Airspace and Safety Analysis - 180 El Camino Real, South San Francisco, CA

Williams Aviation Consultants, Inc. (WAC) was retained by El Camino SSF, LLC c/o Steelwave, LLC to complete an obstruction evaluation and airspace analysis of a study area located at 180 El Camino Real, South San Francisco, CA ***(Figure 1)***. The study area is located NW of San Francisco International Airport (SFO). The proposed project includes three 6-Story R&D Buildings and a proposed residential building. The 6-story buildings have an overall height of approximately 155' Above Mean Sea Level (AMSL), and the residential building has an overall height of approximately 132' AMSL.

The purpose of the analysis was to determine the maximum elevation to which a structure can be erected at the study area without having an adverse effect upon the safe and efficient use of the navigable airspace. The proposed study area's location in relation to San Francisco International Airport (SFO) is shown in ***Figure 2***.

Figure 1 – Study Area

Figure 2 – Study Area Location

FAA Review Process

The FAA utilizes the criteria contained in CFR Part 77 to determine reporting requirements, the impact of a proposed structure on navigable airspace, and whether the structure, if constructed, will require lighting and/or marking.

CFR Part 77 defines the criteria for determining if a structure will require reporting to the FAA, if the structure exceeds the stated criteria and requires the submittal of FAA Form 7460-1, and/or whether or not the structure has an impact on navigable airspace.

If the FAA determines that there is an impact to navigable airspace, a Notice of Presumed Hazard (NPH) will be issued and an aeronautical study will be conducted. Concurrent with the NPH the project is distributed to the FAA divisions having the responsibility for air traffic control, flight procedures, airport infrastructure and navigational aids. Each of these divisions then evaluates the project for impacts within their area of jurisdiction. These divisions submit their comments to the Air Traffic division who will issue a determination.

If the FAA determines that the proposed structure has a substantial adverse impact, they will issue a Determination of Hazard. In some cases, they will offer the project proponent options to mitigate the adverse impact, i.e., lower the structure, redesign etc.

It is not uncommon for the FAA's initial analysis to disregard factors unique to a specific airport such as existing structures or special procedures that have been developed for that airport.

Once the FAA's initial analysis is complete, additional data can be presented to the FAA for their consideration which may result in the approval of the proposed structure.

WAC Analysis

The WAC airport and airspace compatibility analysis includes a review of the following criteria to determine possible adverse impacts to aeronautical operations:

1. Public and private airports in the vicinity of the proposed structure.
2. Federal Aviation Regulation Part 77, Objects Affecting Navigable Airspace.
3. Terminal Instrument Procedures (TERPS) including instrument approach and departure procedures.
4. Visual Flight Rule (VFR) Traffic Pattern Airspace.
5. One Engine Inoperative (OEI) Criteria
6. Airport Land Use Compatibility Plan (ALUCP) Safety Compatibility Zones

Public/Private Airports:

San Francisco International Airport (SFO) Runway 10L is located approximately 1.61 Nautical Miles (NM) SE of the study area ***(Figure 3).*** San Francisco International Airport (SFO) is a public use, public-owned airport located within the City of San Francisco, CA. The airport currently maintains four runways; Runway 10L/28R with a length of 11,870 feet, Runway 10R/28L with a length of 11,381 feet, Runway 1R/19L with a length of 8,650 feet, and Runway 1L/19R with a length of 7,650 feet.

An in-depth analysis of SFO was conducted to determine possible impacts on navigable airspace, flight procedures, and determine the maximum achievable structure elevation which will not adversely impact aeronautical operations.

Figure 3 – Study Area Distance to Runway 10L

CFR Part 77 Analysis

CFR Part 77 Notice Requirements and Obstruction Standards

An analysis of CFR Part 77 Notice Requirements was conducted and it was determined that the proposed project would require formal submission to the FAA.

An analysis of CFR Part 77 Obstruction Standards was completed to determine the maximum Above Mean Sea Level (AMSL) elevation to which a structure could be erected without exceeding CFR Part 77 Civil Airport Imaginary Surfaces ***(Figure 4).*** As stated in FAA Order 7400.2 Procedures for Handling Airspace Matters paragraph 6-3-9b:

"Obstruction standards are used to identify potential adverse effects and are not the basis for a determination. The criteria used in determining the extent of adverse affect are those established by the FAA to satisfy operational, procedural, and electromagnetic requirements. These criteria are contained in regulations, advisory circulars, and orders (e.g., the 8260 Order series and Order 7110.65). Obstruction evaluation personnel must apply these criteria in evaluating the extent of adverse effect to determine if the structure being studied would actually have a substantial adverse effect and would constitute a hazard to air navigation."

CFR Part 77 Obstruction Standards is not used to determine if a structure will be a hazard to air navigation, rather, structures exceeding these criteria are studied closely by the FAA to determine if the structure will require mitigation or if the structure will impact terminal instrument procedures or visual flight rule traffic pattern airspace. Generally, a structure that exceeds CFR Part 77

Obstruction Standards will require mitigation such as lighting and/or marking in order to make it more conspicuous to airmen.

