1. **Title**: Environmental Monitoring for the Food, Beverage, and Natural Product Industry
2. **Form contents last revised date**: 11/03/2020
3. **Catalog/ website course description**: To assist the food, beverage and natural product manufacturing industry in understanding, developing, and implementing impactful and appropriate Environmental Monitoring Plans (EMPs).
4. **Course length**:
	1. 5 Lecture hours (includes 1 hr lunch break and 3-20/2-30 minute breaks)
	2. 3 Activity hours
	3. 8 total contact hours
5. **Student to Instructor/Technician ratio**: TBD
6. **Learning objectives**:
	1. Understand the purpose of an environmental monitoring program.
	2. Determine if an environmental monitoring program is necessary for your facility and, if so, how to develop and implement one.
	3. Recognize the importance of sanitation, sanitary facility design, and good personnel training and hygiene and how it all relates to a successful environmental monitoring program.
	4. Understand the importance of microbes, food-borne pathogens, allergens, and ATP in a manufacturing setting.
	5. Understand how environmental monitoring relates to public health and product quality and how it benefits your business.
	6. Identify different types of environmental monitoring tests and sampling.
	7. Interpret and organize data and monitor results.
7. **Target industry**: Food and beverage; Commercial and regulatory settings; wet or dry food production
8. **Primary audience**: Production associates, supervisors, quality team, management
9. **Portability?**: Class is mobile, location to be determined by BioNetwork FBNP Director and Customized Training Director
10. **Prerequisites, if applicable**: Participants should have a basic understanding of Food Safety, FDA regulations and Quality Control Concepts
11. **Instructor credentials or qualification requirements, if applicable**: N/A
12. **Standards and reference material**: N/A
13. **Suggested key terms**:
	1. Microorganisms, foodborne pathogens, indicator organisms, transient and resident organisms
	2. SOP (Standard Operating Procedure)
	3. Validation, verification
	4. Sanitary design, hygienic zoning, harborage sites
	5. Adenosine triphosphate (ATP), luminometer, ELISA, lateral flow devices, polymerase chain reaction (PCR)
	6. Corrections, corrective actions, record keeping, data analysis
14. **Description and objectives of student hands-on exercises**:
	1. Activity 1: Rank These Facilities
		1. Participants will be given a list of manufacturing facilities with short descriptions regarding what the companies make and some of their practices. They will then be asked to rank the facilities in order of who needs an environmental monitoring program the most to who needs one the least. This will help participants retain the information they’ve learned so far about why it’s important to have an EMP and which aspects of your product and/or facility are important to consider when determining whether or not their company needs an EMP.
	2. Activity 2: Facility Descriptions
		1. Participants will be given a sample EMP for a company that produces potato chips. They will use the example description to write a facility description of their own. Participants will be given the option to write a description for the facility they work in or will be able to choose from a list of pre-written examples. This will help participants begin to develop a plan of their own (if necessary) and will help them understand what information is important to include and how much work goes into developing a thorough EMP.
	3. Activity 3: Glo-Germ (This activity can be modified if class is to be taught in a virtual setting)
		1. Participants will be given instructions on how to apply glo-germ to a specific piece of equipment and then will be asked to move the object around the room and among people. We will then use a blacklight to track the movement of the “germs”. This will build interest for the upcoming information about sanitation, hygiene, and microbes and will demonstrate their importance. It will also demonstrate how important these concepts are and how easily things spread, even when we can’t see them.
	4. Activity 4: Using a Luminometer (This activity can be modified if class is to be taught in a virtual setting)
		1. Participants will be given detailed instructions on how to swab and use the Hygiena luminometer. They will then be allowed to choose a location in the training room to swab and test for ATP residues. We will also execute a test before and after their company’s sanitation procedure to determine whether or not the process and application was successful. This activity will demonstrate the importance of an effective sanitation program and will help participants learn proper swabbing technique.
