

# EXPOSURE ASSESSMENT AT THE AMERICAN UNIVERSITY OF BEIRUT (AUB) CAMPUS AND MEDICAL CENTER

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The American Industrial Hygiene Association (AIHA)

Developing World Outreach Initiative (DWOI)

Technical Project in Beirut, Lebanon

November - December 2020

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with the Environmental Health Safety and Risk Management (EHSRM) group at AUB

# Lebanon and Industrial Hygiene



- Occupational and Environmental Health regulations are lax. Enforcement is sporadic or non-existent.
- Industrial hygiene is typically practiced part time by engineers or consultants.
- Industrial hygiene analytical labs are non-existent in the country.

# Circumstances surrounding the project

2020 was a challenging year for Lebanon. While the assessment was conducted on individuals with fairly consistent employment, several circumstances affected the project.

- COVID-19 Pandemic
  - Lockdowns: alternate work schedules
- Economic Crisis
  - Layoffs; alternate work schedules
- August 4, 2020 Explosion (2,750 tonnes of Ammonium Nitrate exploded at the Port)
  - Focus was on chemical hygiene and hazardous waste issues



Source: Al Jazeera

# The American University of Beirut



- Leading academic institution in Lebanon (and arguably the Middle East).
- Staff and alumni and influential in politics and regional initiatives.
- Operates in conjunction with the AUB Medical Center which is also a premier teaching hospital.

# Project

**Personal Air Monitoring was conducted  
for the following operations**

- **Scope:** Exposure assessment conducted for employees at the **Campus** and **Medical Center**.
- **Dates:** November 24- December 1, 2020.
- **Purpose:** Conduct assessment for employees with increased risk of airborne exposures to chemicals. Population for air monitoring were selected based on recommendations made by AUB Environmental Health Safety and Risk Management (EHSRM)

## Campus

**Power Plant:** operations and maintenance (Diesel generators are used to compensate for regular power outages).

**Spray Painting** at the Paint Shop: (various trades repair University and Medical Center infrastructure).

## Medical Center

**Assessment focused on Operating Room (OR) Therapists:** OR Therapists are assistants to anesthesiologists

**Laundry:** (for Medical Center and University) operations and maintenance.

# Sampling Strategy

| Operational Unit                                            | Contaminant(s) of Interest                           | Sampling and Analytical Method            |
|-------------------------------------------------------------|------------------------------------------------------|-------------------------------------------|
| <i>Campus</i>                                               |                                                      |                                           |
| <b>Power Plant</b><br>(Operators and Maintenance Personnel) | • Benzene, Toluene, Ethylbenzene, Xylene (BTEX)      | • modified NIOSH 1501 (charcoal tube)     |
|                                                             | • Diesel Particulates                                | • modified NIOSH 5040 (37 mm Quartz FF)   |
| <b>Paint Shop</b><br>(Painter)                              | • Volatile Organic Compounds (Profile: 31 compounds) | • modified multiple NIOSH (charcoal tube) |
|                                                             | • Diisocyanates                                      | • modified OSHA 42 (treated GFF)          |
| <i>Medical Center</i>                                       |                                                      |                                           |
| <b>Laundry</b><br>(Operators and Maintenance Personnel)     | • Perchloroethylene (TCE)                            | • modified OSHA 1003 (charcoal tube)      |
| <b>Surgery</b><br>(OR Therapists)                           | • Sevoflurane                                        | • modified OSHA 29 (charcoal tube)        |

## Sample collection and analysis

1. Reviewed the sampling method.
2. Calculated approximate sampling period:
  - Sample calculation for Perchloroethylene; NIOSH Method 1003
    - Method recommends a maximum sample volume of 3 Liters (L); Recommended flow rate range is 0.01 to 0.2 Liters per Minute (L/min)

$$\frac{\text{Max sample volume (L)}}{\text{flow rate } (\frac{\text{L}}{\text{min}})} = \frac{3\text{L}}{0.2 \text{ L/min}} = 30 \text{ minutes.}$$

3. Samples were collected from employees using personal sampling pumps and various media.
4. Samples were sent to the lab after arrival to the US.
5. Results were received and extrapolated. They are reported if they exceed the **Limit of Detection (LOD)**. **Any quantity below the LOD is non-detect and was not reported.**

All results were compared to US Regulatory and Recommended Occupational Exposure Limits (OELs)

### ***Regulatory limits***

*Occupational Safety and Health Administration (OSHA)*

Permissible Exposure Limits (PELs)

Short Term Exposure Limits (STEL) where available

*California Department of Occupational Safety and Health (Cal/OSHA)*

Permissible Exposure Limits (PELs)

Short Term Exposure Limits (STEL) where available

### ***Recommended Limits***

*National Institute of Occupational Safety and Health (NIOSH)*

Recommended Exposure Limit (REL)