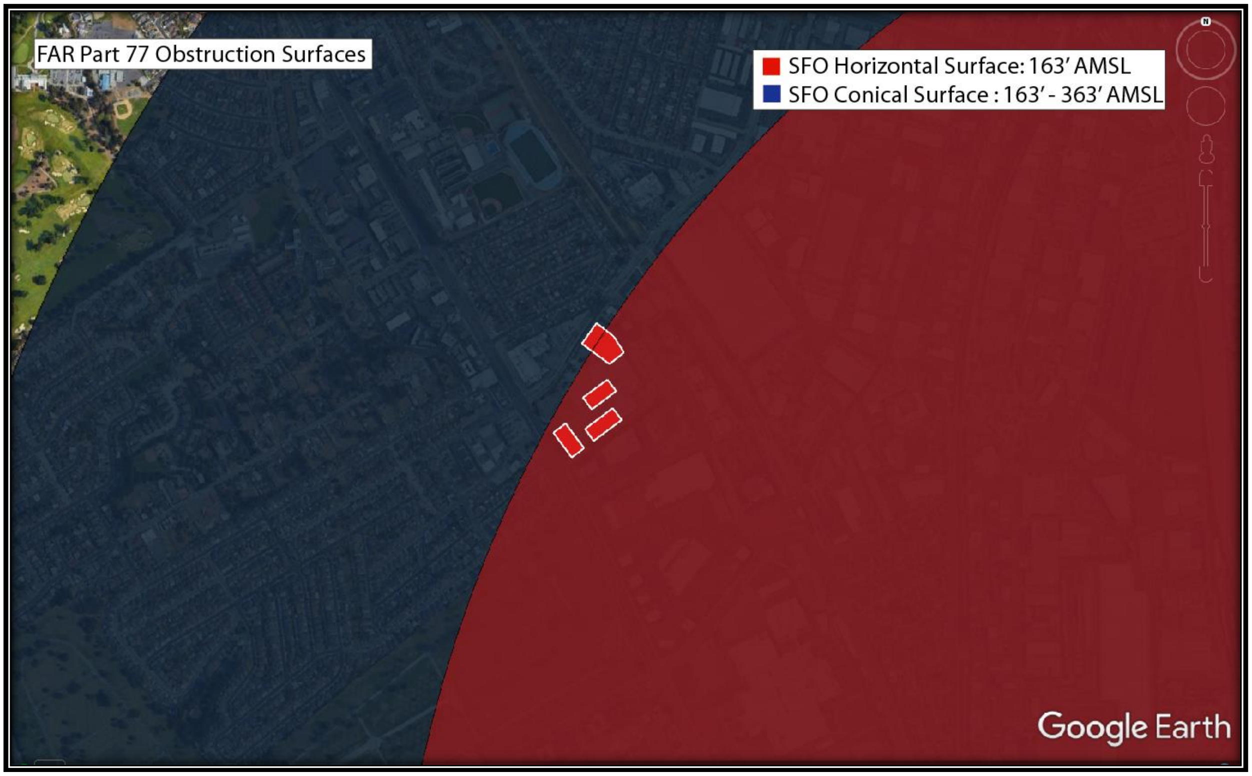

Figure 4 - SFO Civil Airport Imaginary Surfaces

Conclusion: The majority of the study area is located within the 163' Above Mean Sea Level (AMSL) Horizontal Surface for SFO. A small portion of the proposed residential building is located within the Conical Surface for SFO. This Conical Surface has an increasing slope of 20:1.

A penetration to Obstruction Standards does not mean the structure will have an adverse impact to operations, rather the airport's specific procedures, such as Instrument Approach/Departure and VFR Traffic Pattern procedures, must be studied to determine if the specific procedures will be impacted.

The FAA may require an obstruction exceeding Obstruction Standards to be lighted in accordance with FAA Advisory Circular 70/7460-1L to make it more conspicuous to airmen.

Terminal Instrument Procedures (TERPS)

An analysis of the Terminal Instrument Procedures (TERPS) criteria was completed to determine the maximum elevation to which a structure could be erected without impacting SFO instrument approach and departure procedures.

Instrument Approach Procedures

A penetration to the Obstacle Clearance Surfaces (OCS) by a proposed structure would result in the need to increase the procedure's Minimum Descent Altitude (MDA) (the lowest altitude that a pilot can descend on an approach) and would likely receive a Hazard Determination from the FAA.

SFO Instrument Arrival Procedures

A review of SFO's Instrument Approach Procedures (IAP) revealed that the approaches for aircraft landing on Runways 10L/R have the lowest Obstacle Clearance Surfaces (OCS) over the study area.

Figures 5 through 10 display the OCS associated with Instrument Approach Procedure's (IAP) to SFO RWY 10L/R.