	5. Activity 5: ELISA Test (This activity can be modified if class is to be taught in a virtual setting)
		1. Participants will observe an ELISA-based allergen environmental monitoring technique/test. This will enhance the importance of preventing allergen cross-contamination and will help the participants understand different types of allergen tests that are available and how simple it is to use the specific application we’ve chosen to demonstrate.
	6. Activity 6: Data Interpretation
		1. Participants will be given a spreadsheet containing different types of environmental monitoring data. Using what they’ve learned so far, they will be asked to identify potentially concerning data, will learn about problems commonly associated with records, and will help them learn how to identify trends as well as how to interpret data.
	7. Activity 7: Facility Layout
		1. Participants will be given the “bones” of a food manufacturing facility and will be asked to arrange the items they’re given in a way the incorporates what they’ve learned about the importance of sanitary design and flow.
	8. Activity 8: Hygienic Zoning
		1. Participants will be given the layout of a potato chip manufacturing company. As a group, they will be asked to identify zones 1, 2, 3, and 4 based on what they’ve learned about hygienic zoning so far and will be asked to identify the best flow of traffic with regards to people, materials, products, visitors, etc.
15. **Text and supplies needed**:
	1. Powerpoint slides (with notes section) workbook for each participant
	2. Activity Workbook for each participant
	3. Glo-Germ Kit
	4. Hygiena Luminometer
		1. Hygiena swabs
		2. Cooler for housing swabs
	5. Neogen Reveal Elisa Allergen tests
		1. Sanitation equipment (sanitizer spray, gloves, paper towels)
	6. Facility Layout laminated activity
16. **Outline**:
17. Introduction
	1. Agenda, schedule, ice breaker
	2. Objectives & introduction to the topic of environmental monitoring
18. Why should food manufacturing facilities have an environmental monitoring program?
	1. Validation of sanitation plan, food safety
	2. Pathogen control
	3. Is an environmental monitoring program necessary for your facility?
	4. Activity 1: Rank These Facilities
19. Developing an environmental monitoring program
	1. Activity 2: Facility Description
20. Implementing an environmental monitoring program
	1. Create a team
	2. Evaluate your facility and products
	3. Establish a baseline
	4. Establish a verification program
	5. Reevaluate as necessary
21. Sanitary facility design
	1. Activity 3: Glo-Germ (This activity can be modified if class is to be taught in a virtual setting)
22. Personnel & Training
	1. Hygiene
	2. Swabbing technique
23. What are we testing for?
	1. Pathogens
		1. Introduction
		2. Indicator organisms
			1. E. coli
			2. Listeria monocytogenes
		3. Transient & Resident organisms
	2. ATP
		1. Introduction
		2. How to test for it and how does it work?
		3. Activity 4: Using a Luminometer (This activity can be modified if class is to be taught in a virtual setting)
	3. Allergens
		1. ELISA tests
		2. Activity 5: ELISA Test (This activity can be modified if class is to be taught in a virtual setting)
	4. Spoilage Organisms
		1. Testing methods
24. Tracking and trending data
	1. Tracking data
	2. Mapping
	3. Analysis
	4. Activity 6: Data Interpretation
25. Benefits of a good EMP
	1. Outbreak Prevention
	2. Verification of sanitation program
	3. Early warning system and hot spot identification
26. Facility Considerations
	1. Infrastructure
	2. Design
	3. Traffic Flow
		1. Mapping
		2. Hygienic Zoning
	4. Air & Water Flow
	5. Activity 7: Facility Layout
	6. Activity 8: Hygienic Zoning
27. Tools & Timing Considerations
	1. Equipment and tools
	2. Timing recommendations
28. Results and Record Keeping
	1. Results and record keeping
	2. Corrections and corrective actions
	3. Reportable food registry
29. Validation
	1. Validation and validation of sanitation program
	2. Verification
30. Reviewing your Environmental Monitoring Program
31. Summary and Conclusion