HHE HealthHazard® Evaluation Program

Evaluation of Odors in a Pet Care Product Manufacturing Office

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Centers for Disease Control and Prevention
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Disclaimer

The Health Hazard Evaluation Program investigates possible health hazards in the workplace under the authority of the Occupational Safety and Health Act of 1970 (29 U.S.C. § 669(a)(6)). The Health Hazard Evaluation Program also provides, upon request, technical assistance to federal, state, and local agencies to investigate occupational health hazards and to prevent occupational disease or injury. Regulations guiding the Program can be found in Title 42, Code of Federal Regulations, Part 85; Requests for Health Hazard Evaluations (42 CFR Part 85).

Availability of Report

Copies of this report have been sent to the employer and employees at the plant. The state and local health department and the Occupational Safety and Health Administration Regional Office have also received a copy. This report is not copyrighted and may be freely reproduced.

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Introduction

Request

The Health Hazard Evaluation Program received an employer request from a manufacturer of pet care products. Employees were concerned about exposure to odors that were reportedly traveling from the production area to the office area within the building, and whether these odors could harm their health.

Workplace

The building had a pet care product manufacturing area (flea and tick collars, topical insecticides, and shampoos) and an office area. A variety of chemicals such as essential oils (e.g., lemongrass) and insecticides (e.g., fipronil) are used to make the products.

To learn more about the workplace, go to Section A in the Supporting Technical Information

Our Approach

We evaluated the plant over 2 days in November 2015.

- We looked for moisture, water damage, and inspected the wall that separates the office area from the production area.
- We measured carbon dioxide, temperature, and relative humidity over 36 hours.
- We measured airflow in offices and employee restrooms and checked the air pressure relationship between the office and production area.
- We looked at the rooftop air handling systems providing ventilation for the building.
- We reviewed workplace injury and illness logs and interviewed employees about their work, medical history, and work-related health concerns.

To learn more about our methods, go to Section B in the Supporting Technical Information

Our Key Findings

We did not notice any odor in the office area.

We found the potential for odor to move from the production area into the office area

- We noticed multiple gaps and holes in the wall (above the drop ceiling) between the office and the production area.
- There were reports that, in the past, some doors between the office and the production area were propped open.

- Air pressure was higher in the office area than the production area. This means air will tend to flow from the office to the production area. This is desirable because it will reduce the possibility of odors moving from the production area into the office.

The building's environmental control system appears to be working properly

- We did not see any signs of water damage or mold.
- Temperature and carbon dioxide levels were within recommended comfort guidelines. However, relative humidity slightly exceeded a guideline on one day.
- None of the air handling units had any visible evidence of microbial (e.g., bacteria, fungi, etc.) growth.
- Air filters were clean and properly installed in all air handling units.
- Our measurements of the ventilation systems were in agreement with the recently performed test and balance work.

Symptoms reported by employees were non-specific in nature and neither the type nor number of symptoms were found to be unusual.

- Most employees felt management addressed employee concerns and communicated findings well.
- Employees' thyroid conditions are likely not caused by workplace exposures.
- There were no entries of injury or illness on OSHA 300 logs for office employees for the years 2012–2015.

To learn more about our methods, go to Section B in the Supporting Technical Information

Our Recommendations

The Occupational Safety and Health Act requires employers to provide a safe workplace.

Benefits of Improving Workplace Health and Safety:

- ↑ Improved worker health and well-being
- ↑ Better workplace morale
- ↑ Better employee recruiting and retention
- ↑ Improved image and reputation
- ↑ Better products, processes, and services
- ↑ Could increase overall cost savings

The recommendations below are based on the findings of our evaluation. For each recommendation, we list a series of actions you can take to address the issue at your workplace. The actions at the beginning of each list are preferable to the ones listed later. The list order is based on a well-accepted approach called the "hierarchy of controls." The hierarchy of controls groups actions by their likely effectiveness in reducing or removing hazards. In most cases, the preferred approach is to eliminate

hazardous materials or processes and install engineering controls to reduce exposure or shield employees. Until such controls are in place, or if they are not effective or feasible, administrative measures and PPE may be needed. Read more about the hierarchy of controls here: https://www.cdc.gov/niosh/topics/hierarchy/.

