



# PLANNING APPEAL APPLICATION TO CITY COUNCIL

City Clerk's Office | 835 East 14th Street, San Leandro, CA 94577 | (510) 577-3367

## MUST BE SUBMITTED IN PERSON

### General Information + Appeal Timing

Decisions of the Board of Zoning Adjustments, Planning Commission, or the Site Development Sub-Commission may be appealed to City Council and are filed with the City Clerk's Office.

This appeal application must be submitted within fifteen (15) calendar days of the decision, and within ten (10) calendar days of a Tentative Map approval. If the appeal period ends on a weekend or holiday, the time limit shall be extended to the next working day.

### Appeal Application + Fees

Bring the following items to the City Clerk's Office:

1. Signed and completed Appeal Application (front side.)
2. Signed and completed Agreement for Payment of Appeal Fees (back side.)
3. Check payable to City of San Leandro or credit card (with a 2.5% fee) to pay the planning deposit (check with a Planner.)
4. Check payable to City of San Leandro or credit card (2.5% fee) to pay the separate \$534 city clerk fee

### OFFICIAL USE ONLY

#### APPEAL RECEIVED

By  
**A. Mogensen**

Date  
**5/20/2021**

**DEPOSIT PAID** (attach copy of receipt)

**FEE PAID** (attach copy of receipt)  
**\$1129.55**

cc:  
 Planning  CAO

I wish to appeal the decision of the:

Board of Zoning Adjustments

Planning Commission

Site Development Sub-Commission

### Project Address

Project #

PLN \_\_\_\_\_ - \_\_\_\_\_

Date of Action

Approved  
 Denied

### Reasons for Appeal - List all grounds relied upon in making this appeal. (Attach additional sheets if necessary)

### APPELLANT INFORMATION

#### Print Full Name

Applicant  Concerned Resident  Concerned Business Owner  Other: \_\_\_\_\_

Mailing Address

Phone #

Address

Email

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

*Michael R. Mogensen*

05/20/2021

Signature of Appellant

Date



# AGREEMENT FOR PAYMENT OF PLANNING APPEAL FEES

835 East 14th Street, San Leandro, CA 94577 | (510) 577-3325 | [planner@sanleandro.org](mailto:planner@sanleandro.org)

<b>Project Address</b>		Assessor's Parcel #
Address		
City	State	Zip
Project #	Date of Action	<input type="checkbox"/> Approved
PLN _____ - _____		<input type="checkbox"/> Denied

### APPELLANT INFORMATION

<b>Print Full Name</b>		
Mailing Address	Phone #	
Address	Email	
City	State	Zip

I (We) hereby agree to pay all direct costs as listed in the City's adopted fee schedule for the review and processing of application(s) for the subject project, at such time as requested by the Community Development Director. Direct costs include, but are not limited to, hourly personnel charges plus a factor of 3.38 for benefits and administrative overhead; legal fees; communications via telephone or written correspondence with the appellant, property owner, architect, engineer, etc.; analysis and preparation of staff reports and findings; and attendance at public hearings. If applicable, I (we) also hereby agree to pay all contract costs for preparation of an environmental document in compliance with the California Environmental Quality Act.

A deposit is required along with this form. Future payments are due and payable within 30 days. At the completion of the appeal process, any unused balance will be returned to the appellant. Interest will accrue on all costs unpaid 30 days after billing at the maximum legal rate and the City is entitled to recover its costs, including attorney's fees, in collecting unpaid accounts. Delinquent accounts may be sent to a collection agency.

Furthermore, I (we) hereby agree to hold the City harmless from all costs and expenses, including attorney's fees, incurred by the City or held to be the liability of the City in connection with the City's defense of its actions in any proceeding brought in any State or Federal Court challenging the City's actions with respect to my (our) project.

*Michael R. Soyars*

05/20/2021

Signature of Appellant

Date

### STAFF COMMENTS

Paid by credit card  
included City Clerk  
Filing Fee



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May 6, 2021

*Via E-mail*

Dylan Boldt, Vice Chair  
Tony Breslin, Commissioner  
Luis Mendoza, Commissioner  
Kenneth Pon, Commissioner  
Michael Santos, Commissioner  
Rick Solis, Commissioner  
Anthony Tejada, Commissioner  
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Andrew Morgensen, Planning Manager  
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**Re: Comments Regarding Proposed Callan & E. 14th Street Project (PLN18-0036; File # 21-241)**

Dear Vice Chair Boldt, Honorable Commissioners, and Mr. Morgensen:

I am writing on behalf of the Laborers International Union of North America, Local Union 304 and its members living in and around the City of San Leandro (“LIUNA”), regarding the PLN18-0036 Callan & E. 14th Street Project (PLN18-0036; File # 21-241) (“Project”). The Project proposes to construct a five-floor mixed-use residential and retail building on a 1.6-acre site located at 1188 E. 14th Street (APNs: 77-447-14-6, 77-447-15-6, 77-447-14-7, 77-447-7-1) by applicant 14th & Callan Street Developer LLC in the City of San Leandro (“City”).

LIUNA is concerned that the City is proposing to approve the Project without adequate environmental review under the California Environmental Quality Act (“CEQA”), Public Resources Code section 21000, *et seq.*, based on the assertion that the Project’s significant impacts were analyzed in the 2035 General Plan Update Environmental Impact Report certified in 2016 (“2035 General Plan EIR”) or would be substantially mitigated by the City’s uniformly applicable development policies. Infill Environmental Checklist, p. 1-2. LIUNA’s review of the Project has found that the Project will have significant effects relating to indoor air quality that

were not analyzed in the General Plan EIR and will not be substantially mitigated by the City's uniformly applicable development policies. LIUNA respectfully requests that the Commission and Board not approve the Project and instead direct staff to prepare a mitigated negative declaration ("MND") or an infill environmental impact report ("EIR") for the Project prior to approval in compliance with CEQA.

These comments have been prepared with the assistance of certified Industrial Hygienist, Francis "Bud" Offermann, PE, CIH. Mr. Offermann's comment and curriculum vitae are attached as Exhibit A hereto and are incorporated herein by reference and entirety.

## **I. PROJECT DESCRIPTION**

The Project proposed to demolish the existing three buildings and surface parking and require the removal of approximately 31,000 square feet of building area and 8,000 square feet basement beneath the 1188 E. 14th Street structure. The Project also proposes to develop a five-floor mixed-use residential and retail building composed of three floors of apartments, including 191 market-rate units and give inclusionary units, over a 286-space parking garage, grocery store, and three smaller retail spaces. The development would have a total build area of 286,204 gross square feet.

## **II. LEGAL STANDARD**

CEQA requires that an agency analyze the potential environmental impacts of its proposed actions in an environmental impact report ("EIR") (except in certain limited circumstances). *See, e.g.*, Pub. Resources Code ("PRC"), § 21100. The EIR is the very heart of CEQA. *Dunn-Edwards v. BAAQMD* (1992) 9 Cal.App.4th 644, 652. "The 'foremost principle' in interpreting CEQA is that the Legislature intended the act to be read so as to afford the fullest possible protection to the environment within the reasonable scope of the statutory language." *Communities for a Better Environment v. Cal. Resources Agency* (2002) 103 Cal.App.4th 98, 109 ("*CBE v. CRA*").

CEQA allows agencies to streamline environmental review for qualifying infill development projects that meet a detailed list of criteria set forth in Public Resources Code section 21094.5 and CEQA Guidelines section 15183.3. If an EIR has been prepared for a program or plan, the lead agency for a qualifying infill development project "shall examine specific effects of the later project upon the environment by using a tiered [EIR], except that the report on the later project is not required to examine those effects that the lead agency determines were either" mitigated or avoided in the prior EIR, or were examined with sufficient level of detail in the prior EIR to enable the mitigation or avoidance of those effects in the approval of

the later project. PRC § 21094.5(a). This streamlined review only applies to a later project if the lead agency determines that it is:

1. Consistent with the program, plan, policy, or ordinance for which an environmental impact report has been prepared and certified.
2. Consistent with applicable local land use plans and zoning of the city, county, or city and county in which the later project would be located.
3. Not subject to Section 21166.

*Id.* § 21094.5(b).