Figure 5 – LNAV RWY 10L

Figure 6 – LNAV RWY 10R

Figure 7 – RNP 0.30 DA RWY 10R

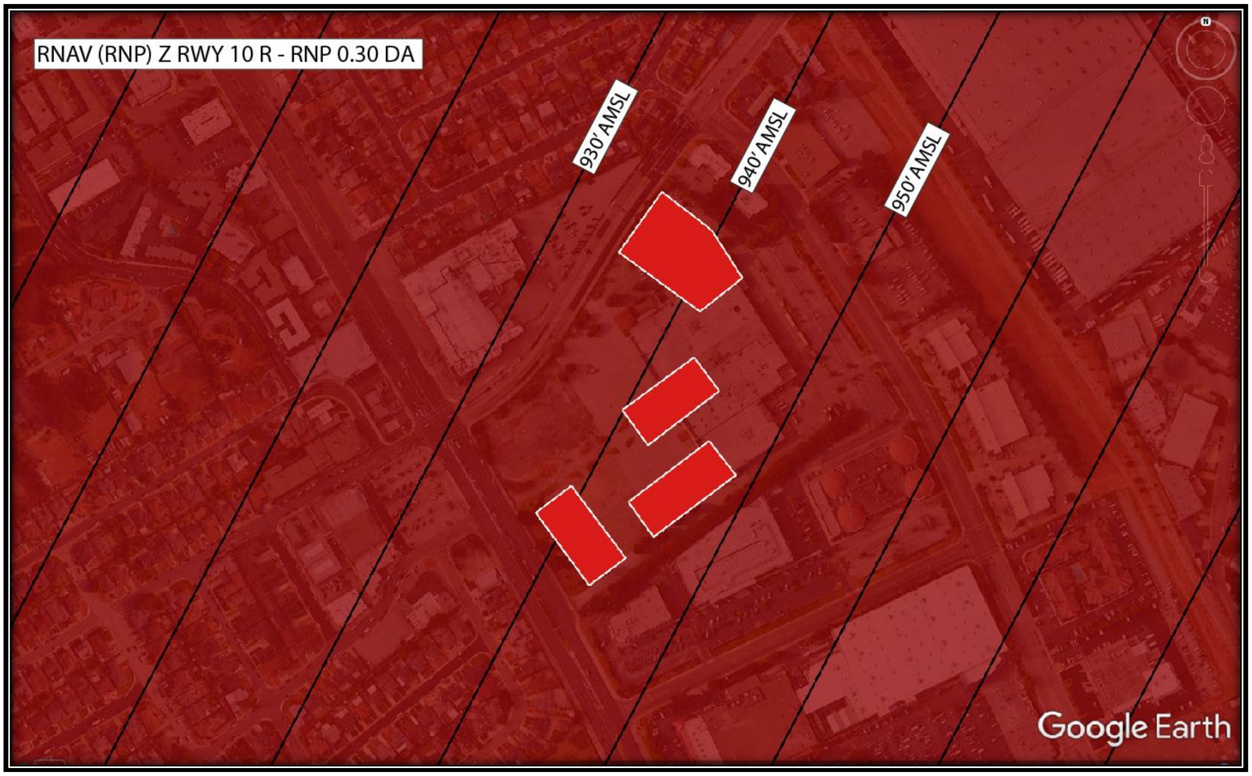

Figure 8 – RNP 0.30 DA RWY 10R Missed Approach AMSL Elevations

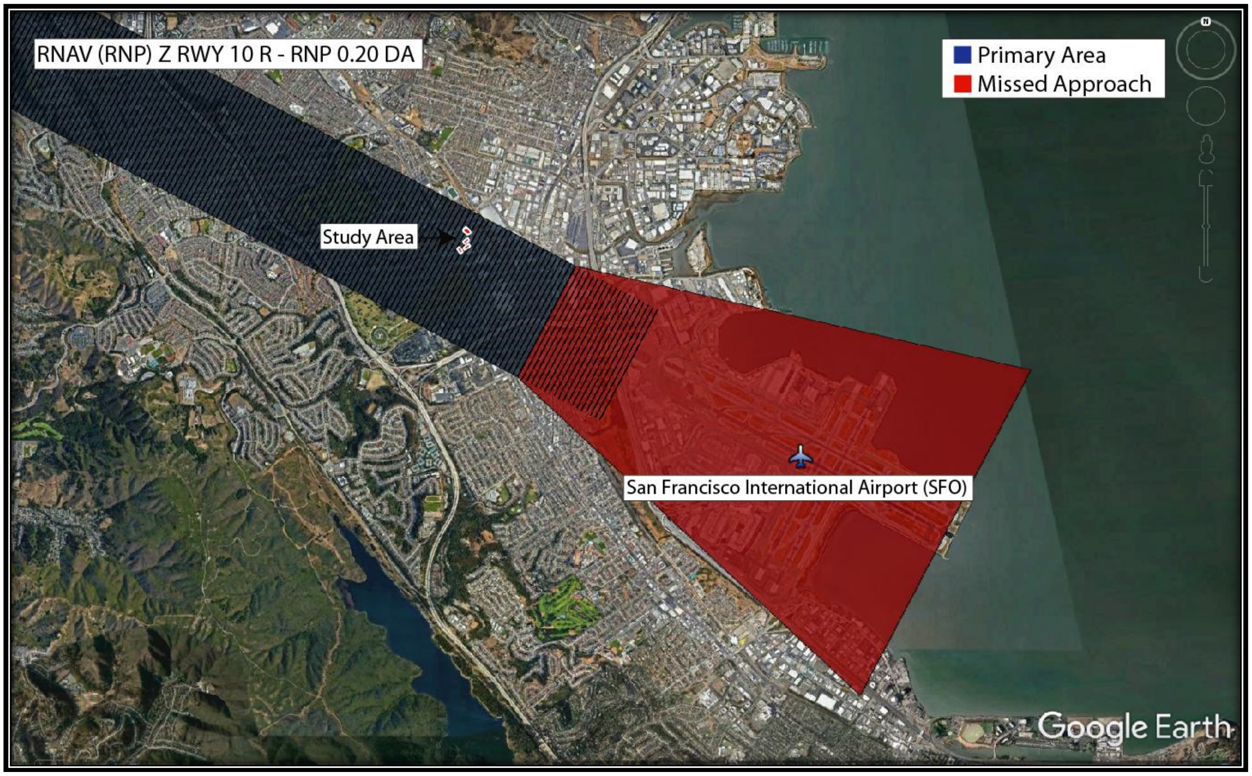

Figure 9 – RNP 0.20 DA RWY 10R

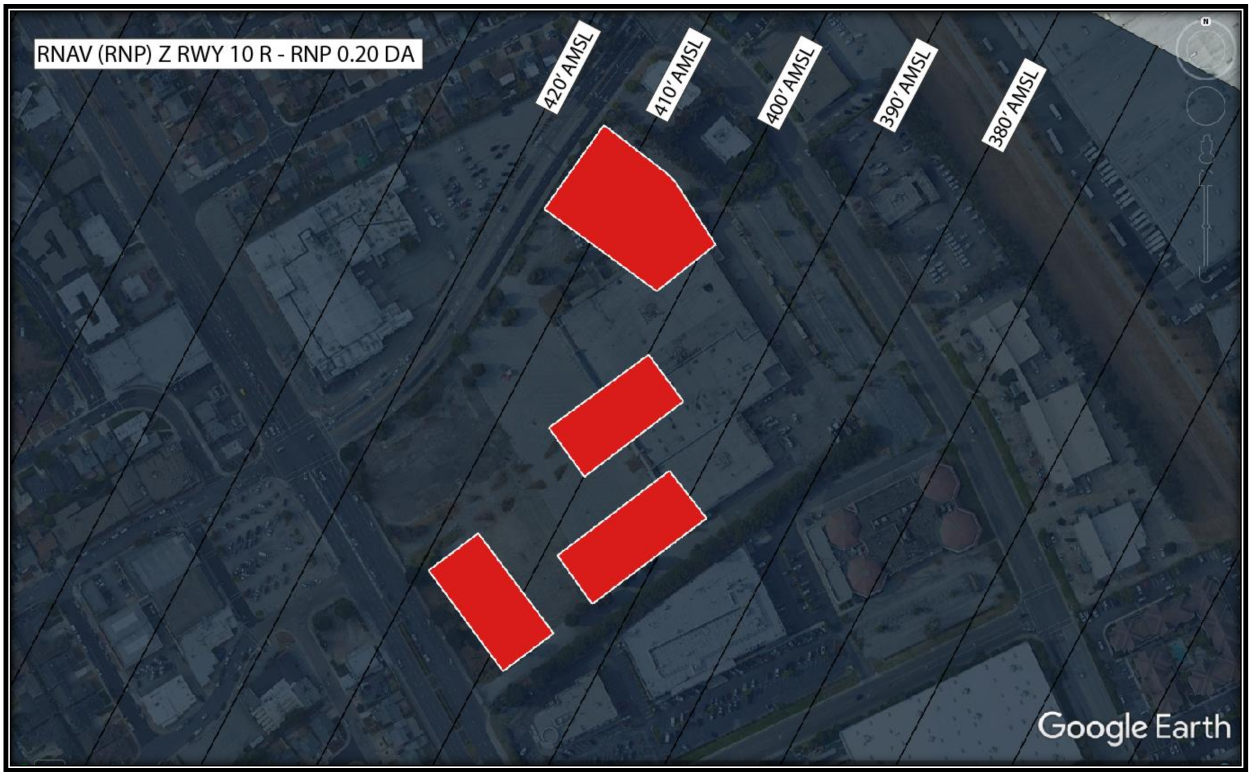

Figure 10 – RNP 0.20 DA RWY 10R AMSL Elevations

Conclusion: The maximum height over the study area, without affecting IAP to SFO, is approximately 385' AMSL to the SE and approximately 415' AMSL to the NW.

