologist	HF15	Furnace	Comfortmaker	Enviroplus 80	16x25x1	MERV 13	n/a	n/a	538	178	1,746	15	450	Y	Y
Main office		Furnace	Rheem		16x25x1	MERV 13	1,369	-858	511	4,286	40,717	15	450	Y	Y

1 MERV 13 minimum rating per CASH Covid-19 recommendations.

2 Values based on 2019 Title 24 120.1(c)3 Equation 120.1-G