*American Conference of Governmental Industrial Hygienists (ACGIH)*

Threshold Limit Value (TLV)

# All OELs and results are expressed as Time Weighted Averages (TWAs)

- Assumptions were made regarding the extent of exposure.
  - If the exposure was assumed to occur throughout the shift, sample results were calculated based on an 8-hour TWA (except where 12-hour shift was reported).
  - If the exposure occurred for a shorter duration than 8 hours, the TWA was calculated assuming exposure for the duration of chemical use based on what workers reported.

$$\frac{C_1T_1 + C_2T_2 \dots C_nT_n}{480} = \text{8-hour TWA}$$

C = concentration (ppm or mg/m<sup>3</sup>)

T<sub>n</sub> = Exposure time to a particular concentration (minutes)

480 = minutes in an 8-hour work shift

# Extended Shift Calculations

- Generally, occupational exposure limits are based on an 8-hour workday. The occupational exposure limit is adjusted for extended work shifts. An adjustment factor is calculated then multiplied to the occupational exposure limit.
- Follows the Brief and Scala model

$$\text{DAILY Adjusted OEL} = \text{OEL} \times \left( \frac{8}{\text{daily hours worked}} \right) \times \left( \frac{24 - \text{daily hours worked}}{16} \right)$$

$$\text{WEEKLY Adjusted OEL} = \left( \frac{40}{\text{weekly hours worked}} \right) \times \left( \frac{168 - \text{weekly hours worked}}{128} \right)$$

# Calculations for Chemical Mixtures

- Generally, if the toxicological effect of the substances are similar (e.g., each substance affects same target organ or has a similar effect), can be considered that the combined effect of the chemicals will be the sum of individual effects.

$$\frac{C1}{EL1} + \frac{C2}{EL2} + \dots + \frac{Cn}{ELn}$$

If the sum is > 1 then the OEL of the mixture is exceeded.

C = Concentration (ppm or mg/m<sup>3</sup>)  
EL = OEL for that particular substance

- Commonly used for mixtures of solvents; In this project it was used to evaluate VOC exposures in the painter.
- **HOWEVER;** ACGIH recommends that this calculation not be done for the following cases:
  - Mixtures of substances which do not have additive effects (e.g. have antagonistic or synergistic effects, etc.)
  - **Carcinogens** (exposure should be eliminated or as low as possible); and
  - Complex mixtures (e.g. diesel exhaust).
- This calculation was considered for evaluating BTEX in Power Plant workers but ultimately **NOT USED**. Benzene is considered a known human carcinogen by International Agency for Research on Cancer (IARC).