Circle-to-Land Instrument Approach Procedure

Each instrument approach procedure to SFO contain a circle-to-land option. The circle-to-land portion of the procedure allows a pilot to approach the airport in instrument conditions then, once he has the airport environment in sight, the pilot can maneuver the aircraft to the opposite end of the runway to land. A pilot would execute this type of instrument approach procedure if the winds were not favorable for landing on the primary runway for which the procedure was designed.

The surfaces which protect the circle-to-land consist of horizontal circular surfaces which extend from the end of each runway. The radius of each circle is dependent on the category of aircraft utilizing the circle-to-land approach.

Figure 11 displays an overview of the lowest OCS associated with the Circle-to-Land Category B Approach to SFO.

Figure 11 – SFO Circle-to-Land Category B

Conclusion: The maximum height over the study area, without affecting Circle-to-Land to SFO, is 660' AMSL.

Visual Flight Rule (VFR) Traffic Pattern Airspace

An analysis of SFO's VFR Traffic Pattern Airspace was completed to determine the maximum elevation to which a structure could be erected without impacting aircraft operating in visual conditions at SFO. A structure that exceeds VFR Part 77 Obstruction Standards (as applied to visual approach runways) could have an impact on aircraft operating in an airport's VFR Traffic Pattern.

Figure 12 displays the elevation to which a structure could be erected without penetrating SFO VFR Traffic Pattern Airspace.

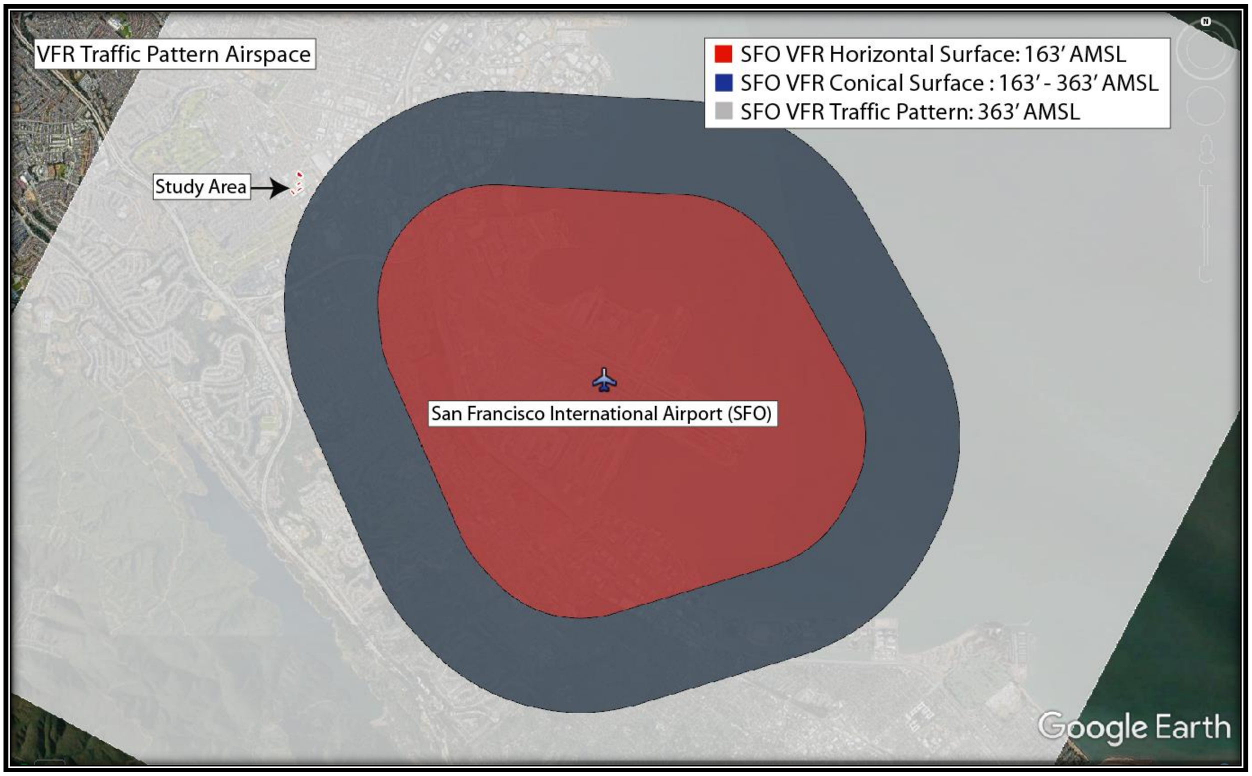

Figure 12 - SFO VFR Traffic Pattern Airspace

Conclusion: The maximum height over the study area, without affecting the VFR Traffic Pattern to SFO is 363’ AMSL.

Obstacle Departure Procedures

The OCS associated with SFO’s published departure procedures were analyzed. A penetration to the Departure procedure Initial Climb Area (ICA) could result in the need for the departure procedure to be modified.

Figures 13 and 14 display an overview of the ICA for SFO RWY 28R Departure.