CEQA Guidelines section 15183.3 sets forth the streamlining provisions for these certain types of infill development projects. Under these streamlining provisions, CEQA review does not apply to an eligible infill project's impacts under two circumstances:

1. If an effect was addressed as a significant effect in a prior EIR for a planning level decision, then, with some exceptions, that effect need not be analyzed again for an individual infill project even when that effect was not reduced to a less than significant level in the prior EIR; and
2. An effect need not be analyzed, even if it was not analyzed in a prior EIR or is more significant than previously analyzed, if the lead agency makes a finding that uniformly applicable development policies or standards, adopted by the lead agency or a city or county, apply to the infill project and would substantially mitigate that effect.

CEQA Guidelines § 15183.3(c). Streamlined review under this section “will range from a complete exemption to an obligation to prepare a narrowed, project-specific environmental document.” *Id.*

The lead agency must examine the infill project in light of the prior EIR to determine if any effects require additional review under CEQA. *Id.* § 15183.3(d). “*Determinations pursuant to this section are questions of fact to be resolved by the lead agency. Such determinations must be supported with enough relevant information and reasonable inferences from this information to support a conclusion, even though other conclusions might also be reached.*” *Id.* (emphasis added). In supporting this determination, the lead agency's written checklist should explain whether the effects of the infill project were analyzed in a prior EIR by citing specific portions of the EIR, whether the infill project will cause new specific effects, and whether substantial new information shows that the adverse effects of the project are more significant than described in the prior EIR. *Id.* § 15183.3(d)(1)(B)-(D). If the project will cause new specific effects or more significant effects, the lead agency should indicate in the checklist whether uniformly applicable

development policies or standards would substantially mitigate those effects and specifically identify the uniformly applicable development policies or standards and explain how it would substantially mitigate the project's effects. *Id.* § 15183.3(d)(1)(E).

Here, the City is proposing to approve the Project based on the streamlined review under Public Resources Code section 20194.5 and CEQA Guidelines section 15183.3 by tiering an Infill Environmental Checklist from the 2035 General Plan EIR. *See* Infill Environmental Checklist, p. 1-2. The City concludes that the Project would not have any significant effects that were not already analyzed in the 2035 General Plan EIR or that the City's uniformly applicable development policies would not substantially mitigate. *Id.*, p. 2-7.

**III. NEITHER THE 2035 GENERAL PLAN EIR OR INFILL CHECKLIST ANALYZED THE PROJECT'S POTENTIAL INDOOR AIR QUALITY IMPACTS AND THE CITY FAILS TO PROVIDE EVIDENCE THAT THESE IMPACTS ARE MITIGATED BY THE CITY'S UNIFORMLY APPLICABLE DEVELOPMENT POLICIES.**

The City failed to analyze the Project's potentially significant impacts on residents from formaldehyde. These impacts were not analyzed or mitigated in the 2035 General Plan EIR nor were they identified as new specific effects of the Project in the Infill Environmental Checklist. By failing to analyze these impacts, the City also failed to identify any uniformly applicable development policies or standards that would mitigate the impacts. Therefore, the City has failed to provide any evidence that these potential impacts were reviewed and mitigated in the 2035 General Plan EIR or mitigated by the City's uniformly applicable development policies, and the City has not met its burden to exempt these impacts from further CEQA review under the two allowable circumstances identified in CEQA Guidelines section 15183.3(c). The City is required to address these impacts in a mitigated negative declaration or Infill EIR under CEQA Guidelines section 15183.3(d)(2) prior to approval.

Formaldehyde is a known human carcinogen and listed by the State of California as a Toxic Air Contaminant ("TAC"). The Bay Area Air Quality Management District ("BAAQMD") has established a significance threshold of health risks for carcinogenic TACs of 10 in a million. The City fails to acknowledge the significant indoor air emissions that will result from the Project.

Mr. Offermann explains that many composite wood products typically used indoors contain formaldehyde-based glues which off-gas formaldehyde over a very long time period. Ex. A, pp. 2-3. He explains, "The primary source of formaldehyde indoors is composite wood products manufactured with urea-formaldehyde resins, such as plywood, medium density

fiberboard, and particle board. These materials are commonly used in building construction for flooring, cabinetry, baseboards, window shades, interior doors, and window and door trims.” *Id.*

Mr. Offermann calculates that future employees of the Project will be exposed to a cancer risk from formaldehyde of approximately 17.7 per million and future residents of the Project will be exposed to a cancer risk of formaldehyde of approximately 120 per million, assuming all materials are compliant with the California Air Resources Board’s formaldehyde airborne toxics control measure. *Id.* at 4-5. These exceed BAAQMD’s CEQA significance thresholds for airborne cancer risk of 10 per million. *Id.* Mr. Offermann stressed that his calculations account for the fact that wood products for the project would be compliant with the most recent CARB standards. *Id.*

Mr. Offermann concludes that these significant environmental impacts must be analyzed, and mitigation measures should be imposed to reduce the risk of formaldehyde exposure. *Id.* at 4. He prescribes a methodology for estimating the Project’s formaldehyde emissions in order to do a more project-specific health risk assessment. *Id.* at 5-10. Mr. Offermann also suggests several feasible mitigation measures, such as requiring the use of composite wood products manufactured with CARB approved no-added formaldehyde (NAF) resins, which are readily available. *Id.* at 12-13.

When a Project exceeds a duly adopted CEQA significance threshold, as here, this alone establishes substantial evidence that the project will have a significant adverse environmental impact. Indeed, in many instances, such air quality thresholds are the only criteria reviewed and treated as dispositive in evaluating the significance of a project’s air quality impacts. See, e.g. *Schenck v. County of Sonoma* (2011) 198 Cal.App.4th 949, 960 (County applies Air District’s “published CEQA quantitative criteria” and “threshold level of cumulative significance”); see also *Communities for a Better Envnt. v. California Res. Agency* (2002) 103 Cal.App.4th 98, 110-11 (“A ‘threshold of significance’ for a given environmental effect is simply that level at which the lead agency finds the effects of the project to be significant”).

The California Supreme Court made clear the substantial importance that an air district significance threshold plays in providing substantial evidence of a significant adverse impact. *Communities for a Better Environment v. South Coast Air Quality Management Dist.* (2010) 48 Cal.4th 310, 327 (“As the [South Coast Air Quality Management] District’s established significance threshold for NOx is 55 pounds per day, these estimates [of NOx emissions of 201 to 456 pounds per day] constitute substantial evidence supporting a fair argument for a significant adverse impact.”). Since expert evidence demonstrates that the Project will exceed the BAAQMD’s CEQA significance threshold, there is substantial evidence that an “unstudied, potentially significant environmental effect[]” exists. See *Friends of Coll. of San Mateo Gardens*

*v. San Mateo Cty. Cmty. Coll. Dist.* (2016) 1 Cal.5th 937, 958.

The failure to address the Project's formaldehyde emissions is contrary to the California Supreme Court's decision in *California Building Industry Ass'n v. Bay Area Air Quality Mgmt. Dist.* (2015) 62 Cal.4th 369, 386 ("CBIA"). In that case, the Supreme Court expressly holds that potential adverse impacts to future users and residents from pollution generated by a proposed project must be addressed under CEQA. At issue in *CBIA* was whether the Air District could enact CEQA guidelines that advised lead agencies that they must analyze the impacts of adjacent environmental conditions on a project. The Supreme Court held that CEQA does not generally require lead agencies to consider the environment's effects on a project. *CBIA*, 62 Cal.4th at 800-01. However, to the extent a project may exacerbate existing environmental conditions at or near a project site, those would still have to be considered pursuant to CEQA. *Id.* at 801. In so holding, the Court expressly held that CEQA's statutory language required lead agencies to disclose and analyze "impacts on a project's users or residents that arise from the project's effects on the environment." *Id.* at 800.

The carcinogenic formaldehyde emissions identified by Mr. Offermann are not an existing environmental condition. Those emissions to the air will be from the Project. People will be using the Project once it is built and begins emitting formaldehyde. Once built, the Project will begin to emit formaldehyde at levels that pose significant direct and cumulative health risks. The Supreme Court in *CBIA* expressly finds that this type of air emission and health impact by the project on the environment and a "project's users and residents" must be addressed in the CEQA process. The existing TAC sources near the Project site would have to be considered in evaluating the cumulative effect on future residents of both the Project's TAC emissions as well as those existing off-site emissions.