# AUB CAMPUS

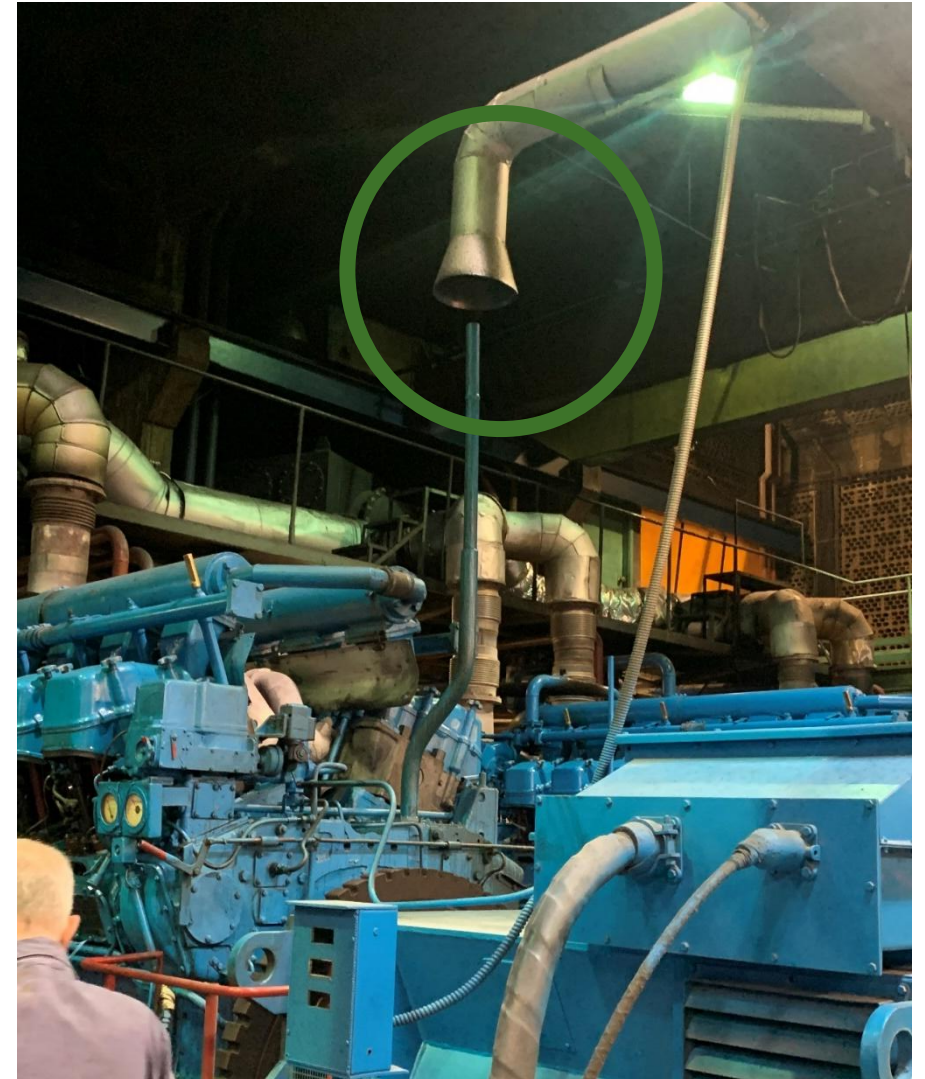
# Power Plant

## Process

- Lebanon has rolling blackouts. The Power Plant has four diesel generators which provide power to the University and Medical Center.
- The area with the generators is separated from the maintenance workshop.
- The Generator Area and Maintenance Workshop have offices, which employees share.

## Ventilation

- Each generator has a dedicated local exhaust ventilation. Exhausted air goes to a scrubber and then the exterior of the building.
- There is no ducted Heating Ventilation and Air Conditioning (HVAC) system in the building.
- Offices have a wall mounted air conditioning unit (which does not provide fresh outdoor air).



# Power Plant Continued

## Workers

- Operates 24 hours a day/ 7 days a week.
- Has operators and maintenance workers.
  - Maintenance: work 8 hour shifts.
  - Operators: Work 12 hour shifts on a modified 2-2-3 schedule.

## Personal Protective Equipment (PPE)

- All employees: ear plugs, gloves, coveralls, and safety shoes.
- Required to wear face coverings due to the ongoing pandemic. These face coverings are not rated for exposures to chemicals nor particulates.



# Power Plant: BTEX

- Sampled
  - 1 Maintenance worker
  - 3 Operators
- Assumptions
  - Consistent exposure throughout shift. Similar exposure for un-sampled portion of the shift.
- Results
  - One operator had exposure greater than the limit of detection ( $> \text{LOD}$ ) for benzene and toluene.
  - Other operators and maintenance workers had exposures  $< \text{LODs}$ .
  - The operator was below **8-hour OELs** and extended shift adjusted OELs for Benzene and Toluene.

# Extended Shift Assessment – Benzene and Toluene

Only one operator had exposure > LOD for both Benzene and Toluene. His exposures were below all adjusted OELs it was compared to. Exposure could also come from smoking. Smoking habits were not evaluated during this assessment.

## Benzene

| 8-hour TWA | 8-hour OEL (ppm) |     | Adjusted OEL |
|------------|------------------|-----|--------------|
| 0.03       | OSHA PEL         | 1   | 0.5          |
|            | CalOSHA PEL      | 1   | 0.5          |
|            | NIOSH REL        | 0.1 | 0.05         |
|            | ACGIH TLV        | 0.5 | 0.25         |

## Toluene

| 8-hour TWA | 8-hour OEL (ppm) |     | Adjusted OEL |
|------------|------------------|-----|--------------|
| 0.069      | OSHA PEL         | 200 | 100          |
|            | CalOSHA PEL      | 10  | 5            |
|            | NIOSH REL        | 100 | 50           |
|            | ACGIH TLV        | 20  | 10           |

# Power Plant: Diesel Particulates

- Sampled
  - 3 Maintenance workers
  - 1 Operator
- Assumptions
  - Consistent exposure throughout shift. Similar exposure for un-sampled portion of the shift.
- Results
  - Results are reported as 3 fractions
    - **Organic Carbon**
      - **There is only an OEL for this fraction.**
    - Elemental Carbon
    - Total Carbon (organic carbon + elemental carbon)
  - All workers had exposure > LOD. Largest fraction was organic carbon for all samples
  - **All sampled workers exceeded the ACGIH TLV for Organic Carbon of 0.02 mg/m<sup>3</sup>**

# Extended Shift Assessment – Diesel Particulates

## Diesel Particulates

- ACGIH TLV for organic carbon is 0.02 mg/m<sup>3</sup>
  - No other OELs for organic carbon
- A daily adjusted OEL and a weekly adjusted OEL is calculated. The more conservative value is used.
  - Daily adjusted OEL was slightly more conservative.
  - Adjusted daily OEL is **0.01 mg/m<sup>3</sup>**

## Analysis

- All sampled workers had exposure to diesel particulates greater than the LOD.
- All Maintenance workers all exceeded the ACGIH TLV by **2.5 to 5.5x (times)**.
- The operator exceeded the adjusted TLV by **2x**.
- Exposure should be kept as low as possible since Diesel is considered a carcinogen by IARC. Many other agencies including the National Toxicology Program, NIOSH, and EPA classify it as likely to cause cancer.