Figure 13 - SFO RWY 28R ICA

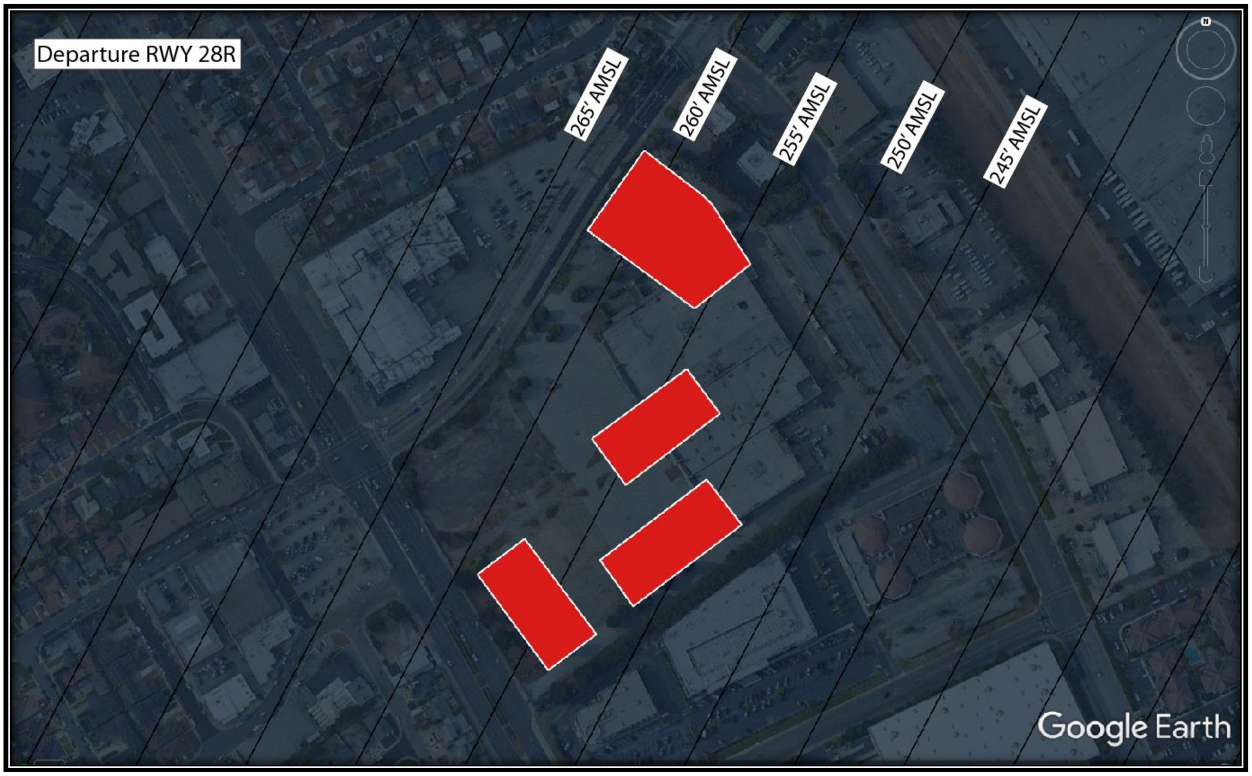

Figure 14 - SFO RWY 28L ICA AMSL Elevations

Conclusion: The maximum height over the study area, without affecting the RWY 28R Departure ICA is approximately 247' AMSL to the SE and approximately 263' AMSL to the NW.

One Engine Inoperative (OEI)

All commercial airlines are required to develop OEI procedures for each airport / runway out of which they conduct flight operations. The Federal Aviation Regulations (FARs) prescribe that in the event of an engine failure on takeoff, commercial air carrier type aircraft must be loaded in such a manner that they are able to clear obstacles along their intended route of flight by either 35 feet vertically or 300 feet laterally.

It is the airlines responsibility that in an event of an engine failure on takeoff, commercial air carrier type aircraft must be loaded in such a manner that they are able to clear obstacles along their intended route of flight. Also, the FAA has stated they do not consider OEI departure splay paths in their analysis. OEI Departure Splay Paths should not be used to determine the maximum achievable building heights over the property.

Figure 15 displays the SFO OEI Splay Path off Runways 28R/L. The SFO iALP Single Point Analysis Tool was used to determine the maximum heights allowed at the study area. ***Figure 16*** shows the maximum OEI heights at the 4 study locations without exceeding the SFO iALP online tool.

