National Fire Academy

N0233 – Chemical Hazard Analysis for Risk-Based Response
Version: 1st Edition, 1st Printing, May 2024
Quarter:
ACE Credit:
IACET Continuing Education Units:

Length of Course: 9 Days (58 hr., 50 min., Monday – Friday; Monday – Thursday)
Prerequisite: Yes
Curriculum: Hazardous Materials
Training Specialist: Dave Donohue
Instructor:
Instructor email/phone:
Classroom: J-
Meeting Time: 8 AM – 5 PM

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Course Description (Catalog)

N0233 – "Chemical Hazard Analysis for Risk-Based Response." This nine-day course is designed to prepare responders, planners and allied professionals with the knowledge and skills needed to analyze hazardous materials/weapons of mass destruction (WMD) incidents using the risk-based response (RBR) process that utilizes facts, science and circumstances. Primarily focused on the product involved, this analysis will also incorporate information concerning the container, environment and cause. This course supports response personnel and allied professionals seeking specialized training in advanced chemical risk assessment and analysis. The student will be able to effectively communicate the hazards and associated harm identified in a timely and concise manner to make recommendations concerning control zones, personal protective equipment (PPE) and decontamination methods to develop a safer RBR.

Through an interactive, student-centered approach, students will conduct a product hazard analysis and create communication strategies by:

- Conducting an initial product hazard analysis for multiple products using limited information.
- Using the periodic table to identify the general hazards associated with a material for developing an initial product hazard analysis.
- Conducting briefings based on their hazard analysis for hazardous materials/WMD incidents.
- Analyzing the characteristics of molecular size, polarity and shape and how these affect the physical and chemical properties of a material.
- Conducting a product hazard analysis to support an RBR process in a hazard situation.

Student Qualifications (Primary and Secondary Audience)

The target audience for this course is emergency responders and allied professionals who are responsible for preventing, preparing for, responding to, mitigating and/or recovering from hazardous materials/WMD incidents.

This curriculum is aligned with National Fire Protection Association (NFPA) 470, *Hazardous Materials/Weapons of Mass Destruction (WMD) Standard for Responders*, 2022 edition.

Course Scope (Goal)

Upon successful completion of this course, students will be able to conduct a comprehensive product hazard analysis based on the facts, science and circumstances of a hazardous materials/WMD incident. The purpose of this product hazard analysis is to identify the hazards and associated harms and to communicate those hazards to protect responders, the public and the environment through planning and preparedness, using an RBR process.

Course Objectives (Course Learning Outcomes – TLOs)

After successfully completing this course, you will be able to accomplish the following:

- Conduct an initial product hazard analysis for multiple products with limited information.
- Use the periodic table to identify elements that may be encountered in incident response.
- Conduct a hazard analysis for an incident involving a salt compound.
- Justify scene control, detection, personal protective equipment (PPE) and decontamination considerations, given a scenario involving an inorganic nonsalt compound.
- Justify scene control, detection, personal protective equipment (PPE) and decontamination considerations, given a scenario involving hydrocarbon families.

- Justify scene control, detection, personal protective equipment (PPE) and decontamination considerations, given a scenario involving hydrocarbon derivatives.
- Develop response objectives for products that exist as gases in their ambient state.
- Summarize the significance of terms related to flammability and combustion in determining response objectives.
- Determine protective measures based on an analysis of the hazards of ionizing radiation.
- Create response objectives based on a hazard analysis of an incident involving corrosive materials.
- Analyze the hazards of products classified as oxidizers or reactive materials.
- Conduct a briefing concerning the hazards of a substance involved in an incident with a focus on the toxicity consideration that is appropriate for the target audience.
- Analyze chemical information in an accurate and timely manner in order to determine the hazards and the relative severity of the hazards of the given compounds.

Course Delivery Method

The National Fire Academy (NFA) offers specialized training courses and advanced management programs of national impact in an academic classroom environment on campus at the National Emergency Training Center (NETC) in Emmitsburg, Maryland and through their State, local, tribal, and US territories training partners. All course materials are designed for interactive classroom environments, in either paper notebook or electronic formats.

Course Schedule

The purpose of the course schedule is to give you, at a glance, the required preparation, activities, and evaluation components of your course.