# Recommendations for Power Plant

***Summary of findings:*** All monitored workers were overexposed to diesel particulates and one worker had exposure to benzene and toluene below the OELs.

- Verify that the **local exhaust ventilation, scrubbers, and generators** are working properly. Ensure that maintenance is conducted on all systems at the frequency specified by the manufacturer.
- Staff reported that the generators were installed decades ago and serve at a larger capacity than originally anticipated. Consider alternative exhaust treatment systems such as filters, catalysts and/or converters, and a corresponding maintenance program.
- Change filters in the AC units in offices a frequency specified by the manufacturer. When funding does become available, introducing a fresh air system to offices is recommended.
- Consider turning off engines whenever possible.
- Establish an air monitoring plan.
- Consider reduce the hours of work exposed to exhaust through job rotation and scheduling.
- Use personal protective equipment, such a half face air purifying respirator with HEPA and organic vapor filters.

# Paint Shop

## Process

- AUB has various trades and workshops in their Physical Plant including a paint shop
- Majority of painting is conducted using spray operations.

## Ventilation

- Paint booth with a filters and exhaust fan.

## Workers

- 8-hour shifts.
- During the survey painters had an alternating work schedule. Worked 2 days a week.

## PPE

- Work shirt, work pants, safety shoes.
- Face coverings. These are not rated for protecting against gases and vapors.



## Painter: Volatile Organic Compounds (VOCs)

- Sampled
  - 1 Painter over two shifts
- Assumptions
  - Consistent exposure throughout shift. Similar exposure for un-sampled portion of the shift.
- Results
  - Analysis for 31 VOCs; The following were > LOD for both samples.
    - Ethyl Alcohol
    - Ethylbenzene
    - Isopropyl Alcohol
    - N-butylacetate
    - Toluene
    - Xylene
  - All results were below their respective OELs and OEL for mixtures. OELs on next slide.

| Chemicals detected above the LOD | OSHA PEL     | Ca/OSHA PEL | NIOSH REL    | ACGIH TLV    |
|----------------------------------|--------------|-------------|--------------|--------------|
| Ethyl Alcohol                    | 1000         | 1000        | 1000         | NA           |
| Ethylbenzene                     | 100          | 5           | 100          | 20           |
| Isopropyl Alcohol                | 400          | 400         | 400          | 200          |
| N-butylacetate                   | 150          | 150         | 150          | 150          |
| Toluene                          | 200          | 10          | 100          | 50           |
| Xylene                           | 100          | 100         | 100          | 100          |
| Sample 1: Combined OEL           | <b>0.029</b> | <b>0.43</b> | <b>0.048</b> | <b>0.093</b> |
| Sample 2: Combined OEL           | <b>0.065</b> | <b>0.70</b> | <b>0.10</b>  | <b>0.15</b>  |

### Sample calculation

$$\frac{1.1 \text{ ppm Ethyl Alcohol}}{1000 \text{ ppm (OSHA PEL)}} + \frac{0.19 \text{ ppm Ethylbenzene}}{100 \text{ ppm}} + \frac{0.33 \text{ ppm Isopropyl Alcohol}}{400 \text{ ppm}} + \frac{0.31 \text{ ppm N-butylacetate}}{150 \text{ ppm}} + \frac{3.8 \text{ ppm Toluene}}{200 \text{ ppm}} + \frac{0.38 \text{ ppm Xylene}}{100 \text{ ppm}} = 0.029$$

- Since this value is less than 1, the exposures to mixtures is below the combined OEL.

### Analysis

- All results were below their respective OELs and OEL for mixtures.

# Painters: Diisocyanates

- Sampled
  - 1 Painter over three shifts
- Assumptions
  - No exposure whenever diisocyanate containing chemical wasn't used.
- Results
  - All results were non-detect for diisocyanates ( $< \text{LOD}$ ).
  - Likely that painters did not use diisocyanate containing products.

# Recommendations

***Summary of findings:*** VOC levels were below their respective occupational exposure limits. No Diisocyanates were detected.

- Use low VOC paint whenever possible.
- Remove obstructions from in front of the paint booth ventilation exhaust to keep it operating optimally.
- Conduct preventative maintenance on the booth and document it to ensure consistency.
- Recommended PPE: Nitrile gloves, half face respirators with combination HEPA and organic vapor cartridges.





# MEDICAL CENTER

# Laundry Department

## Process

- Serves University employees and the Medical Center. Majority of laundry comes from the hospital.
- Perchloroethylene (Perc) is used in AUB's dry-cleaning process. The facility has one machine which uses Perc. Exposure to vapors occurs when operators load and unload clothes from this machine, and when maintenance is conducted.