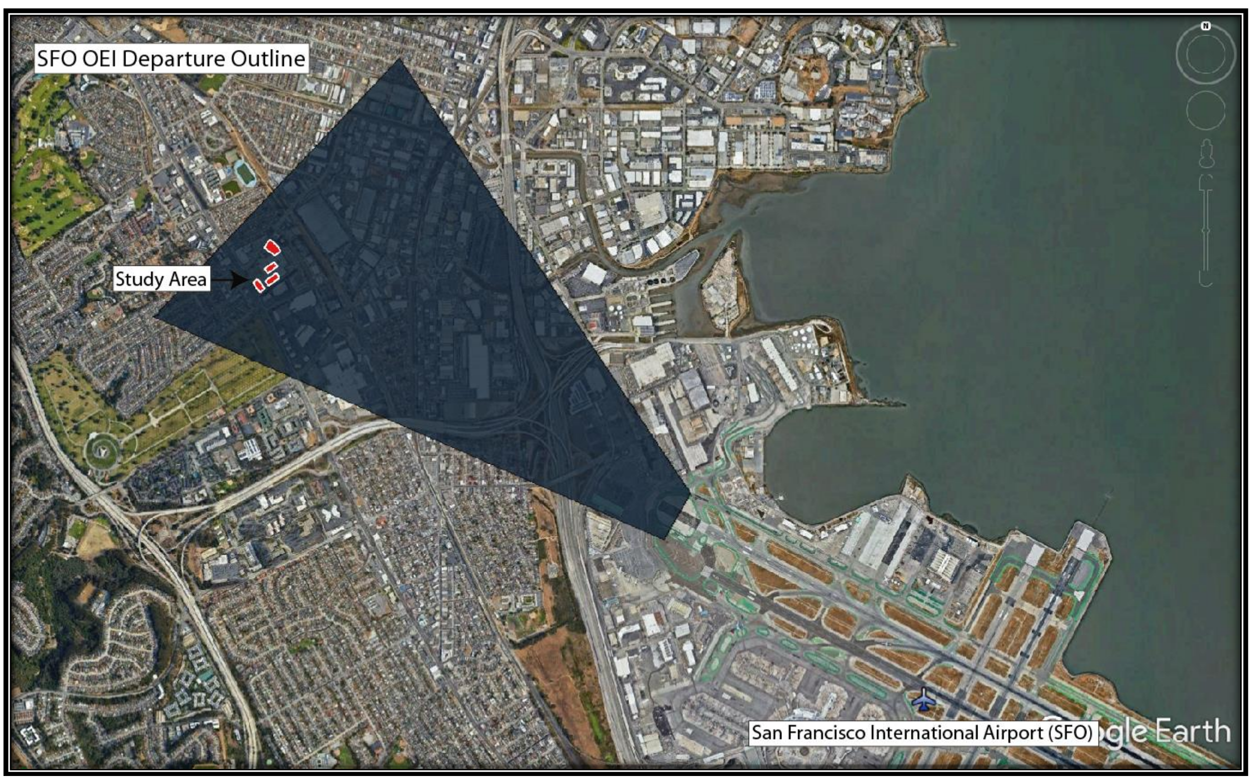

Figure 15 – OEI Splay over Study Area

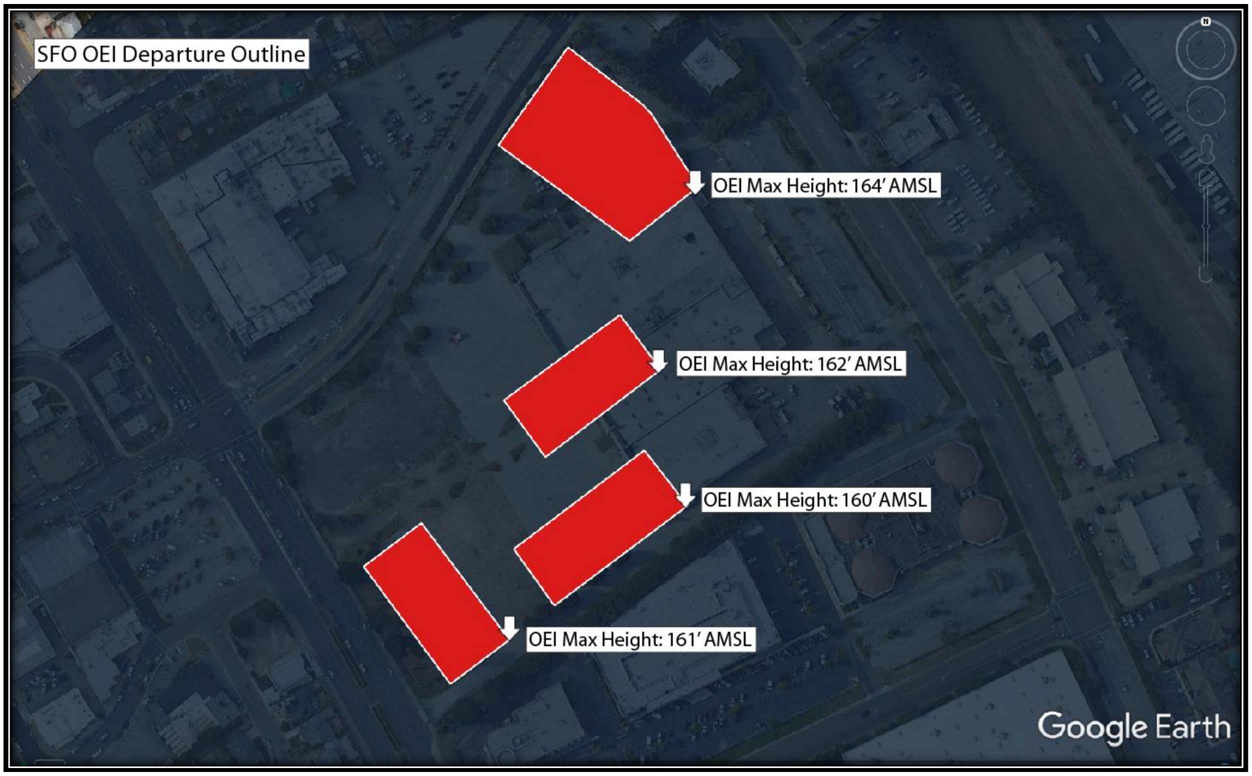

Figure 16 – SFO iALP OEI Max Heights

Conclusion: The proposed 155' AMSL R & D 6-Story Buildings, and the proposed 132' AMSL Residential Building will not exceed the SFO OEI Maximum Heights.

Safety Compatibility Policies

Figure 17 displays the Safety Compatibility Zones for SFO.

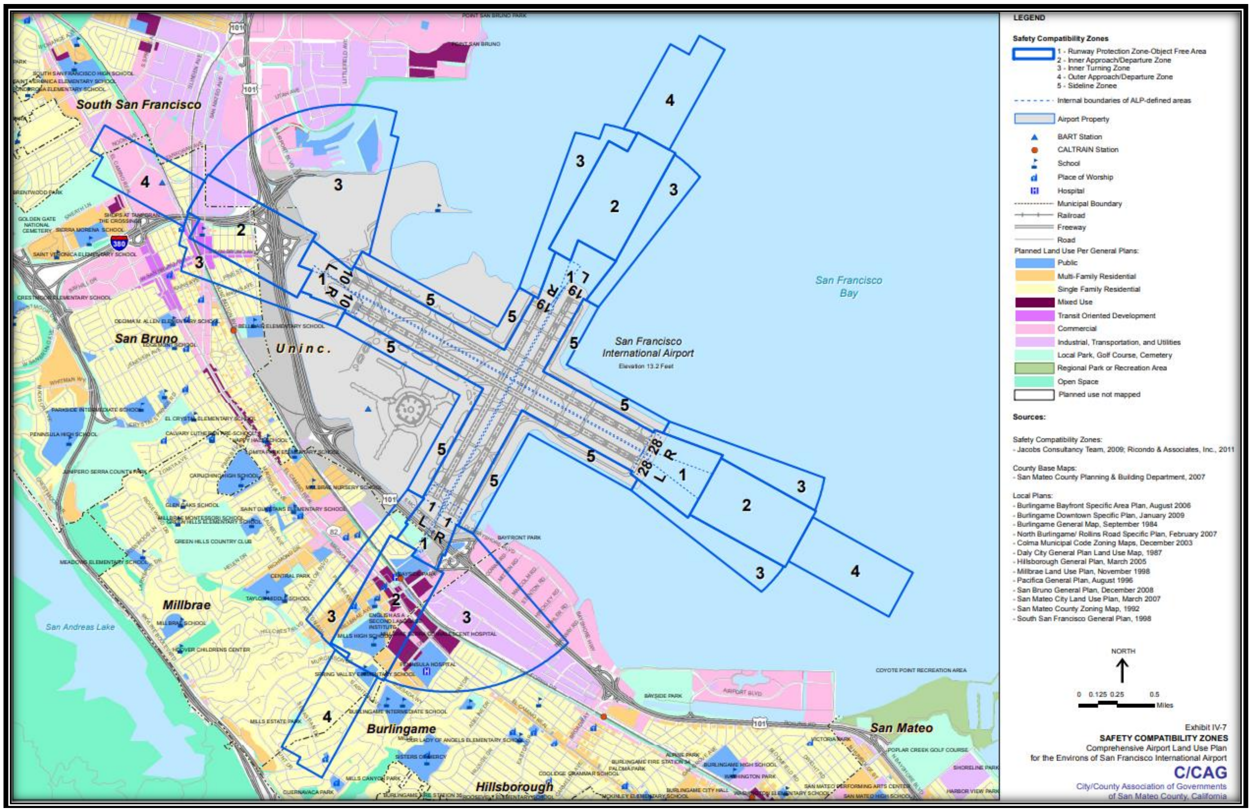

Figure 17 – Safety Compatibility Zones

Shown in ***Figure 18***, the proposed Biosafety Level 2 R & D buildings are located within Zone 4. "Zone 4 - Outer Approach/Departure Zone (OADZ): Zone 4, the OADZ, extends along the extended runway centerline immediately beyond the IADZ. It is subject to overflights of aircraft on approach and straight-out departures. At SFO, the OADZ off the west end of Runways 10R-28L and 10L-28R is overflown by a high proportion of departures using Runways 28L and 28R, especially long-haul departures by heavy, wide-body aircraft."[1]

