COVID-19 Environmental Sampling Project

Background

NJIT has contracted with an environmental consulting firm to conduct environmental monitoring in support of NJIT's pandemic recovery efforts. Environmental monitoring will focus on the collection and analysis of environmental samples from three distinct media including: surface sampling, air sampling, and waste water sampling. Surface sampling will concentrate on common touch surfaces in General parameters of the sampling protocols are outlined below.

Surface Sampling

Surface sampling for SARS-CoV-2, the causative agent of COVID-19, will be conducted to verify disinfection efficacy or to document an emergency response disinfection. Surface sample collection will be concentrated in classrooms, teaching laboratories, and common use areas to confirm the efficacy of cleaning and disinfection efforts. Surface sampling will be comprised of two distinct sampling protocols:

1) Preliminary surface testing with ATP Meter

The ATP direct-read bio-luminescence meter will be used to measure the general cleanliness of the surface being tested. Adenosine Triphosphate (ATP), a molecule found in living cells, can be used as a surrogate to measure the efficacy of cleaning. If a surface is cleaned correctly, there will be no to little ATP present on that surface. The bio-luminescence meter utilizes the Luciferase enzyme to measure ATP. When Luciferase interacts with ATP it produces light, which is measured by the bio-luminescence meter, the amount of light produced is directly correlated to the amount of ATP present on the surface. The direct-read ATP meter is particularly valuable to immediately determine which high touch surfaces in a building require a higher level of disinfection or need to be re-cleaned. Once a pattern is established, the overall cleaning process can be improved by focusing on surfaces that returned elevated ATP results. ATP results are expressed in Relative Light Units. The following cut off points will be used for ATP measurements:

- Less than 100 – (green) clean, adequate disinfection achieved
- 100 to 200 – (yellow) clean, adequate disinfection may not have been achieved, will not trigger call to Building Services to re-clean the area, these surfaces will be included in training for custodial staff to help improve their cleaning efficiency
- Greater than 200 – (red) will trigger alert to Building Services to re-clean the area, these surfaces will be included in training for custodial staff to help improve their cleaning efficiency.

2) Surface sampling for SARS-COV-2

Following pre-screening with the ATP meter, select surfaces will be sampled for SARS-COV-2. Using a 6-inch sterile HydraFlock swab with a Polystyrene Handle, obtained from the laboratory, an area approximately 25 cm2 on the target surface is swabbed. Once the sampling is complete, the swab is placed inside a sterile screw cap vial with 1 mL of molecular preservative. The samples are placed into a thermally insulated cooler to maintain appropriate temperature during shipment. The samples are then shipped to an independent laboratory where they are analyzed by the polymerase chain reaction for SARS-CoV-2. The polymerase chain reaction (PCR) is a laboratory-based method that measures the amount of viral DNA/RNA present in a sample. The PCR method relies on a protein responsible for DNA replication in cells (DNA/RNA), where this protein will only replicate DNA strands that match the COVID-

19 sequence. The thermocycler (PCR machine), is also equipped with a luminometer, which measures the amount of light produced during the reaction to estimate the amount of SARS-CoV-2 present in the sample. If replication exceeds a cycle threshold (CT) score established by the laboratory the sample is determined to be positive for the SARS-CoV-2. The CT score which is inversely related to the concentration of RNA in the sample.

- A CT score of less than 40 is considered positive.
- A positive CT score indicating that SARS-CoV-2 was present on an environmental surface will require NJIT to employ enhanced cleaning protocols, implement COVID-19 surveillance testing of the impacted population, and subsequent re-sampling of the area.

3) Air sampling for SARS-COV-2

Air sample collection will be concentrated in classrooms, teaching laboratories, and common use area to confirm virus mitigation efforts are effectively managing airborne transmission. Air samples are collected using a linear oscillating pump in conjunction with a 0.3 µm Polytetrafluoroethylene (PTFE) filter housed 37 mm cassettes. The pump pulls the air from the surrounding area into the cassette where any airborne virus particulates are captured. The samples are collected at a flow rate of 15 liters per minute (LPM), for 2 hours, totaling 1800 liters. Once sampling is complete, samples are shipped to an independent laboratory for analysis. Samples are analyzed via a polymerase chain reaction (PCR) method. The PCR method relies on a protein responsible for DNA replication in cells (DNA/RNA), where this protein will only replicate DNA strands that match the COVID-19 sequence. The thermocycler (PCR machine), is also equipped with a luminometer, which measures the amount of light produced during the reaction to estimate the amount of SARS-CoV-2 present in the sample. If replication exceeds a cycle threshold (CT) score established by the laboratory the sample is determined to be positive for the SARS-CoV-2. The CT score is inversely related to the concentration of RNA in the sample.

- A CT score of less than 40 is considered positive.
- A positive CT score indicating that SARS-CoV-2 was present in an air sample will require NJIT to employ enhanced cleaning protocols, air filter replacement in the affected area, implement COVID-19 surveillance testing of the impacted population, and subsequent re-sampling of the area.

4) Waste water sampling

Waste water samples will be collected and analyzed on a weekly basis from each occupied dormitory building on the NJIT campus. Research has shown wastewater testing may result in identifying the virus in a population earlier than testing of individuals and may therefore be useful as an early warning screening tool that predicts potential cluster locations. Waste water sampling will be conducted using a GLS sampler and pump equipped with a suction tube and strainer placed into the waste water effluent stream exiting each dormitory building. Some sampling points are located inside the building at accessible building clean out traps while other sampling points are located outside the building at municipal sewer access points, depending on building configuration. Similar to the other environmental media, once sampling is complete, waste water samples are shipped to an independent laboratory for analysis. Samples are analyzed via a polymerase chain reaction (PCR) method. For waste water sampling, the log of the concentration of RNA per liter in a sample is a linear relationship with the number of cases in the community. In order to establish a target threshold of what constitutes a positive sample, NJIT conducted preliminary sampling to establish baseline criteria. All preliminary sampling has returned non detectible results. Therefore, similar to the air sampling and surface

sampling protocols, a cycle threshold (CT) score of less than 40 is considered positive. As additional sampling data is collected, there may be an opportunity to build a predictive model that can correlate the strength of the CT score results, the concentration of RNA in the waste water, and the number of cases in a building.

NJIT and our industrial hygiene consultants have developed risk-based response strategies that are based on the strength of the positive result expressed in CT values and virus concentration per liter of waste water.

The lower the CT value, the higher the virus concentration, the more stringent the response. We have established 4 risk levels: low, moderate, high, and extremely high. As the risk level increases the testing, isolation, and quarantine of building occupants, along with other mitigation strategies, similarly increase.

Each of the residence halls are tested weekly and lab results are returned in 1 day.

- Positive sample results, indicating elevated levels of virus in the sewer discharge, will require:
    - medical testing of building occupants to identify infected individuals;
    - enhanced cleaning and disinfection protocols;
    - quarantine of the impacted students in the specific dormitory; and
    - shifting converged learning to virtual learning for duration of isolation period.

- As the risk level associated with the sampling result increases, the strength of the risk-mitigation strategies described above will similarly increase.