

Lessons learned from the implementation of IAQ strategies during the design, construction, and occupancy of a sustainable office complex

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In 1999, the State of California initiated the design of its largest office-building complex. The State Legislature mandated that this complex exceed the state's energy code in effect at the time by at least 30% as well as be constructed as an example of sustainable construction. As a result, numerous pioneering specifications and guidelines were developed to enhance indoor air quality, energy and water efficiency, as well as increase recycled contents in building materials. This abstract focuses on the ventilation and volatile organic compounds aspects of these specifications and guidelines.

Measures taken to ensure enhanced performance of the ventilation systems of these buildings included: providing minimum outdoor air intakes, cleaned of any oils, requiring that the ductwork be sealed during transportation, and wrapped with insulation during installation (instead of lined at the factory). A specification known as *Section 01350* was developed to direct manufacturers in the testing of interior finishing materials for emissions of volatile organic compounds. Data from emission tests allowed the buildings' designers to select building materials based not only on their traditional attributes (e.g., performance, aesthetics, and costs) but also on their environmental attributes. A list of target chemicals and exposure limit values were included in *Section 01350* consistent with health-protective air quality standards. Testing of the indoor air occurred prior to occupancy to ensure that the target chemicals were below the maximum allowable concentrations. A follow-up indoor air quality study was conducted in these buildings for

nearly two years after occupancy in order to better understand the time variance of indoor volatile organic compounds.

This project proved that careful building design and material selection result in both exemplary energy efficiency and enhanced indoor air quality. Sustainable design and construction added only a few percent to the total building costs for this project. In general, the building industry, including design and building professionals as well as building material manufacturers, responded favorably to these challenges. The average concentrations of volatile organic compounds measured in these newly constructed buildings met the criteria and compared favorably to averages reported in the United States Environmental Protection Agency's *BASE* study of 100 existing buildings with no-known problems. Nonetheless, in two of the larger buildings, areas of local ventilation rates were found below the building design rates, indicating that despite sophisticated building automation controls, under ventilated areas may exist in larger buildings due to poor air mixing.