The Supreme Court's reasoning is well-grounded in CEQA's statutory language. CEQA expressly includes a project's effects on human beings as an effect on the environment that must be addressed in an environmental review. "Section 21083(b)(3)'s express language, for example, requires a finding of a 'significant effect on the environment' (§ 21083(b)) whenever the 'environmental effects of a project will cause substantial adverse effects on human beings, either directly or indirectly.'" *CBIA*, 62 Cal.4th at 800. Likewise, "the Legislature has made clear—in declarations accompanying CEQA's enactment—that public health and safety are of great importance in the statutory scheme." *Id.* (citing e.g., §§ 21000, subds. (b), (c), (d), (g), 21001, subds. (b), (d)). It goes without saying that the future employees of the Project are human beings and the health and safety of those employees must be subjected to CEQA's safeguards.

The City has a duty to investigate issues relating to a project's potential environmental impacts. See *County Sanitation Dist. No. 2 v. County of Kern* (2005) 127 Cal.App.4th 1544,



1597-98 (“[U]nder CEQA, the lead agency bears a burden to investigate potential environmental impacts.”). The proposed Project will have significant impacts on air quality and health risks by emitting cancer-causing levels of formaldehyde into the air that will expose future residents and employees to cancer risks potentially in excess of BAAQMD’s threshold of significance for cancer health risks of 10 in a million.

#### **IV. Conclusion**

LIUNA respectfully requests that the City withdraw the Infill Environmental Checklist and prepare either an MND or Infill EIR to analyze and mitigate the Project’s adverse environmental impacts. Thank you for considering these comments.

Sincerely,

A handwritten signature in blue ink, appearing to read "Paige F.", with a stylized flourish extending to the right.

Paige Fennie

# Exhibit A



## INDOOR ENVIRONMENTAL ENGINEERING



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Date: May 6, 2021

To: Paige Fennie  
Lozeau | Drury LLP  
1939 Harrison Street, Suite 150  
Oakland, California 94612

From: Francis J. Offermann PE CIH

Subject: Indoor Air Quality: Callan and E 14<sup>th</sup> Street Project, San Leandro, CA.  
(IEE File Reference: P-4451)

Pages: 19

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### **Indoor Air Quality Impacts**

Indoor air quality (IAQ) directly impacts the comfort and health of building occupants, and the achievement of acceptable IAQ in newly constructed and renovated buildings is a well-recognized design objective. For example, IAQ is addressed by major high-performance building rating systems and building codes (California Building Standards Commission, 2014; USGBC, 2014). Indoor air quality in homes is particularly important because occupants, on average, spend approximately ninety percent of their time indoors with the majority of this time spent at home (EPA, 2011). Some segments of the population that are most susceptible to the effects of poor IAQ, such as the very young and the elderly, occupy their homes almost continuously. Additionally, an increasing number of adults are working from home at least some of the time during the workweek. Indoor air quality also is a serious concern for workers in hotels, offices and other business establishments.

The concentrations of many air pollutants often are elevated in homes and other buildings relative to outdoor air because many of the materials and products used indoors contain

and release a variety of pollutants to air (Hodgson et al., 2002; Offermann and Hodgson, 2011). With respect to indoor air contaminants for which inhalation is the primary route of exposure, the critical design and construction parameters are the provision of adequate ventilation and the reduction of indoor sources of the contaminants.

**Indoor Formaldehyde Concentrations Impact.** In the California New Home Study (CNHS) of 108 new homes in California (Offermann, 2009), 25 air contaminants were measured, and formaldehyde was identified as the indoor air contaminant with the highest cancer risk as determined by the California Proposition 65 Safe Harbor Levels (OEHHA, 2017a), No Significant Risk Levels (NSRL) for carcinogens. The NSRL is the daily intake level calculated to result in one excess case of cancer in an exposed population of 100,000 (i.e., ten in one million cancer risk) and for formaldehyde is 40 µg/day. The NSRL concentration of formaldehyde that represents a daily dose of 40 µg is 2 µg/m<sup>3</sup>, assuming a continuous 24-hour exposure, a total daily inhaled air volume of 20 m<sup>3</sup>, and 100% absorption by the respiratory system. All of the CNHS homes exceeded this NSRL concentration of 2 µg/m<sup>3</sup>. The median indoor formaldehyde concentration was 36 µg/m<sup>3</sup>, and ranged from 4.8 to 136 µg/m<sup>3</sup>, which corresponds to a median exceedance of the 2 µg/m<sup>3</sup> NSRL concentration of 18 and a range of 2.3 to 68.

Therefore, the cancer risk of a resident living in a California home with the median indoor formaldehyde concentration of 36 µg/m<sup>3</sup>, is 180 per million as a result of formaldehyde alone. The CEQA significance threshold for airborne cancer risk is 10 per million, as established by the South Coast Air Quality Management District (BAAQMD, 2017).

Besides being a human carcinogen, formaldehyde is also a potent eye and respiratory irritant. In the CNHS, many homes exceeded the non-cancer reference exposure levels (RELs) prescribed by California Office of Environmental Health Hazard Assessment (OEHHA, 2017b). The percentage of homes exceeding the RELs ranged from 98% for the Chronic REL of 9 µg/m<sup>3</sup> to 28% for the Acute REL of 55 µg/m<sup>3</sup>.

The primary source of formaldehyde indoors is composite wood products manufactured with urea-formaldehyde resins, such as plywood, medium density fiberboard, and

particleboard. These materials are commonly used in building construction for flooring, cabinetry, baseboards, window shades, interior doors, and window and door trims.

In January 2009, the California Air Resources Board (CARB) adopted an airborne toxics control measure (ATCM) to reduce formaldehyde emissions from composite wood products, including hardwood plywood, particleboard, medium density fiberboard, and also furniture and other finished products made with these wood products (California Air Resources Board 2009). While this formaldehyde ATCM has resulted in reduced emissions from composite wood products sold in California, they do not preclude that homes built with composite wood products meeting the CARB ATCM will have indoor formaldehyde concentrations below cancer and non-cancer exposure guidelines.

A follow up study to the California New Home Study (CNHS) was conducted in 2016-2018 (Singer et. al., 2019), and found that the median indoor formaldehyde in new homes built after 2009 with CARB Phase 2 Formaldehyde ATCM materials had lower indoor formaldehyde concentrations, with a median indoor concentrations of  $22.4 \mu\text{g}/\text{m}^3$  (18.2 ppb) as compared to a median of  $36 \mu\text{g}/\text{m}^3$  found in the 2007 CNHS. Unlike in the CNHS study where formaldehyde concentrations were measured with pumped DNPH samplers, the formaldehyde concentrations in the HENGH study were measured with passive samplers, which were estimated to under-measure the true indoor formaldehyde concentrations by approximately 7.5%. Applying this correction to the HENGH indoor formaldehyde concentrations results in a median indoor concentration of  $24.1 \mu\text{g}/\text{m}^3$ , which is 33% lower than the  $36 \mu\text{g}/\text{m}^3$  found in the 2007 CNHS.

Thus, while new homes built after the 2009 CARB formaldehyde ATCM have a 33% lower median indoor formaldehyde concentration and cancer risk, the median lifetime cancer risk is still 120 per million for homes built with CARB compliant composite wood products. This median lifetime cancer risk is more than 12 times the OEHHA 10 in a million cancer risk threshold (OEHHA, 2017a).

With respect to the Callan and E 14<sup>th</sup> Street Project, San Leandro, CA the buildings consist of residential and commercial buildings.

The employees of the commercial spaces are expected to experience significant indoor exposures (e.g., 40 hours per week, 50 weeks per year). These exposures for employees are anticipated to result in significant cancer risks resulting from exposures to formaldehyde released by the building materials and furnishing commonly found in offices, warehouses, residences and hotels.

Because these commercial spaces will be constructed with CARB Phase 2 Formaldehyde ATCM materials, and be ventilated with the minimum code required amount of outdoor air, the indoor formaldehyde concentrations are likely similar to those concentrations observed in residences built with CARB Phase 2 Formaldehyde ATCM materials, which is a median of 24.1  $\mu\text{g}/\text{m}^3$  (Singer et. al., 2020)

Assuming that the commercial spaces employees work 8 hours per day and inhale 20  $\text{m}^3$  of air per day, the formaldehyde dose per work-day at the offices is 161  $\mu\text{g}/\text{day}$ .