Figure 19 displays the Incompatibile and Avoid Land Use Criteria for Zone 4. Biosafety Level 3 and 4 facilities are Incompatibile within Zone 4. "Biosafety Level 3 and 4 facilities: Medical and biological research facilities involving the storage and processing of extremely toxic or infectious agents ***(Figure 20***). See Policy SP-3 for additional detail."[1]

Figure 21 displays the SP-3 Hazardous Uses definitions. Biosafety Level 2 practices, equipment, and facility design and construction are applicable to clinical, diagnostic, teaching, and other laboratories in which work is done with the broad spectrum of indigenous moderate-risk agents that are present in the communityand associated with human disease of varying severity. **<u>The proposed R & D facilities are Biosafety Level 2.</u>**

[1] Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport

Figure 18 – Study Area with Safety Compatibility Zones

Table IV-2 (1 of 2) Safety Compatibility Criteria		
	LAND USE CRITERIA	
ZONE	INCOMPATIBLE[1/]	AVOID[1/]
Zone 1: Runway Protection Zone and Object Free Area (RPZ-OFA)		
	All new structures[3/] Places of assembly not in structures Hazardous uses[2/] Critical public utilities[2/]	Nonresidential uses except very low intensity uses[4/] in the "controlled activity area."[2/]
Zone 2: Inner Approach/Departure Zone (IADZ)		
	Children's schools[2/] Large child day care centers and noncommercial employer-sponsored centers ancillary to a place of business[2/] Hospitals, nursing homes Hazardous uses[2/] Critical public utilities[2/] Theaters, meeting halls, places of assembly seating more than 300 people Stadiums, arenas	---
Zone 3: Inner Turning Zone (ITZ)		
	Biosafety Level 3 and 4 facilities[2/] Children's schools[2/] Large child day care centers[2/] Hospitals, nursing homes Stadiums, arenas	Hazardous uses other than Biosafety Level 3 and 4 facilities[2/] Critical public utilities[2/]
Zone 4: Outer Approach/Departure Zone (OADZ)		
	Biosafety Level 3 and 4 facilities[2/] Children's schools[2/] Large child day care centers[2/] Hospitals, nursing homes Stadiums, arenas	Hazardous uses other than Biosafety Level 3 and 4 facilities[2/] Critical public utilities[2/]

Figure 19 – Land Use Criteria

Table IV-2 (2 of 2) Safety Compatibility Criteria

Notes:

1/ *Avoid:* Use is not fully compatible and should not be permitted unless no feasible alternative is available. Where use is allowed, habitable structures shall be provided with at least 50 percent more exits than required by applicable codes. Where the 50-percent factor results in a fraction, the number of additional exits shall be rounded to the next highest whole number.

Incompatible Use is not compatible in the indicated zones and cannot be permitted.

2/ Definitions

- *Biosafety Level 3 and 4 facilities:* Medical and biological research facilities involving the storage and processing of extremely toxic or infectious agents. See Policy SP-3 for additional detail.
- *Children's schools:* Public and private schools serving preschool through grade 12, excluding commercial services.
- *Controlled Activity Area: The lateral edges of the RPZ, outside the Runway Safety Area (RSA) and the extension of the RSA, which extends to the outer edge of the RPZ. See FAA Advisory Circular 150/5300-13, Airport Design, Section 212a.(1)(b).*
- *Critical public utilities:* Facilities that, if disabled by an aircraft accident, could lead to public safety or health emergencies. They include the following: electrical power generation plants, electrical substations, wastewater treatment plants, and public water treatment facilities.
- *Hazardous uses:* Uses involving the manufacture, storage, or processing of flammable, explosive ,or toxic materials that would substantially aggravate the consequences of an aircraft accident. See Policy SP-3 for additional detail.
- *Large child day care centers:* Commercial facilities defined in accordance with Health and Safety Code, Section 1596.70, et seq., and licensed to serve 15 or more children. Family day care homes and noncommercial employer-sponsored facilities ancillary to place of business are allowed.

3/ Structures serving specific aeronautical functions are allowed, in compliance with applicable FAA design standards.

4/ Examples include parking lots and outdoor equipment storage.

SOURCE: Ricondo & Associates, Inc., June 2012.
PREPARED BY: Ricondo & Associates, Inc., June 2012.

Figure 20 – Safety Compatibility Criteria

SP-3 HAZARDOUS USES

Hazardous uses, facilities involving the manufacture, processing, or storage of hazardous materials, can pose serious risks to the public in case of aircraft accidents. Hazardous materials of particular concern in this ALUCP, and which are covered by the safety compatibility criteria in Table IV-2, are the following:

A. **Aboveground fuel storage** — This includes storage tanks with capacities greater than 10,000 gallons of any substance containing at least 5 percent petroleum.[11] Project sponsors must provide evidence of compliance with all applicable regulations prior to the issuance of development permits.

B. **Facilities where toxic substances are manufactured, processed or stored** — Proposed land use projects involving the manufacture or storage of toxic substances may be allowed if the amounts of the substances do not exceed the threshold planning quantities for hazardous and extremely hazardous substances specified by the EPA.[12]

C. **Explosives and fireworks manufacturing and storage** — Proposed land use projects involving the manufacture or storage of explosive materials may be allowed in safety zones only in compliance with the applicable regulations of the California Division of Occupational Safety and Health (Section 5252, Table EX-1). Project sponsors must provide evidence of compliance with applicable state regulations prior to the issuance of any development permits.[13]

D. **Medical and biological research facilities handling highly toxic or infectious agents** — These facilities are classified by "Biosafety Levels."[14] Biosafety Level 1 does not involve hazardous materials and is not subject to the restrictions on hazardous uses in Table IV-2. Definitions of the other three biosafety levels are quoted from *Biosafety in Microbiological and Biomedical Laboratories*, below.[15]

   a. Biosafety Level 2 practices, equipment, and facility design and construction are applicable to clinical, diagnostic, teaching, and other laboratories in which work is done with the broad spectrum of indigenous moderate-risk agents that are present in the community and associated with human disease of varying severity.

   b. Biosafety Level 3 practices, safety equipment, and facility design and construction are applicable to clinical, diagnostic, teaching, research, or production facilities in which work is done with indigenous or exotic agents with a potential for respiratory transmission, and which may cause serious and potentially lethal infection.

   c. Biosafety Level 4 practices, safety equipment, and facility design and construction are applicable for work with dangerous and exotic agents that pose a high individual risk of life-threatening disease, which may be transmitted via the aerosol route and for which there is no available vaccine or therapy.