## Ventilation

- Liquid Perc is kept in a drum in a room with operable windows.
- Dry cleaning machine is a closed loop vented system. The process heats the chemical.
- Overhead vents dissipate heat, reduce humidity, and dilute airborne chemicals.

## Workers

- Operators and maintenance workers.
- 8 hours shifts.

## PPE

- At the time of the survey only maintenance workers wore gloves and respirators while working with Perc. Operators did not wear gloves nor a respirator at machine interface.



# Laundry Continued



Overhead Ventilation System at the Laundry



Pointing at the water separator

Due to economic challenges, maintenance in the past year has been conducted less often than the manufacturer specified frequency. Exposure to maintenance personnel may be affected.

# Laundry continued



Laundry Maintenance Worker loading  
Perc into dry cleaning machine (Video)

To watch video,  
hover over the  
image and  
press play

## Laundry Workers: Perchloroethylene

- Sampled
  - 1 operator over two periods
  - 1 maintenance worker over one period
- Assumptions
  - Operators exposed to Perc for about 1 hour daily.
  - Maintenance on the machine is conducted occasionally. Exposure duration can range from minutes to hours.
- Results
  - All results were > LOD.
  - All results were below OSHA PEL of 100 ppm.
  - One result was **above CalOSHA PEL and ACGIH TLV of 25 ppm.**
  - NIOSH doesn't have a limit and recommends reducing exposures to the lowest possible level since they recognize Perc as a carcinogen.
  - All samples were below all applicable STELs.

# Recommendations



- While replacing a process during an economic crisis is not feasible, decommissioning the dry cleaning machine should be prioritized whenever possible.
- Place TCE barrel closer to the process to reduce exposure and possibility of spill. Ideally, TCE would be transferred to the process with a closed piping system or at least, a gas canister with valve.
- Provide Hazard identification, response, and spill cleanup training.
- Conduct preventative maintenance based on the frequency recommended by the manufacturer to ensure machines are functioning optimally (especially the vapor recovery system).

# Recommendations Continued

- Establish, implement, and train on decontamination procedures for personnel handling TCE, and also, for those working with caustic detergents.
- Establish an air monitoring plan.
- Keep the door closed as much as possible. Wait until the machine is cooler before opening the door.
- Recommended PPE: half face negative pressure air purifying respirator with organic vapor filters; chemical resistant nitrile, Butyl rubber with long cuffs.

Chemical Resistant Nitrile



Butyl Rubber



# Medical Center Operating Rooms

- The exposure assessment was limited to Operating Room Therapists, whom assist the anesthesiologists before and during operations.
- Due to the sensitive nature of their work, access to the Operating Rooms was restricted.
- Therapists reported:
  - The operating suites are under positive pressure.
  - Higher exposures are likely with pediatric cases as opposed to adult patients.
  - They walk in and out of the suite and do not remain in the Operating Room during the entire surgery.
- Sevoflurane is halogenated anesthetic used during operations at the AUBMC. Therapists are responsible for filling the anesthesia delivery system with liquid Sevoflurane, as well as, assisting with administering it to the patients.



## Operating Room: Sevofluorane

- Sampled
  - 3 Operating Room Therapists over three shifts.
- Assumption:
  - Consistent exposure throughout shift
- Results:
  - No OSHA PEL; There's a NIOSH REL of 2 ppm.
  - One therapist was < LOD
  - One was above the REL.
  - One was > LOD but below the REL.

# Recommendations

**Summary of findings:** Sevoflurane levels varied. One worker had no exposure, one had exposure below the OEL, the third worker had exposure above the OEL. There is possibility of exposure above the recommended limit (NIOSH REL of 2ppm) for OR Therapists.

- Establish an air monitoring plan.
- Remove any obstructions from in front of the ventilation system (if any) to keep it operating optimally.
- Step out of the room whenever possible.
- Conduct preventative maintenance on the anesthesia machine as recommended by the manufacturer and document it to ensure consistency.
- Recommended PPE: Nitrile gloves, N-95 respirator with activated carbon layer (Pictured on the right).



| Substance Specific Health Standards (OSHA, US) |
|------------------------------------------------|
| Acrylonitrile                                  |
| Asbestos                                       |
| Benzene                                        |
| Cadmium                                        |
| Coke Oven Emissions                            |
| Cotton Dust                                    |
| 1,2 -Dibromo-3-chloropropane                   |
| Ethylene oxide                                 |
| Formaldehyde                                   |
| Inorganic arsenic                              |
| Lead                                           |
| Methylene Chloride                             |
| 4,4'-Methylene-dianiline                       |
| Vinyl chloride                                 |

## Overall Program Recommendations

- Notify workers of their exposures and provide them context by noting whether or not their exposures exceeded any OELs. (Template included in report packet)
- Establish a written injury and illness prevention plan. Include sections on hazard identification, assessment, mitigation, and accident investigation. If plan already exists, elaborate on air monitoring.
- Prioritize hazardous operations and sample for chemical contaminants whenever economically feasible.
  - OSHA (US) has 14 substance specific standards (to the left) which define sampling frequency and notification terms. These substances can be prioritized for air monitoring if used at AUB.
- Provide hazard communication training to all workers including medical staff.
- Establish procedures for donning personal protective equipment and decontamination procedures. Train workers on them.