Assuming that these employees work 5 days per week and 50 weeks per year for 45 years (start at age 20 and retire at age 65) the average 70-year lifetime formaldehyde daily dose is 70.9  $\mu\text{g}/\text{day}$ .

This is 1.77 times the NSRL (OEHHA, 2017a) of 40  $\mu\text{g}/\text{day}$  and represents a cancer risk of 17.7 per million, which exceeds the CEQA cancer risk of 10 per million. This impact should be analyzed in an environmental impact report (“EIR”), and the agency should impose all feasible mitigation measures to reduce this impact. Several feasible mitigation measures are discussed below and these and other measures should be analyzed in an EIR.

The residential occupants will potentially have continuous exposure (e.g. 24 hours per day, 52 weeks per year). These exposures are anticipated to result in significant cancer risks resulting from exposures to formaldehyde released by the building materials and furnishing commonly found in residential construction.

Because these residences will be constructed with CARB Phase 2 Formaldehyde ATCM materials, and be ventilated with the minimum code required amount of outdoor air, the indoor residential formaldehyde concentrations are likely similar to those concentrations observed in residences built with CARB Phase 2 Formaldehyde ATCM materials, which is a median of 24.1  $\mu\text{g}/\text{m}^3$  (Singer et. al., 2020)

Assuming that the residential occupants inhale 20  $\text{m}^3$  of air per day, the average 70-year lifetime formaldehyde daily dose is 482  $\mu\text{g}/\text{day}$  for continuous exposure in the residences. This exposure represents a cancer risk of 120 per million, which is more than 12 times the CEQA cancer risk of 10 per million. For occupants that do not have continuous exposure, the cancer risk will be proportionally less but still substantially over the CEQA cancer risk of 10 per million (e.g. for 12/hour/day occupancy, more than 6 times the CEQA cancer risk of 10 per million).

Appendix A, Indoor Formaldehyde Concentrations and the CARB Formaldehyde ATCM, provides analyses that show utilization of CARB Phase 2 Formaldehyde ATCM materials will not ensure acceptable cancer risks with respect to formaldehyde emissions from composite wood products.

Even composite wood products manufactured with CARB certified ultra low emitting formaldehyde (ULEF) resins do not insure that the indoor air will have concentrations of formaldehyde that meet the OEHHA cancer risks that substantially exceed 10 per million. The permissible emission rates for ULEF composite wood products are only 11-15% lower than the CARB Phase 2 emission rates. Only use of composite wood products made with no-added formaldehyde resins (NAF), such as resins made from soy, polyvinyl acetate, or methylene diisocyanate can insure that the OEHHA cancer risk of 10 per million is met.

The following describes a method that should be used, prior to construction in the environmental review under CEQA, for determining whether the indoor concentrations resulting from the formaldehyde emissions of specific building materials/furnishings selected exceed cancer and non-cancer guidelines. Such a design analyses can be used to

identify those materials/furnishings prior to the completion of the City's CEQA review and project approval, that have formaldehyde emission rates that contribute to indoor concentrations that exceed cancer and non-cancer guidelines, so that alternative lower emitting materials/furnishings may be selected and/or higher minimum outdoor air ventilation rates can be increased to achieve acceptable indoor concentrations and incorporated as mitigation measures for this project.

### Pre-Construction Building Material/Furnishing Formaldehyde Emissions Assessment

This formaldehyde emissions assessment should be used in the environmental review under CEQA to assess the indoor formaldehyde concentrations from the proposed loading of building materials/furnishings, the area-specific formaldehyde emission rate data for building materials/furnishings, and the design minimum outdoor air ventilation rates. This assessment allows the applicant (and the City) to determine, before the conclusion of the environmental review process and the building materials/furnishings are specified, purchased, and installed, if the total chemical emissions will exceed cancer and non-cancer guidelines, and if so, allow for changes in the selection of specific material/furnishings and/or the design minimum outdoor air ventilations rates such that cancer and non-cancer guidelines are not exceeded.

1.) Define Indoor Air Quality Zones. Divide the building into separate indoor air quality zones, (IAQ Zones). IAQ Zones are defined as areas of well-mixed air. Thus, each ventilation system with recirculating air is considered a single zone, and each room or group of rooms where air is not recirculated (e.g. 100% outdoor air) is considered a separate zone. For IAQ Zones with the same construction material/furnishings and design minimum outdoor air ventilation rates. (e.g. hotel rooms, apartments, condominiums, etc.) the formaldehyde emission rates need only be assessed for a single IAQ Zone of that type.

2.) Calculate Material/Furnishing Loading. For each IAQ Zone, determine the building material and furnishing loadings (e.g., m<sup>2</sup> of material/m<sup>2</sup> floor area, units of furnishings/m<sup>2</sup> floor area) from an inventory of all potential indoor formaldehyde sources, including flooring, ceiling tiles, furnishings, finishes, insulation, sealants,



adhesives, and any products constructed with composite wood products containing urea-formaldehyde resins (e.g., plywood, medium density fiberboard, particleboard).

3.) Calculate the Formaldehyde Emission Rate. For each building material, calculate the formaldehyde emission rate ( $\mu\text{g}/\text{h}$ ) from the product of the area-specific formaldehyde emission rate ( $\mu\text{g}/\text{m}^2\text{-h}$ ) and the area ( $\text{m}^2$ ) of material in the IAQ Zone, and from each furnishing (e.g. chairs, desks, etc.) from the unit-specific formaldehyde emission rate ( $\mu\text{g}/\text{unit-h}$ ) and the number of units in the IAQ Zone.

NOTE: As a result of the high-performance building rating systems and building codes (California Building Standards Commission, 2014; USGBC, 2014), most manufacturers of building materials furnishings sold in the United States conduct chemical emission rate tests using the California Department of Health “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions for Indoor Sources Using Environmental Chambers,” (CDPH, 2017), or other equivalent chemical emission rate testing methods. Most manufacturers of building furnishings sold in the United States conduct chemical emission rate tests using ANSI/BIFMA M7.1 Standard Test Method for Determining VOC Emissions (BIFMA, 2018), or other equivalent chemical emission rate testing methods.

CDPH, BIFMA, and other chemical emission rate testing programs, typically certify that a material or furnishing does not create indoor chemical concentrations in excess of the maximum concentrations permitted by their certification. For instance, the CDPH emission rate testing requires that the measured emission rates when input into an office, school, or residential model do not exceed one-half of the OEHHA Chronic Exposure Guidelines (OEHHA, 2017b) for the 35 specific VOCs, including formaldehyde, listed in Table 4-1 of the CDPH test method (CDPH, 2017). These certifications themselves do not provide the actual area-specific formaldehyde emission rate (i.e.,  $\mu\text{g}/\text{m}^2\text{-h}$ ) of the product, but rather provide data that the formaldehyde emission rates do not exceed the maximum rate allowed for the certification. Thus, for example, the data for a certification of a specific type of flooring may be used to calculate that the area-specific emission rate of formaldehyde is less than  $31 \mu\text{g}/\text{m}^2\text{-h}$ , but not the actual measured specific emission rate, which may be 3, 18, or  $30 \mu\text{g}/\text{m}^2\text{-h}$ . These area-specific emission rates determined

from the product certifications of CDPH, BIFA, and other certification programs can be used as an initial estimate of the formaldehyde emission rate.

If the actual area-specific emission rates of a building material or furnishing is needed (i.e. the initial emission rates estimates from the product certifications are higher than desired), then that data can be acquired by requesting from the manufacturer the complete chemical emission rate test report. For instance if the complete CDPH emission test report is requested for a CDHP certified product, that report will provide the actual area-specific emission rates for not only the 35 specific VOCs, including formaldehyde, listed in Table 4-1 of the CDPH test method (CDPH, 2017), but also all of the cancer and reproductive/developmental chemicals listed in the California Proposition 65 Safe Harbor Levels (OEHHA, 2017a), all of the toxic air contaminants (TACs) in the California Air Resources Board Toxic Air Contamination List (CARB, 2011), and the 10 chemicals with the greatest emission rates.