We encourage the company to use a health and safety committee to discuss our recommendations and develop an action plan. Both employee representatives and management representatives should be included on the committee. Helpful guidance can be found in "Recommended Practices for Safety and Health Programs" Web link: https://www.osha.gov/shpguidelines/index.html.

Recommendation: Prevent odors from migrating into the office area.

Why? By keeping odors out of the office area, most employee complaints will be reduced.

How? At your workplace, we recommend these specific actions:

Seal all gaps in the wall that separates the office from the production area.

Create and enforce a company policy that prohibits propping open doors between the office and production area.

- Place signs at each of the doors leading to/from the production area that serves as a reminder not to prop open doors.

Encourage employees to report potential work-related health concerns to their supervisors.

- If necessary, employees should seek evaluation and care from a healthcare provider who is knowledgeable in occupational medicine and indoor environmental quality issues.

Establish an office "fragrance-free" policy to limit exposure for employees who may be sensitive to products with strong odors or scents (such as perfumes, air fresheners, and incense).

Supporting Technical Information

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Section A: Workplace Information

Building

The building is a steel column and beam structure covered in stucco with a low-slope flat roof covered by a rubber membrane. A previous owner of the company moved into this building in 2012. We were told that the building had been vacant for some time and extensive remodeling was done prior to the move. The current employer bought the company in late 2012 and began production of various pet care products on site. At that time, employees reported recurring odors in the office area when the production area produced specific products that contained essential oils such as lemon grass or fipronil, an insecticide used in some pet care products.

The office area has two floors, each covering approximately 21,000 square feet. The first floor contains 24 offices, 36 cubicles, 4 conference rooms, and 2 restrooms. The second floor contains 30 offices, 40 cubicles, 2 conference rooms, and 2 restrooms. There were four doors on each floor that allowed foot traffic between the office area and the production area. A total of 100 employees worked in the office area. The production plant area measured approximately 120,000 square feet and was separated from the office area by a gypsum board wall. There were 72 employees working in the plant.

Climate control for the entire office area was achieved through the use of 21 constant air volume (CAV) roof-mounted air handling units that were outfitted with a pleated filter. Each air handling unit supplied either heated or cooled air (depending on the season) to specific zones through a main sheet metal duct and multiple flexible branching ducts attached to ceiling mounted registers. Thermostatic control of each unit was achieved through electronic sensors in different areas. Airflow dampers located in the roof-mounted air handling units were set to allow for the introduction of approximately 10% outdoor air. Management reported that some office employees occasionally propped open the doors between the production plant and the office area.

History of Issue at Workplace

An indoor environmental quality (IEQ) evaluation was conducted in June 2015 by a consultant hired by the company. That evaluation included carbon dioxide (CO_2), carbon monoxide, temperature, and relative humidity (RH) sampling; air sampling for particulates and volatile organic compounds (VOCs); and a visual inspection of the heating, ventilation, and air-conditioning (HVAC) systems. Results of the contractors' evaluation was as follows: No carbon monoxide was found; temperature, RH, and CO_2 levels were within the recommended comfort guidelines established by the American National Standards Institute (ANSI) and ASHRAE. All particulate and VOC air samples were well below occupational exposure limits (OELs). Since fipronil does not have an OEL, the company established their own OEL of 1 microgram per cubic meter of air as an 8-hour time-weighted-average. This OEL also has a skin notation associated with it, meaning that contact with the product could result in absorption through the skin or cause skin irritation.

Section B: Methods and Results

Methods: Environmental Assessment

We measured CO_2, temperature, and RH at two locations on each floor of the office area over 36 hours using calibrated TSI Q-Trak™ Indoor Air Quality monitors. We use indoor and outdoor CO_2 concentrations to determine if indoor occupied spaces are adequately ventilated [ANSI/ASHRAE 2016]. We measure temperature and RH because they can affect how employees perceive their indoor environment [ANSI/ASHRAE 2017]. We reviewed building drawings, a contractor ventilation system assessment report, maintenance records, and a ventilation test and balance report. We measured airflow using a calibrated TSI Accubalance EBT 731 ventilation flow hood in numerous offices, cubicle areas, and restrooms. We used ventilation smoke tubes to visualize airflow direction at each doorway between the office and the production area. We also inspected the wall above the drop ceiling that separates the office from the production area for holes and gaps that could allow the migration of air contaminants into the office areas.