Figure 21 – SP-3 Hazardous Uses

WAC Conclusion: Accoding to Dr. Kinkead Reiling, CEO and Founder of Bonneville Labs (see Attachment A) "The lowest level 1 (BSL-1) precautions consist of regular hand-washing and minimal personal protective equipment. These types of laboratories are ubiquitous in industry and are found in teaching setting such as high schools and colleges. The second lowest level (BSL-2) precautions consist of good laboratory practices and training, restricted lab access, decontamination practices, and protective measures such as the use of biosafety cabinets, gloves, lab coat, and safety glasses to allow the handling of generally treatable human diseases; examples could include Hepatitis A, B, and C, and Salmonella. Numerous laboratories throughout the bay area and country safely operate Biosafety Level 2 (BSL-2) facilities for research and development purposes.

In fact, the low-level risk to the community and public from a BSL-1 or BSL-2 research laboratory is not widely different, in that the organism handled in either one of them would not cause harm above organisms already found in the community, are generally treatable, and the robust facility, engineering, biosafety practices and security control measures necessary to effectively contain them are not highly susceptible to human error. Illness and infections spreading into communities surrounding a BSL-1 or BSL-2 lab are generally unheard of because research on high-risk agents and pathogens can only be performed in BSL-3 or 4 laboratories. While serving the health and well-being of our community through research to prevent disease, these labs do not pose high levels of risk by adhering to all relevant biosecurity and safety standards required by law."

Therefore, the difference between BSL-1 and BSL-2 are minimal, and the restrtictions in Safety Compatibility Zone 4 at SFO should not restrict the use of BSL-2. Only Biosafety Level 3 and 4 facilities are stated as being incompatible within Zone 4.

WAC Summary

The proposed 155' AMSL R & D 6-Story Buildings, and the proposed 132' AMSL Residential Building will not exceed the SFO Part 77 Civil Airport Imaginary Surfaces, SFO TERPs Surfaces, or SFO OEI Surfaces.

The WAC technical analysis revealed:

- ***An analysis of CFR Part 77 Notice Requirements was conducted and it was determined that the proposed project would require formal submission to the FAA.***

- ***The majority of the study area is located within the 163' Above Mean Sea Level (AMSL) Horizontal Surface for SFO. A small portion of the proposed residential building is located within the Conical Surface for SFO. This Conical Surface has an increasing slope of 20:1.***

- ***The maximum height over the study area, without affecting IAP to SFO, is approximately 385' AMSL to the SE and approximately 415' AMSL to the NW.***

- ***The maximum height over the study area, without affecting Circle-to-Land to SFO, is 660' AMSL.***

- ***The maximum height over the study area, without affecting the VFR Traffic Pattern to SFO is 363' AMSL.***

- ***The maximum height over the study area, without affecting the RWY 28R Departure ICA is approximately 247' AMSL to the SE and approximately 263' AMSL to the NW.***

- ***The proposed 155' AMSL R & D 6-Story Buildings, and the proposed 132' AMSL Residential Building will not exceed the SFO OEI Maximum Heights.***

- ***Accoding to Dr. Kinkead Reiling, CEO and Founder of Bonneville Labs (see Attachment A), the difference between BSL-1 and BSL-2 are minimal, and the restrtictions in Safety Compatibility Zone 4 at SFO should not restrict the use of BSL-2. Only Biosafety Level 3 and 4 facilities are stated as being incompatible within Zone 4.***

Attachment A

Tom Williams, City Manager
Darcy Smith, Community Development Director
City of Millbrae
621 Magnolia Ave
Millbrae, CA 94030

My name is Dr. Kinkead Reiling. I am the founder of Bonneville Labs, a bio-entrepreneur, and graduate of UCSF. I have been a scientist, entrepreneur and am now a co-working laboratory operator all focused on research and innovation for over 25 years. At my current company, we support over 20 innovative bio-based companies across the bay area. Given the breadth of companies that I have seen over this time, I feel that I am uniquely positioned to comment on need for and relative safety of biolabs in the bay area.

Life science entrepreneurs and scientists need access to high quality laboratory space to handle biological samples safely and effectively as they perform the research critical to sustaining innovation in the industry. Bio-labs are designed to meet stringent safety requirements and the level of containment ranges from the lowest level 1 (BSL-1) to the highest at level 4 (BSL-4). My current laboratories support research up to BSL-2 thus enabling work on topics from disease to climate change.

The lowest level 1 (BSL-1) precautions consist of regular hand-washing and minimal personal protective equipment. These types of laboratories are ubiquitous in industry and are found in teaching setting such as high schools and colleges. The second lowest level (BSL-2) precautions consist of good laboratory practices and training, restricted lab access, decontamination practices, and protective measures such as the use of biosafety cabinets, gloves, lab coat, and safety glasses to allow the handling of generally treatable human diseases; examples could include Hepatitis A, B, and C, and Salmonella. Numerous laboratories throughout the bay area and country safely operate Biosafety Level 2 (BSL-2) facilities for research and development purposes.

In fact, the low-level risk to the community and public from a BSL-1 or BSL-2 research laboratory is not widely different, in that the organism handled in either one of them would not cause harm above organisms already found in the community, are generally treatable, and the robust facility, engineering, biosafety practices and security control measures necessary to effectively contain them are not highly susceptible to human error. Illness and infections spreading into communities surrounding a BSL-1 or BSL-2 lab are generally unheard of because research on high-risk agents and pathogens can only be performed in BSL-3 or 4 laboratories. While serving the health and well-being of our community through research to prevent disease, these labs do not pose high levels of risk by adhering to all relevant biosecurity and safety standards required by law.

Simply reflect on the year 2020, it is clear that there is an ongoing need for BSL-1 and BSL-2 lab space in the US for the purpose of performing research on the biology of disease-causing agents.

To conclude, the need for laboratories to safely and effectively research and prevent disease is increasing with great speed. The low-level risk of BSL-2 labs are on par with BSL-1 as they are limited to handling lower-risk organisms that in many cases are already present and generally controlled within our communities. I hope that the City of Millbrae will recognize the low-level risk of BSL-2 labs and be supportive of the life science industry that is working diligently to use biotechnology to address the pressing issues of our time ranging from illness to climate change.

Sincerely,
Dr. Reiling
CEO and Founder, Bonneville Labs