# Challenges

- Acquiring the necessary calibrators.
  - AUB has calibrators that expired for their factory calibration. They need to send the equipment abroad for factory calibration. I had to borrow calibrators from others in the US and had a hard time locating the resources on my own.
- Convincing workers to wear personal sampling pumps.
  - Some people were not interested in wearing pumps or removed the air monitor during sampling.
- Management concerns about sample results.
  - Communicating results and hazard mitigation efforts.
- Economic feasibility in implementing hazard mitigation measures. Eliminating a process, replacing it with a less hazardous one, and introducing and maintaining the ventilation system are all preferred modes of mitigating hazards as compared to administrative controls and PPE. These are also more expensive options which may not be economically feasible at this time.
- Cultural outlook on health and safety.
  - Some people do not want to know when they're sick.
  - Environmental issues are widely ignored or mismanaged (on a national level, not at the university).
  - Prevention is not as valued as reactive care. (Attitude of “live every day like it's your last”).



# OTHER WORK

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# Hazardous Building Materials Training

The blast on August 4, 2020, created a large volume of building debris in Beirut.

Lebanon has had to sort through a variety of potentially hazardous materials so that they export their hazardous waste to other countries. Since they do not have a hazardous waste landfill, how to handle this waste has been a hot topic in the country.

The EHSRM Staff requested a hazardous building materials awareness training. I provided a brief overview of how to identify hazardous building materials and what the regulatory requirements are for sampling them in the US. This course is similar to the Asbestos, Lead, Silica, Awareness Training I provide to trades who work for the City and County of San Francisco Department of Public Works.



*A sculpture by artist Hayat Nazer, made from glass and rubble from the Beirut Blast on August 4, 2020.*

Source: <https://www.cnn.com/style/article/lebanese-artist-sculpture-rubble-beirut-explosion-trnd/index.html>

# Contribution to the EHSRM Newsletter: Stay Safe

I was honored that EHSRM at AUB had asked me to write an article about industrial hygiene for their newsletter called *Stay Safe*.

They featured my written work as their Article of the Month for issue #50.

## THINK SAFE

1. Industrial hygiene is a job that should be available only in industries.  
a. True      b. False
2. Office workers are less likely to suffer a disabling injury from a fall than non-office workers.  
a. True      b. False
3. Despite the overall controls used to prevent hazards (engineering controls, administrative controls and personal protective equipment) additional programs, such as medical programs, preventative maintenance systems and emergency preparation, may still be necessary.  
a. True      b. False

Answers are on page 2

### Identifying the hazardous elements



Sampling Equipment

# NEWSLETTER

Jan. 2021 - Issue # 50

## WELCOME NOTE

Dear Readers,

The results of the *UI GreenMetric World Universities Ranking for 2020* is out. AUB did a great move forward and was ranked as the *185th most sustainable university* based on a multi-criteria analysis related to six broad categories: setting and infrastructure, energy and climate change, waste management, water management, transportation, and research & education. AUB scored 6,900 out of 10,000 possible points as compared to last year's score of 5,825 that helped AUB to jump from rank 242 to rank 185 out of 912 participating universities. EHSRM will be analyzing the ranking scorecard in order to identify gaps, develop an action plan and work with all stakeholders on improving AUB's sustainability structure to achieve better results in the future. Moreover, EHSRM prepared all the required data and evidences related to SDG 6 and SDG 7 (clean water and sanitation, and affordable and clean energy, respectively) for the Times Higher Education Impact ranking for the year 2020.

EHSRM collaborated with a Senior Industrial Hygienist from the County of San Francisco to secure a grant from the Developing World Outreach Initiative (DWOI) to assess exposures to contaminants and conduct air monitoring for physical plant, laundry and anesthesiology department staff. The project focuses on measuring exposures to halogenated anesthetic gases, volatile organic compounds (VOCs), diesel particulates, and benzene, toluene, ethyl benzene and xylene (BTEX). Sampling for these different contaminants were collected and sent back to the US for analysis. Results will be reported back to take the appropriate mitigation measures.

After securing a grant from ASHA through the Office of Grants & Contracts, EHSRM prepared the Initial Environmental Examination (IEE) and Climate Risk Management (CRM) reports and collaborated with FPDU, Chemistry and MMD regarding the design of the cold stores for the storage of chemicals to render them safe. Moreover, EHSRM is collaborating with FAFS regarding the ASHA water security project at AREC whose objective is to develop an alternative water management plan through deploying specific technologies related to rainwater harvesting, wastewater and dairy wastewater treatment. EHSRM will be preparing the respective IEE and CRM reports for the project. On another front, EHSRM reviewed and updated the University laser safety regulations and automated the process of radiation safety lab inspections through the use of the iAuditor app.