In addition to looking for water damage and potential mold contamination, we checked for hidden moisture using a TRAMEX Moisture Encounter Plus nondestructive moisture meter. This hand-held direct-reading device can measure the interior wall moisture levels.

Results: Environmental Assessment

In August 2014, a heating, ventilation and air-conditioning contractor performed a test, adjust, and balance of all 21 CAV rooftop air handling units that delivered air to the office areas through more than 100 supply diffusers on the first and second floor. The contractor provided a report that certified all air handling units were operating according to design. We repeated these measurements using an airflow measuring hood and found that our measurements confirmed that the air delivered to the office areas was within approximately ± 10 percent of the measurements made by the contractor. The volumetric flow rates for the first floor (north end) ranged from 61 to 309 cubic feet per minute (cfm) while the south end ranged from 53 cfm to 178 cfm. For the second floor, the north end volumetric flow rates ranged from 147 cfm to 435 cfm while the south end ranged from 44 cfm to 225 cfm. All volumetric flow rates that were measured were in accordance with design specifications. However, our measurements did show that the south end of either floor (which had less people working in the area) had less volumetric flow rate when compared to the north end. Some supply diffusers were inaccessible due to the presence of hanging light fixtures. All rooftop air handlers were found to be clean and each 2 inch thick pleated air filter (MERV rating = 8) had been changed about 2 months ago.

In 2012 and again in 2015, a few offices on the north side of the first floor finance area were flooded during heavy rain. Concern was raised over the potential for mold growth inside the walls. During our interviews, a few employees mentioned that management responded quickly to clean up the water intrusion. The company also had the soil near the building re-graded to ensure water runs away from the building. We checked the walls of these offices and adjacent offices using the moisture meter and found no evidence of moisture in the walls.

Another concern expressed by employees involved an odor that appeared to migrate from the production area into the office area (first and second floors). This odor was reportedly more noticeable during the production of certain products that contained aromatic ingredients such as essential oils. We checked the air pressure relationship at each doorway between the office area and the production area using ventilation smoke tubes to visualize airflow direction when these doors were opened. At the time of our evaluation, all airflow patterns indicated a positive air pressure relationship between the office and the production area on both floors. This means that air will flow from the office to the production area and reduce the possibility of odors migrating into the office area.

We also investigated other ways that odors from the production area could potentially migrate into the office areas. We removed ceiling tiles along the firewall that separates the production area from the office area and examined the wall for holes or gaps between the two areas. We found multiple openings along the entire length of the firewall (above the drop ceiling) that could allow air contaminants to migrate between the two areas (e.g., gaps around pipes and electrical conduits, holes where pipes and electrical components were removed). These openings could also affect the positive pressure relationship between the office and the production area. Most employees we interviewed stated that the odors had become much less noticeable over time, and were seldom detected at the time of our visit.

Finally, we used a TSI Q-Trak Model 7565 to monitor for temperature, RH, and CO_2 at two locations (north and south) on each floor. These datalogging instruments were operated continuously for nearly 36 hours using a 10-minute sampling interval. Temperature on the first floor (north and south) ranged from 74°F to 76°F with RH values ranging from 31% to 42%. The outdoor CO_2 concentration was 395 parts per million (ppm). Measurements of CO_2 on the first floor ranged from 400 ppm to 990 ppm. On the second floor, temperature ranged from 71°F to 75°F with RH values ranging from 31% to 52%. CO_2 values on the second floor ranged from 421 ppm to 730 ppm. All peak CO_2 and RH values occurred in the afternoon between 1:30 p.m. and 3:00 p.m., but were within comfort guidelines the rest of the day and evening. All of these measurements were well within the range of ANSI/ASHRAE occupant comfort guidelines [ANSI/ASHRAE 2016, 2017]. The Environmental Protection Agency (EPA) recommends maintaining indoor RH below 60% and ideally in a range from 30% to 50%, while ASHRAE recommends maintaining at or below 65% [NIOSH 2012]. The maximum RH value we measured of 52% was slightly higher than the EPA ideal value of 50%.

Methods: Employee Health

Employee Interviews

We held confidential, voluntary medical interviews with employees. We obtained a roster of employees working in the office area and interviewed 42 of 100 employees either while on-site or by phone. Employees were selected so that we had a representative sample from both floors and all office areas and departments.