Alternatively, a sample of the building material or furnishing can be submitted to a chemical emission rate testing laboratory, such as Berkeley Analytical Laboratory (<https://berkeleyanalytical.com>), to measure the formaldehyde emission rate.

4.) Calculate the Total Formaldehyde Emission Rate. For each IAQ Zone, calculate the total formaldehyde emission rate (i.e.  $\mu\text{g/h}$ ) from the individual formaldehyde emission rates from each of the building material/furnishings as determined in Step 3.

5.) Calculate the Indoor Formaldehyde Concentration. For each IAQ Zone, calculate the indoor formaldehyde concentration ( $\mu\text{g/m}^3$ ) from Equation 1 by dividing the total formaldehyde emission rates (i.e.  $\mu\text{g/h}$ ) as determined in Step 4, by the design minimum outdoor air ventilation rate ( $\text{m}^3/\text{h}$ ) for the IAQ Zone.

$$C_{in} = \frac{E_{total}}{Q_{oa}} \quad (\text{Equation 1})$$

where:

$C_{in}$  = indoor formaldehyde concentration ( $\mu\text{g/m}^3$ )

$E_{total}$  = total formaldehyde emission rate ( $\mu\text{g/h}$ ) into the IAQ Zone.

$Q_{oa}$  = design minimum outdoor air ventilation rate to the IAQ Zone ( $m^3/h$ )

The above Equation 1 is based upon mass balance theory, and is referenced in Section 3.10.2 “Calculation of Estimated Building Concentrations” of the California Department of Health “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions for Indoor Sources Using Environmental Chambers”, (CDPH, 2017).

6.) Calculate the Indoor Exposure Cancer and Non-Cancer Health Risks. For each IAQ Zone, calculate the cancer and non-cancer health risks from the indoor formaldehyde concentrations determined in Step 5 and as described in the OEHHA Air Toxics Hot Spots Program Risk Assessment Guidelines; Guidance Manual for Preparation of Health Risk Assessments (OEHHA, 2015).

7.) Mitigate Indoor Formaldehyde Exposures of exceeding the CEQA Cancer and/or Non-Cancer Health Risks. In each IAQ Zone, provide mitigation for any formaldehyde exposure risk as determined in Step 6, that exceeds the CEQA cancer risk of 10 per million or the CEQA non-cancer Hazard Quotient of 1.0.

Provide the source and/or ventilation mitigation required in all IAQ Zones to reduce the health risks of the chemical exposures below the CEQA cancer and non-cancer health risks.

Source mitigation for formaldehyde may include:

- 1.) reducing the amount materials and/or furnishings that emit formaldehyde
- 2.) substituting a different material with a lower area-specific emission rate of formaldehyde

Ventilation mitigation for formaldehyde emitted from building materials and/or furnishings may include:

- 1.) increasing the design minimum outdoor air ventilation rate to the IAQ Zone.

NOTE: Mitigating the formaldehyde emissions through use of less material/furnishings, or use of lower emitting materials/furnishings, is the preferred mitigation option, as

mitigation with increased outdoor air ventilation increases initial and operating costs associated with the heating/cooling systems.

Further, we are not asking that the builder “speculate” on what and how much composite materials be used, but rather at the design stage to select composite wood materials based on the formaldehyde emission rates that manufacturers routinely conduct using the California Department of Health “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions for Indoor Sources Using Environmental Chambers,” (CDPH, 2017), and use the procedure described earlier above (i.e. Pre-Construction Building Material/Furnishing Formaldehyde Emissions Assessment) to insure that the materials selected achieve acceptable cancer risks from material off gassing of formaldehyde.

**Outdoor Air Ventilation Impact.** Another important finding of the CNHS, was that the outdoor air ventilation rates in the homes were very low. Outdoor air ventilation is a very important factor influencing the indoor concentrations of air contaminants, as it is the primary removal mechanism of all indoor air generated contaminants. Lower outdoor air exchange rates cause indoor generated air contaminants to accumulate to higher indoor air concentrations. Many homeowners rarely open their windows or doors for ventilation as a result of their concerns for security/safety, noise, dust, and odor concerns (Price, 2007). In the CNHS field study, 32% of the homes did not use their windows during the 24-hour Test Day, and 15% of the homes did not use their windows during the entire preceding week. Most of the homes with no window usage were homes in the winter field session. Thus, a substantial percentage of homeowners never open their windows, especially in the winter season. The median 24-hour measurement was 0.26 air changes per hour (ach), with a range of 0.09 ach to 5.3 ach. A total of 67% of the homes had outdoor air exchange rates below the minimum California Building Code (2001) requirement of 0.35 ach. Thus, the relatively tight envelope construction, combined with the fact that many people never open their windows for ventilation, results in homes with low outdoor air exchange rates and higher indoor air contaminant concentrations.

The Project is close to roads with moderate to high traffic (e.g., E 14<sup>th</sup> Street, Callan Street, San Leandro Blvd, etc.) as well as BART rail traffic and air traffic from Oakland International Airport.

According to the Infill Environmental Checklist – Callan and E 14<sup>th</sup> Street, San Leandro, CA (Placeworks, 2021), the existing noise levels as measured at LT-1 and LT-2 are 73 and 74 dBA CNEL respectively.

As a result of the high outdoor noise levels, the current project will require a mechanical supply of outdoor air ventilation to allow for a habitable interior environment with closed windows and doors. Such a ventilation system would allow windows and doors to be kept closed at the occupant's discretion to control exterior noise within building interiors.

**PM<sub>2.5</sub> Outdoor Concentrations Impact.** An additional impact of the nearby motor vehicle traffic associated with this project, are the outdoor concentrations of PM<sub>2.5</sub>. According to the Infill Environmental Checklist – Callan and E 14<sup>th</sup> Street, San Leandro, CA (Placeworks, 2021), the Project is located in the San Francisco Bay Area Basin, which is a State and Federal non-attainment area for PM<sub>2.5</sub>.

An air quality analyses should to be conducted to determine the concentrations of PM<sub>2.5</sub> in the outdoor and indoor air that people inhale each day. This air quality analyses needs to consider the cumulative impacts of the project related emissions, existing and projected future emissions from local PM<sub>2.5</sub> sources (e.g. stationary sources, motor vehicles, and airport traffic) upon the outdoor air concentrations at the Project site. If the outdoor concentrations are determined to exceed the California and National annual average PM<sub>2.5</sub> exceedence concentration of 12 µg/m<sup>3</sup>, or the National 24-hour average exceedence concentration of 35 µg/m<sup>3</sup>, then the buildings need to have a mechanical supply of outdoor air that has air filtration with sufficient removal efficiency, such that the indoor concentrations of outdoor PM<sub>2.5</sub> particles is less than the California and National PM<sub>2.5</sub> annual and 24-hour standards.

It is my experience that based on the projected high traffic noise levels, the annual average concentration of PM<sub>2.5</sub> will exceed the California and National PM<sub>2.5</sub> annual and 24-hour standards and warrant installation of high efficiency air filters (i.e. MERV 13 or higher) in all mechanically supplied outdoor air ventilation systems.

### **Indoor Air Quality Impact Mitigation Measures**

The following are recommended mitigation measures to minimize the impacts upon indoor quality:

Indoor Formaldehyde Concentrations Mitigation. Use only composite wood materials (e.g. hardwood plywood, medium density fiberboard, particleboard) for all interior finish systems that are made with CARB approved no-added formaldehyde (NAF) resins (CARB, 2009). CARB Phase 2 certified composite wood products, or ultra-low emitting formaldehyde (ULEF) resins, do not insure indoor formaldehyde concentrations that are below the CEQA cancer risk of 10 per million. Only composite wood products manufactured with CARB approved no-added formaldehyde (NAF) resins, such as resins made from soy, polyvinyl acetate, or methylene diisocyanate can insure that the OEHHA cancer risk of 10 per million is met.

Alternatively, conduct the previously described Pre-Construction Building Material/Furnishing Chemical Emissions Assessment, to determine that the combination of formaldehyde emissions from building materials and furnishings do not create indoor formaldehyde concentrations that exceed the CEQA cancer and non-cancer health risks.