## ARTICLE OF THE MONTH | What is Industrial Hygiene?

Workplace health and safety was considered a privilege before it became a right. Prior to the industrial revolution, workers would go home with devastating injuries simply because they endured neglectful conditions to bring home a paycheck. Industrial hygiene which is the science dedicated to anticipating, recognizing, evaluating, and controlling workplace hazards, revolutionized the field of occupational health. Essentially what an industrial hygienist does, is evaluate exposures and recommend protective measures. Hazards may be biological, chemical, or physical (such as noise, radiation, etc.) and can be found inside and outside of workplaces.

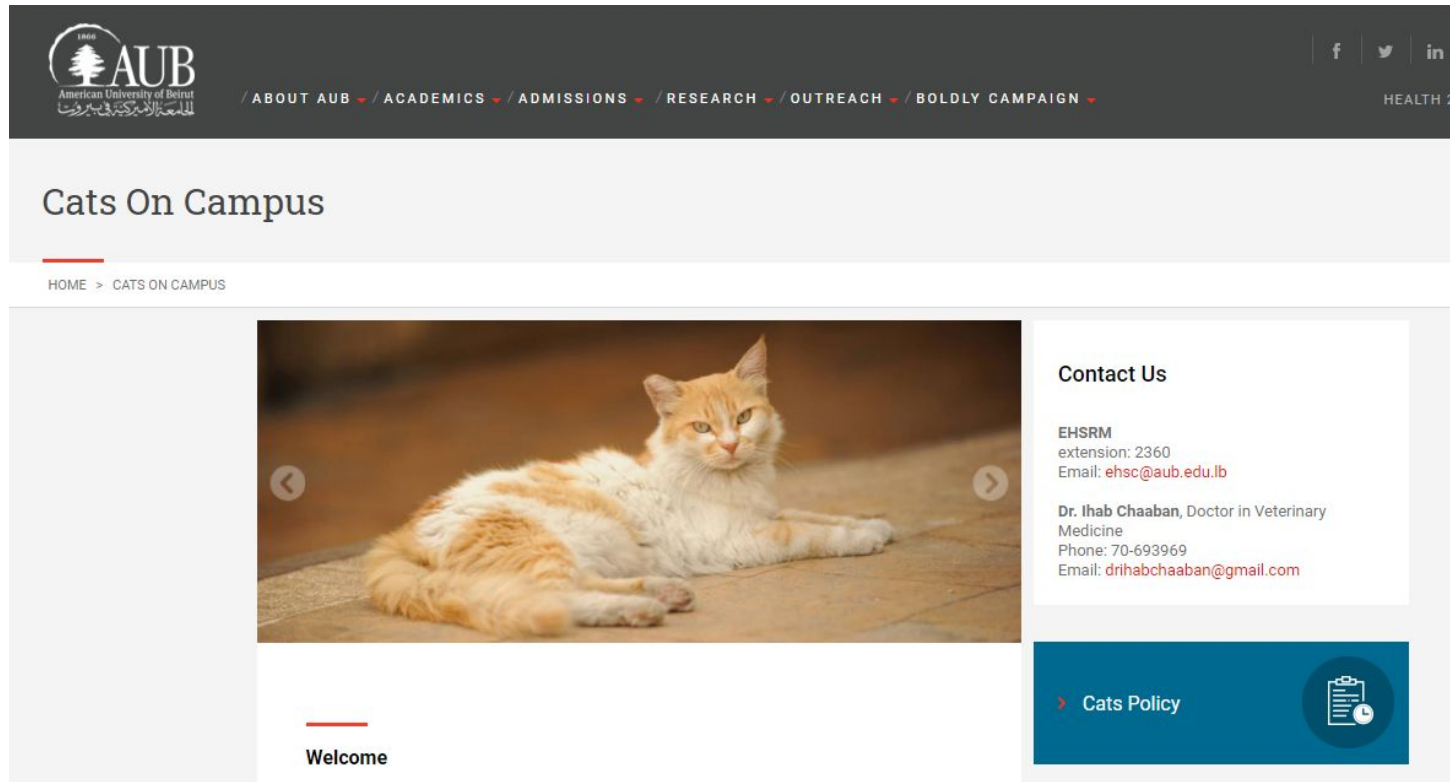
To better understand how exposure is measured and the considerations made to protect people, let's take AUB's powerplant as an example. Operators and maintenance personnel work around the clock to keep these generators running for the Campus and Medical Center. Generators are noisy, emit particles, and expose workers to diesel fumes. While these hazards may be invisible, they are capable of causing illness to workers over time, in an uncontrolled environment. Currently, there is no one method which identifies and measures all contaminants. One must first identify a contaminant before testing for it. In our example, to measure exposure to fuel components like benzene and toluene, workers wear a small personal pump on their belt, connected to tubing, with a filter at the other end. The filter is placed on the worker's collar within their breathing zone. The pump has a motor which draws air through the tubing and ultimately the filter. The sample is collected for the duration of a workers shift and then sent to the lab for analysis. This is one method to conduct an exposure assessment. There may be multiple methods to sample for contaminants such as using direct reading instruments or badges like those worn by personnel exposed to radiation. Once a sample is analyzed, an exposure concentration is determined which can then facilitate risk assessment. Risk of developing a disease is evaluated by comparing the exposure concentration to a numerical limits, established by regulatory or research agencies such as *OSHA* and *NIOSH*. Any concentration at or above these numerical limit indicates an increased risk of an adverse health effect associated with that contaminant.