Record Review

We reviewed OSHA's Form 300 Log of Work-Related Injuries and Illnesses for the years 2012–2015.

Results: Employee Health

Confidential Medical Interviews

Among the 42 employees we interviewed, 30 were female. Employees' average age was 42 years (range: 23–60). The average length of employment by the former and current employer was 5.2 years (range: 4 months–15 years and average length of time working in the current building was 2.75 years (range: 4 months–3.5 years). Employees worked an average of 45 hours per week, with an average of 44 hours per week spent in the building. Thirty-two of 42 employees reported spending zero hours a week in the production area. Of the 10 employees who reported spending part of their work week in the production area, the average was a little over 2 hours/week. Twenty-nine of 42 employees reported they never smoked; eight were former smokers, 3 currently smoked, and 2 did not answer. When asked about current ownership of indoor pets, 24 reported owning dogs and 17 owned cats.

Since some employees had previously expressed concerns about thyroid disease to the employer, we asked employees about thyroid conditions and year diagnosed if present. Eight out of 42 employees reported thyroid conditions (a mix of hyperthyroidism, hypothyroidism, benign nodules, and thyroid cancer). Among these 8 cases, 5 occurred before employment began at this building. Three cases of thyroid nodules were reported since moving into this location; all three employees worked in various office locations. Thyroid nodules are very common in the general population; nodules are more common in women and their occurrence increases with age. Approximately 90% of thyroid nodules are not cancerous when biopsied. Additional information on thyroid conditions can be found at https://www.mayoclinic.org/search/search-results?q=thyroid%20nodule and in Section D.

Self-reported Symptoms

Employees were asked if they experienced a variety of health symptoms in the 4 weeks prior to our site visit, while at work in the building. Two employees we interviewed had not worked in the building in the previous 4 weeks due to health concerns; their specific concerns are not discussed here to protect confidentiality. If employees reported a specific symptom(s), we then asked how often the symptom(s) had occurred over the 4 weeks prior to our visit. Table 1 lists self-reported symptom prevalence by participants. There were no specific departments or building locations where more symptoms were reported by employees than in other departments or building locations. Most employees attributed their non-specific symptoms to seasonal or animal allergies, colds/viral infections, or stress (headache). Among the 32 employees that reported one or more symptoms while at work, five sought medical care. Most employees reported their symptoms were the same when at work or not at work in the building.

In the general population, 86%–95% have one or more common symptoms such as those reported here during any given 2- to 4-week period, and the average adult reports a minimum of one symptom every 4–6 days [Barsky and Borus 1995]. In addition, the average adult has two to three upper respiratory infections per year [Benninger et al. 2003].

We asked open-ended questions about work climate and odors migrating from the production area to the office area. Most employees stated they did not notice odors from the production side of the building. Among the few employees who did notice odors, most stated that at the time of our

evaluation the odors were much less noticeable than in the past, and that management had done a good job communicating steps they had taken in addressing these concerns, to include assessing the ventilation system and enforcing the policy of keeping the doors between the production and office sides of the building closed.

Among employees who reported thyroid conditions, most pre-dated employment by this company at this location, or were thyroid nodules that are common in the general population. Most symptoms reported by employees at the time of our evaluation were non-specific in nature and are common in the general population, and were not associated with building conditions.

Record Review

Our review of the facility OSHA Logs found that all entries were from the production side of the facility and primarily involved sprains, strains, and slips. There were no OSHA Log entries related to chemical exposures in the production area. There were no OSHA Log entries for office workers.

Discussion

Overall, it appears that the ventilation systems were operating as designed and had been recently tested and balanced, which resulted in maintaining the desired air pressure relationship between the offices and the production areas (desirable to minimize the migration of odors). However, some reported work practices (perhaps most notably propping doors open) could result in odors intermittently migrating into the office. Additionally, openings in the wall (above the drop ceiling) between the office and production areas were unnecessary pathways for odors to migrate into the office. Additional environmental sampling (chemical or microbial) does not appear to be necessary because; sampling results are difficult to interpret because of (a) the absence of guidelines, (b) the common and widespread presence of low-levels of chemicals and/or microbial agents, and (c) uncertainty about the relationship between low levels of such agents and specific health effects.