It is important to note that we are not asking that the builder “speculate” on what and how much composite materials be used, but rather at the design stage to select composite wood materials based on the formaldehyde emission rates that manufacturers routinely conduct using the California Department of Health “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions for Indoor Sources Using Environmental Chambers”, (CDPH, 2017), and use the procedure described above (i.e. Pre-Construction Building Material/Furnishing Formaldehyde Emissions Assessment) to

insure that the materials selected achieve acceptable cancer risks from material off gassing of formaldehyde.

Outdoor Air Ventilation Mitigation. Provide each habitable room with a continuous mechanical supply of outdoor air that meets or exceeds the California 2016 Building Energy Efficiency Standards (California Energy Commission, 2015) requirements of the greater of 15 cfm/occupant or 0.15 cfm/ft<sup>2</sup> of floor area. Following installation of the system conduct testing and balancing to insure that required amount of outdoor air is entering each habitable room and provide a written report documenting the outdoor airflow rates. Do not use exhaust only mechanical outdoor air systems, use only balanced outdoor air supply and exhaust systems or outdoor air supply only systems. Provide a manual for the occupants or maintenance personnel, that describes the purpose of the mechanical outdoor air system and the operation and maintenance requirements of the system.

PM<sub>2.5</sub> Outdoor Air Concentration Mitigation. Install air filtration with sufficient PM<sub>2.5</sub> removal efficiency (e.g. MERV 13 or higher) to filter the outdoor air entering the mechanical outdoor air supply systems, such that the indoor concentrations of outdoor PM<sub>2.5</sub> particles are less than the California and National PM<sub>2.5</sub> annual and 24-hour standards. Install the air filters in the system such that they are accessible for replacement by the occupants or maintenance personnel. Include in the mechanical outdoor air ventilation system manual instructions on how to replace the air filters and the estimated frequency of replacement.

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<http://www.usgbc.org/credits/homes/v4>

## APPENDIX A

### INDOOR FORMALDEHYDE CONCENTRATIONS AND THE CARB FORMALDEHYDE ATCM

With respect to formaldehyde emissions from composite wood products, the CARB ATCM regulations of formaldehyde emissions from composite wood products, do not assure healthful indoor air quality. The following is the stated purpose of the CARB ATCM regulation - *The purpose of this airborne toxic control measure is to “reduce formaldehyde emissions from composite wood products, and finished goods that contain composite wood products, that are sold, offered for sale, supplied, used, or manufactured for sale in California”*. In other words, the CARB ATCM regulations do not “assure healthful indoor air quality”, but rather “reduce formaldehyde emissions from composite wood products”.

Just how much protection do the CARB ATCM regulations provide building occupants from the formaldehyde emissions generated by composite wood products? Definitely some, but certainly the regulations do not “*assure healthful indoor air quality*” when CARB Phase 2 products are utilized. As shown in the Chan 2019 study of new California homes, the median indoor formaldehyde concentration was of 22.4  $\mu\text{g}/\text{m}^3$  (18.2 ppb), which corresponds to a cancer risk of 112 per million for occupants with continuous exposure, which is more than 11 times the CEQA cancer risk of 10 per million.

Another way of looking at how much protection the CARB ATCM regulations provide building occupants from the formaldehyde emissions generated by composite wood products is to calculate the maximum number of square feet of composite wood product that can be in a residence without exceeding the CEQA cancer risk of 10 per million for occupants with continuous occupancy.

For this calculation I utilized the floor area (2,272  $\text{ft}^2$ ), the ceiling height (8.5 ft), and the number of bedrooms (4) as defined in Appendix B (New Single-Family Residence Scenario) of the Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions for Indoor Sources Using Environmental Chambers, Version 1.1, 2017, California

Department of Public Health, Richmond, CA. <https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx>.

For the outdoor air ventilation rate I used the 2019 Title 24 code required mechanical ventilation rate (ASHRAE 62.2) of 106 cfm (180 m<sup>3</sup>/h) calculated for this model residence. For the composite wood formaldehyde emission rates I used the CARB ATCM Phase 2 rates.

The calculated maximum number of square feet of composite wood product that can be in a residence, without exceeding the CEQA cancer risk of 10 per million for occupants with continuous occupancy are as follows for the different types of regulated composite wood products.

Medium Density Fiberboard (MDF) – 15 ft<sup>2</sup> (0.7% of the floor area), or  
Particle Board – 30 ft<sup>2</sup> (1.3% of the floor area), or  
Hardwood Plywood – 54 ft<sup>2</sup> (2.4% of the floor area), or  
Thin MDF – 46 ft<sup>2</sup> (2.0 % of the floor area).

For offices and hotels the calculated maximum amount of composite wood product (% of floor area) that can be used without exceeding the CEQA cancer risk of 10 per million for occupants, assuming 8 hours/day occupancy, and the California Mechanical Code minimum outdoor air ventilation rates are as follows for the different types of regulated composite wood products.

Medium Density Fiberboard (MDF) – 3.6 % (offices) and 4.6% (hotel rooms), or  
Particle Board – 7.2 % (offices) and 9.4% (hotel rooms), or  
Hardwood Plywood – 13 % (offices) and 17% (hotel rooms), or  
Thin MDF – 11 % (offices) and 14 % (hotel rooms)

Clearly the CARB ATCM does not regulate the formaldehyde emissions from composite wood products such that the potentially large areas of these products, such as for flooring, baseboards, interior doors, window and door trims, and kitchen and bathroom cabinetry,

could be used without causing indoor formaldehyde concentrations that result in CEQA cancer risks that substantially exceed 10 per million for occupants with continuous occupancy.

Even composite wood products manufactured with CARB certified ultra low emitting formaldehyde (ULEF) resins do not insure that the indoor air will have concentrations of formaldehyde that meet the OEHHA cancer risks that substantially exceed 10 per million. The permissible emission rates for ULEF composite wood products are only 11-15% lower than the CARB Phase 2 emission rates. Only use of composite wood products made with no-added formaldehyde resins (NAF), such as resins made from soy, polyvinyl acetate, or methylene diisocyanate can insure that the OEHHA cancer risk of 10 per million is met.

If CARB Phase 2 compliant or ULEF composite wood products are utilized in construction, then the resulting indoor formaldehyde concentrations should be determined in the design phase using the specific amounts of each type of composite wood product, the specific formaldehyde emission rates, and the volume and outdoor air ventilation rates of the indoor spaces, and all feasible mitigation measures employed to reduce this impact (e.g. use less formaldehyde containing composite wood products and/or incorporate mechanical systems capable of higher outdoor air ventilation rates). See the procedure described earlier (i.e., Pre-Construction Building Material/Furnishing Formaldehyde Emissions Assessment) to insure that the materials selected achieve acceptable cancer risks from material off gassing of formaldehyde.

Alternatively, and perhaps a simpler approach, is to use only composite wood products (e.g. hardwood plywood, medium density fiberboard, particleboard) for all interior finish systems that are made with CARB approved no-added formaldehyde (NAF) resins.

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## Indoor Environmental Engineering

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### **Education**

M.S. Mechanical Engineering (1985)  
Stanford University, Stanford, CA.

Graduate Studies in Air Pollution Monitoring and Control (1980)  
University of California, Berkeley, CA.

B.S. in Mechanical Engineering (1976)  
Rensselaer Polytechnic Institute, Troy, N.Y.

### **Professional Experience**

President: Indoor Environmental Engineering, San Francisco, CA. December, 1981 - present.

Direct team of environmental scientists, chemists, and mechanical engineers in conducting State and Federal research regarding indoor air quality instrumentation development, building air quality field studies, ventilation and air cleaning performance measurements, and chemical emission rate testing.

Provide design side input to architects regarding selection of building materials and ventilation system components to ensure a high quality indoor environment.

Direct Indoor Air Quality Consulting Team for the winning design proposal for the new State of Washington Ecology Department building.

Develop a full-scale ventilation test facility for measuring the performance of air diffusers; ASHRAE 129, Air Change Effectiveness, and ASHRAE 113, Air Diffusion Performance Index.

Develop a chemical emission rate testing laboratory for measuring the chemical emissions from building materials, furnishings, and equipment.

Principle Investigator of the California New Homes Study (2005-2007). Measured ventilation and indoor air quality in 108 new single family detached homes in northern and southern California.

Develop and teach IAQ professional development workshops to building owners, managers, hygienists, and engineers.