Exposure assessments can be conducted for hundreds of contaminants, pollutants, air quality determinants, noise, mold, etc. Once results are received, recommendations may be made to reduce exposures or modify existing controls. These recommendations must be feasible, which is often a balance between safety needs and economics. In our example, the power plant has an existing fume extraction system to remove contaminants and workers are required to wear personal protective equipment. These sort of controls have saved countless lives and have influenced our work culture.

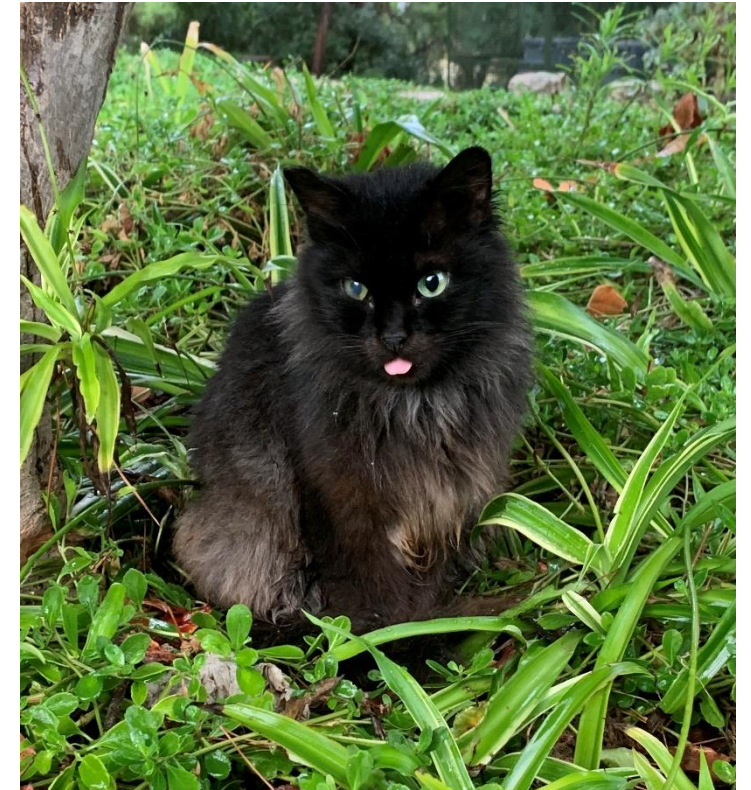
As we learned this year with the ongoing pandemic, changing the way we conduct our daily lives can be challenging. Adopting new behaviors however, can save provide a valuable shift in improving the quality of life. Protecting workers is not only in the best interest for the employee, employers also benefit by maintaining a healthy and productive work force.

By Carine Kouyoumji Abdelnour – Senior Industrial Hygienist

# AUB is famous for its cats. I pet all the cats.



The screenshot shows the AUB (American University of Beirut) website header with the university logo and navigation links: / ABOUT AUB / ACADEMICS / ADMISSIONS / RESEARCH / OUTREACH / BOLDLY CAMPAIGN. Below the header is a section titled "Cats On Campus" with a sub-link "HOME > CATS ON CAMPUS". The main content area features a large image of an orange and white cat lying on a stone surface. To the right of the image is a "Contact Us" box with the following information: EHSRM, extension: 2360, Email: [ehsc@aub.edu.lb](mailto:ehsc@aub.edu.lb), Dr. Ihab Chaaban, Doctor in Veterinary Medicine, Phone: 70-693969, Email: [drihabchaaban@gmail.com](mailto:drihabchaaban@gmail.com). Below the contact box is a blue button labeled "Cats Policy" with a calendar icon.



**Fun Fact: EHSRM is responsible for the safety and wellbeing of these cats.**

# THANK YOU FOR THE OPPORTUNITY!



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**AIHA Developing World Outreach Initiative (DWOI)**

**SGS Galson Laboratories**

**SKC Inc.**

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