Section C: Tables

Table 1. Symptoms reported by employees while at work in the past 4 weeks (n = 40)

	No (N, %)	Yes (N, %)
Headache	23 (58%)	17 (42%)
Dry, itching eyes	27 (68%)	13 (32%)
Stuffy nose	27 (68%)	13 (32%)
Sore throat	33 (82%)	7 (18%)
Cough	33 (82%)	7 (18%)
Unusual fatigue	38 (95%)	2 (5%)
Wheeze	39 (98%)	1 (2%)
Chest tightness	39 (98%)	1 (2%)
Earache	38 (95%)	2 (5%)
Nausea	39 (98%)	1 (2%)
Leg cramps	39 (98%)	1 (2%)
Dizziness	40 (100%)	0 (0%)

Section D: Thyroid Conditions

Thyroid Cancer

In 2017, an estimated 57,000 new cases of thyroid cancer will be diagnosed in the United States. Three of four cases occur in women [American Cancer Society 2017]. Thyroid cancer is the most rapidly increasing cancer in the United States. This rapid increase in incidence is due to more detection of small papillary carcinomas as a result of more sensitive diagnostic procedures and increased medical surveillance for thyroid cancer [American Cancer Society 2017; Davies and Welch 2014, Vaccarella et al. 2016]. Overdiagnosis (diagnosing a thyroid tumor that will not result in symptoms or death if left alone) has been estimated to account for 70% to 80% of thyroid cancer cases among women in the United States, based on 2003–2007 data [Vaccarella et al. 2016].

Papillary thyroid cancer is the most common type of thyroid cancer and accounts for more than 80% of non–radiation-associated spontaneous thyroid cancers in the United States [NCRP 2008]. Papillary cancer tends to grow very slowly and has good prognosis in treated patients [Sherman 2003]. Other types of thyroid cancer include follicular, Hurthle cell, medullary, and anaplastic [American Cancer Society 2016].

Risk factors for thyroid cancer include ionizing radiation, a diet low in iodine, certain hereditary conditions, and benign thyroid disease. Patients with goiter, thyroid adenoma, nodules, and hyperthyroidism are at higher risk for developing thyroid cancer, but not patients with hypothyroidism [Franceschi et al. 1999; Pazaitou-Panayiotou et al. 2012; Preston-Martin et al. 2003].

Hypothyroidism, Hyperthyroidism, and Thyroid Nodules

Hypothyroidism, or thyroid hormone deficiency, is common. In a nationwide survey, 4.3% of the U.S. population had blood tests indicating hypothyroidism [Hollowell et al. 2002]. In parts of the world with sufficient iodine in the diet such as the United States, the most common causes of hypothyroidism are autoimmune hypothyroidism and medical treatment such as surgery, radioactive iodine to treat hyperthyroidism, and radiotherapy for cancer [Jameson et al. 2014]. Autoimmune disorders are often inherited. They occur when the immune system attacks itself by mistake, producing antibodies against specific cells in the body. The exact cause of the body developing antibodies against its own tissues is not known. However, genetic variations in HLA-DR and CTLA-4 (genes related to the immune system) are risk factors for developing autoimmune hypothyroidism [Jameson et al. 2014]. Hashimoto's thyroiditis is a type of autoimmune hypothyroidism.

Hyperthyroidism occurs when the thyroid gland is overactive. Approximately 1.3% of the U.S. population had evidence of hyperthyroidism in a nationwide survey [Hollowell et al. 2002]. Graves' disease is the most common type of hyperthyroidism. In Graves' disease, the entire thyroid gland is stimulated by antibodies to grow and produce too much thyroid hormone. Graves' disease tends to run in families. Other possible causes include too much iodine in the diet, exposure to tobacco smoke, infections, and emotional stress [Jameson et al. 2014; Smith and Hegedüs 2016].

Thyroid nodules are also quite common. Physical examination can detect a thyroid nodule in approximately 2%–6% of adults who undergo physical examination with palpation (touch) of the thyroid gland. By ultrasound examination, approximately 19%–35% of adults have a detectable thyroid nodule. Nodules can be solitary or multiple. They might or might not produce thyroid hormone [Jameson et al. 2014].

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