Air Pollution Engineer: Earth Metrics Inc., Burlingame, CA, October, 1985 to March, 1987.

Responsible for development of an air pollution laboratory including installation a forced choice olfactometer, tracer gas electron capture chromatograph, and associated calibration facilities. Field team leader for studies of fugitive odor emissions from sewage treatment plants, entrainment of fume hood exhausts into computer chip fabrication rooms, and indoor air quality investigations.

Staff Scientist: Building Ventilation and Indoor Air Quality Program, Energy and Environment Division, Lawrence Berkeley Laboratory, Berkeley, CA. January, 1980 to August, 1984.

Deputy project leader for the Control Techniques group; responsible for laboratory and field studies aimed at evaluating the performance of indoor air pollutant control strategies (i.e. ventilation, filtration, precipitation, absorption, adsorption, and source control).

Coordinated field and laboratory studies of air-to-air heat exchangers including evaluation of thermal performance, ventilation efficiency, cross-stream contaminant transfer, and the effects of freezing/defrosting.

Developed an *in situ* test protocol for evaluating the performance of air cleaning systems and introduced the concept of effective cleaning rate (ECR) also known as the Clean Air Delivery Rate (CADR).

Coordinated laboratory studies of portable and ducted air cleaning systems and their effect on indoor concentrations of respirable particles and radon progeny.

Co-designed an automated instrument system for measuring residential ventilation rates and radon concentrations.

Designed hardware and software for a multi-channel automated data acquisition system used to evaluate the performance of air-to-air heat transfer equipment.

Assistant Chief Engineer: Alta Bates Hospital, Berkeley, CA, October, 1979 to January, 1980.

Responsible for energy management projects involving installation of power factor correction capacitors on large inductive electrical devices and installation of steam meters on physical plant steam lines. Member of Local 39, International Union of Operating Engineers.

Manufacturing Engineer: American Precision Industries, Buffalo, NY, October, 1977 to October, 1979.

Responsible for reorganizing the manufacturing procedures regarding production of shell and tube heat exchangers. Designed customized automatic assembly, welding, and testing equipment. Designed a large paint spray booth. Prepared economic studies justifying new equipment purchases. Safety Director.

Project Engineer: Arcata Graphics, Buffalo, N.Y. June, 1976 to October, 1977.

Responsible for the design and installation of a bulk ink storage and distribution system and high speed automatic counting and marking equipment. Also coordinated material handling studies which led to the purchase and installation of new equipment.

### **PROFESSIONAL ORGANIZATION MEMBERSHIP**

American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- Chairman of SPC-145P, Standards Project Committee - Test Method for Assessing the Performance of Gas Phase Air Cleaning Equipment (1991-1992)
- Member SPC-129P, Standards Project Committee - Test Method for Ventilation Effectiveness (1986-97)
  - Member of Drafting Committee
- Member Environmental Health Committee (1992-1994, 1997-2001, 2007-2010)
  - Chairman of EHC Research Subcommittee
  - Member of Man Made Mineral Fiber Position Paper Subcommittee
  - Member of the IAQ Position Paper Committee
  - Member of the Legionella Position Paper Committee
  - Member of the Limiting Indoor Mold and Dampness in Buildings Position Paper Committee
- Member SSPC-62, Standing Standards Project Committee - Ventilation for Acceptable Indoor Air Quality (1992 to 2000)
  - Chairman of Source Control and Air Cleaning Subcommittee
- Chairman of TC-4.10, Indoor Environmental Modeling (1988-92)
  - Member of Research Subcommittee
- Chairman of TC-2.3, Gaseous Air Contaminants and Control Equipment (1989-92)
  - Member of Research Subcommittee

American Society for Testing and Materials (ASTM)

- D-22 Sampling and Analysis of Atmospheres
  - Member of Indoor Air Quality Subcommittee
- E-06 Performance of Building Constructions

American Board of Industrial Hygiene (ABIH)

American Conference of Governmental Industrial Hygienists (ACGIH)

- Bioaerosols Committee (2007-2013)



American Industrial Hygiene Association (AIHA)

Cal-OSHA Indoor Air Quality Advisory Committee

International Society of Indoor Air Quality and Climate (ISIAQ)

- Co-Chairman of Task Force on HVAC Hygiene

U. S. Green Building Council (USGBC)

- Member of the IEQ Technical Advisory Group (2007-2009)
- Member of the IAQ Performance Testing Work Group (2010-2012)

Western Construction Consultants (WESTCON)

### **PROFESSIONAL CREDENTIALS**

Licensed Professional Engineer - Mechanical Engineering

Certified Industrial Hygienist - American Board of Industrial Hygienists

### **SCIENTIFIC MEETINGS AND SYMPOSIA**

Biological Contamination, Diagnosis, and Mitigation, Indoor Air'90, Toronto, Canada, August, 1990.

Models for Predicting Air Quality, Indoor Air'90, Toronto, Canada, August, 1990.

Microbes in Building Materials and Systems, Indoor Air '93, Helsinki, Finland, July, 1993.

Microorganisms in Indoor Air Assessment and Evaluation of Health Effects and Probable Causes, Walnut Creek, CA, February 27, 1997.

Controlling Microbial Moisture Problems in Buildings, Walnut Creek, CA, February 27, 1997.

Scientific Advisory Committee, Roomvent 98, 6<sup>th</sup> International Conference on Air Distribution in Rooms, KTH, Stockholm, Sweden, June 14-17, 1998.

Moisture and Mould, Indoor Air '99, Edinburgh, Scotland, August, 1999.

Ventilation Modeling and Simulation, Indoor Air '99, Edinburgh, Scotland, August, 1999.

Microbial Growth in Materials, Healthy Buildings 2000, Espoo, Finland, August, 2000.

Co-Chair, Bioaerosols X- Exposures in Residences, Indoor Air 2002, Monterey, CA, July 2002.

Healthy Indoor Environments, Anaheim, CA, April 2003.

Chair, Environmental Tobacco Smoke in Multi-Family Homes, Indoor Air 2008, Copenhagen, Denmark, July 2008.

Co-Chair, ISIAQ Task Force Workshop; HVAC Hygiene, Indoor Air 2002, Monterey, CA, July 2002.

Chair, ETS in Multi-Family Housing: Exposures, Controls, and Legalities Forum, Healthy Buildings 2009, Syracuse, CA, September 14, 2009.

Chair, Energy Conservation and IAQ in Residences Workshop, Indoor Air 2011, Austin, TX, June 6, 2011.

Chair, Electronic Cigarettes: Chemical Emissions and Exposures Colloquium, Indoor Air 2016, Ghent, Belgium, July 4, 2016.

### **SPECIAL CONSULTATION**

Provide consultation to the American Home Appliance Manufacturers on the development of a standard for testing portable air cleaners, AHAM Standard AC-1.

Served as an expert witness and special consultant for the U.S. Federal Trade Commission regarding the performance claims found in advertisements of portable air cleaners and residential furnace filters.

Conducted a forensic investigation for a San Mateo, CA pro se defendant, regarding an alleged homicide where the victim was kidnapped in a steamer trunk. Determined the air exchange rate in the steamer trunk and how long the person could survive.

Conducted *in situ* measurement of human exposure to toluene fumes released during nailpolish application for a plaintiffs attorney pursuing a California Proposition 65 product labeling case. June, 1993.

Conducted a forensic *in situ* investigation for the Butte County, CA Sheriff's Department of the emissions of a portable heater used in the bedroom of two twin one year old girls who suffered simultaneous crib death.

Consult with OSHA on the 1995 proposed new regulation regarding indoor air quality and environmental tobacco smoke.

Consult with EPA on the proposed Building Alliance program and with OSHA on the proposed new OSHA IAQ regulation.

Johnson Controls Audit/Certification Expert Review; Milwaukee, WI. May 28-29, 1997.

Winner of the nationally published 1999 Request for Proposals by the State of Washington to conduct a comprehensive indoor air quality investigation of the Washington State Department of Ecology building in Lacey, WA.

Selected by the State of California Attorney General's Office in August, 2000 to conduct a comprehensive indoor air quality investigation of the Tulare County Court House.

Lawrence Berkeley Laboratory IAQ Experts Workshop: "Cause and Prevention of Sick Building Problems in Offices: The Experience of Indoor Environmental Quality Investigators", Berkeley, California, May 26-27, 2004.

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“Building Air Quality Facts and Myths”, The City of Oakland / Alameda County Safety Seminar, Oakland, CA, June 12, 1998.

“Building Engineering and Moisture”, Building Contamination Workshop, University of California Berkeley, Continuing Education in Engineering and Environmental Management, San Francisco, CA, October 21-22, 1999.

“Identifying and Mitigating Mold Contamination in Buildings”, Western Construction Consultants Association, Oakland, CA, March 15, 2000; AIG Construction Defect Seminar, Walnut Creek, CA, May 2, 2001; City of Oakland Public Works Agency, Oakland, CA, July 24, 2001; Executive Council of Homeowners, Alamo, CA, August 3, 2001.

“Using the EPA BASE Study for IAQ Investigation / Communication”, Joint Professional Symposium 2000, American Industrial Hygiene Association, Orange County & Southern California Sections, Long Beach, October 19, 2000.

“Ventilation,” Indoor Air Quality: Risk Reduction in the 21<sup>st</sup> Century Symposium, sponsored by the California Environmental Protection Agency/Air Resources Board, Sacramento, CA, May 3-4, 2000.

“Workshop 18: Criteria for Cleaning of Air Handling Systems”, Healthy Buildings 2000, Espoo, Finland, August 2000.

“Closing Session Summary: ‘Building Investigations’ and ‘Building Design & Construction’”, Healthy Buildings 2000, Espoo, Finland, August 2000.

“Managing Building Air Quality and Energy Efficiency, Meeting the Standard of Care”, BOMA, MidAtlantic Environmental Hygiene Resource Center, Seattle, WA, May 23<sup>rd</sup>, 2000; San Antonio, TX, September 26-27, 2000.

“Diagnostics & Mitigation in Sick Buildings: When Good Buildings Go Bad,” University of California Berkeley, September 18, 2001.

“Mold Contamination: Recognition and What To Do and Not Do”, Redwood Empire Remodelers Association; Santa Rosa, CA, April 16, 2002.

“Investigative Tools of the IAQ Trade”, Healthy Indoor Environments 2002; Austin, TX; April 22, 2002.

“Finding Hidden Mold: Case Studies in IAQ Investigations”, AIHA Northern California Professionals Symposium; Oakland, CA, May 8, 2002.

“Assessing and Mitigating Fungal Contamination in Buildings”, Cal/OSHA Training; Oakland, CA, February 14, 2003 and West Covina, CA, February 20-21, 2003.

“Use of External Containments During Fungal Mitigation”, Invited Speaker, ACGIH Mold Remediation Symposium, Orlando, FL, November 3-5, 2003.

Building Operator Certification (BOC), 106-IAQ Training Workshops, Northwest Energy Efficiency Council; Stockton, CA, December 3, 2003; San Francisco, CA, December 9, 2003; Irvine, CA, January 13, 2004; San Diego, January 14, 2004; Irwindale, CA, January 27, 2004; Downey, CA, January 28, 2004; Santa Monica, CA, March 16, 2004; Ontario, CA, March 17, 2004; Ontario, CA, November 9, 2004, San Diego, CA, November 10, 2004; San Francisco, CA, November 17, 2004; San Jose, CA, November 18, 2004; Sacramento, CA, March 15, 2005.

“Mold Remediation: The National QUEST for Uniformity Symposium”, Invited Speaker, Orlando, Florida, November 3-5, 2003.

“Mold and Moisture Control”, Indoor Air Quality workshop for The Collaborative for High Performance Schools (CHPS), San Francisco, December 11, 2003.

“Advanced Perspectives In Mold Prevention & Control Symposium”, Invited Speaker, Las Vegas, Nevada, November 7-9, 2004.

“Building Sciences: Understanding and Controlling Moisture in Buildings”, American Industrial Hygiene Association, San Francisco, CA, February 14-16, 2005.

“Indoor Air Quality Diagnostics and Healthy Building Design”, University of California Berkeley, Berkeley, CA, March 2, 2005.

“Improving IAQ = Reduced Tenant Complaints”, Northern California Facilities Exposition, Santa Clara, CA, September 27, 2007.

“Defining Safe Building Air”, Criteria for Safe Air and Water in Buildings, ASHRAE Winter Meeting, Chicago, IL, January 27, 2008.

“Update on USGBC LEED and Air Filtration”, Invited Speaker, NAFA 2008 Convention, San Francisco, CA, September 19, 2008.

“Ventilation and Indoor air Quality in New California Homes”, National Center of Healthy Housing, October 20, 2008.

“Indoor Air Quality in New Homes”, California Energy and Air Quality Conference, October 29, 2008.

“Mechanical Outdoor air Ventilation Systems and IAQ in New Homes”, ACI Home Performance Conference, Kansas City, MO, April 29, 2009.

“Ventilation and IAQ in New Homes with and without Mechanical Outdoor Air Systems”, Healthy Buildings 2009, Syracuse, CA, September 14, 2009.



“Ten Ways to Improve Your Air Quality”, Northern California Facilities Exposition, Santa Clara, CA, September 30, 2009.

“New Developments in Ventilation and Indoor Air Quality in Residential Buildings”, Westcon meeting, Alameda, CA, March 17, 2010.

“Intermittent Residential Mechanical Outdoor Air Ventilation Systems and IAQ”, ASHRAE SSPC 62.2 Meeting, Austin, TX, April 19, 2010.

“Measured IAQ in Homes”, ACI Home Performance Conference, Austin, TX, April 21, 2010.

“Respiration: IEQ and Ventilation”, AIHce 2010, How IH Can LEED in Green buildings, Denver, CO, May 23, 2010.

“IAQ Considerations for Net Zero Energy Buildings (NZEB)”, Northern California Facilities Exposition, Santa Clara, CA, September 22, 2010.

“Energy Conservation and Health in Buildings”, Berkeley High School Green Career Week, Berkeley, CA, April 12, 2011.

“What Pollutants are Really There ?”, ACI Home Performance Conference, San Francisco, CA, March 30, 2011.

“Energy Conservation and Health in Residences Workshop”, Indoor Air 2011, Austin, TX, June 6, 2011.

“Assessing IAQ and Improving Health in Residences”, US EPA Weatherization Plus Health, September 7, 2011.

“Ventilation: What a Long Strange Trip It’s Been”, Westcon, May 21, 2014.

“Chemical Emissions from E-Cigarettes: Direct and Indirect Passive Exposures”, Indoor Air 2014, Hong Kong, July, 2014.

“Infectious Disease Aerosol Exposures With and Without Surge Control Ventilation System Modifications”, Indoor Air 2014, Hong Kong, July, 2014.

“Chemical Emissions from E-Cigarettes”, IMF Health and Welfare Fair, Washington, DC, February 18, 2015.

“Chemical Emissions and Health Hazards Associated with E-Cigarettes”, Roswell Park Cancer Institute, Buffalo, NY, August 15, 2014.

“Formaldehyde Indoor Concentrations, Material Emission Rates, and the CARB ATCM”, Harris Martin’s Lumber Liquidators Flooring Litigation Conference, WQ Minneapolis Hotel, May 27, 2015.

“Chemical Emissions from E-Cigarettes: Direct and Indirect Passive Exposure”, FDA Public Workshop: Electronic Cigarettes and the Public Health, Hyattsville, MD June 2, 2015.

“Creating Healthy Homes, Schools, and Workplaces”, Chautauqua Institution, Athenaeum Hotel, August 24, 2015.

“Diagnosing IAQ Problems and Designing Healthy Buildings”, University of California Berkeley, Berkeley, CA, October 6, 2015.

“Diagnosing Ventilation and IAQ Problems in Commercial Buildings”, BEST Center Annual Institute, Lawrence Berkeley National Laboratory, January 6, 2016.

“A Review of Studies of Ventilation and Indoor Air Quality in New Homes and Impacts of Environmental Factors on Formaldehyde Emission Rates From Composite Wood Products”, AIHce2016, May, 21-26, 2016.

“Admissibility of Scientific Testimony”, Science in the Court, Proposition 65 Clearinghouse Annual Conference, Oakland, CA, September 15, 2016.

“Indoor Air Quality and Ventilation”, ASHRAE Redwood Empire, Napa, CA, December 1, 2016.