DAY 1	DAY 2
Introduction, Welcome and Administrative	Day 1 review Learning Checkpoints (Unit 1 and 2)
Break	*Break*
Introduction (cont'd) Unit 1: Product Hazard Analysis and Risk-Based Response Activity 1.1, Part 1: Pre-course Review: Essential Terms Activity 1.1, Part 2: Pre-course Review: Physical and Chemical Properties	Unit 3: Salts (cont'd) Activity 3.3: Hydroxide, Peroxide and Cyanide Salts Activity 3.4: Oxysalts
Break	*Break*
Unit 1: Product Hazard Analysis and Risk-Based Response (cont'd) Unit 2: The Periodic Table and Atomic Structure	Unit 3: Salts (cont'd) Activity 3.5: Identifying Salts and Their Hazards Activity 3.6: Analyzing Salt Hazards
Lunch Break	*Lunch Break*
Unit 2: The Periodic Table and Atomic Structure (cont'd)	Unit 3: Salts (cont'd) Activity 3.6: Analyzing Salt Hazards (cont'd)
Break	*Break*
Unit 2: The Periodic Table and Atomic Structure (cont'd) Activity 2.1: The 40 Common Elements Unit 3: Salts Activity 3.1: Getting to Know the Salts	Unit 4: Inorganic Nonsalts Activity 4.1: Getting to Know the Inorganic Nonsalts
Break	*Break*
Unit 3: Salts (cont'd) Activity 3.2: Binary Salts	Unit 4: Inorganic Nonsalts (cont'd) Activity 4.2: Hazards of Inorganic Nonsalts
Wrap-up/parking lot review	Wrap-up/parking lot review
Orientation to Chemical Reference Databases. Complete Activity 2.1 and any worksheets not completed in class.	Complete worksheets not completed in class. Complete chemical family summary worksheets (optional).

Note: This schedule is subject to modification by the instructors and approved by the training specialist.

DAY 3	DAY 4
Day 2 review Learning Checkpoint (Unit 3) Unit 4: Inorganic Nonsalts (cont'd) Activity 4.3: Identifying Inorganic Nonsalts and Their Hazards	Day 3 review Learning Checkpoints (Unit 4 and 5) Unit 6: Hydrocarbon Derivatives (cont'd) Activity 6.1: Functional Group Recognition Activity 6.2: Halogenated Hydrocarbons
Break	*Break*
Unit 5: Hydrocarbons and Hydrocarbon Radicals Activity 5.1: Getting to Know the Hydrocarbons	Unit 6: Hydrocarbon Derivatives (cont'd) Activity 6.3: Nitrogen Compounds
Lunch Break	*Lunch Break*
Unit 5: Hydrocarbons and Hydrocarbon Radicals (cont'd) Activity 5.2: Review of Hydrocarbon Families Activity 5.3: Hydrocarbon Radicals and International Union of Pure and Applied Chemistry Naming	Unit 6: Hydrocarbon Derivatives (cont'd) Activity 6.4: Oxygen-Based Compounds and Sulfur Compounds
Break	*Break*
Activity 5.4: Analyzing Hydrocarbon Hazards Unit 5: Hydrocarbons and Hydrocarbon Radicals (cont'd)	Unit 6: Hydrocarbon Derivatives (cont'd) Activity 6.5: Alcohols, Ketones, Aldehydes, Organic Acids and Esters
Break	*Break*
Unit 6: Hydrocarbon Derivatives	Unit 6: Hydrocarbon Derivatives (cont'd) Activity 6.6: All Hydrocarbon Derivative Families Activity 6.7: Product Hazard Analysis
Wrap-up/parking lot review	Wrap-up/parking lot review
Complete worksheets not completed in class. Complete chemical family summary worksheets (optional).	Complete Activity 6.6 and any worksheets not completed in class. Complete chemical family summary worksheets (optional).

<table>
<tr><th>DAY 5</th><th>DAY 6</th></tr>
<tr><td>Day 4 review

Unit 6: Hydrocarbon Derivatives (cont’d)

Activity 6.7: Product Hazard Analysis (cont’d)

Activity 6.8: Hydrocarbon Derivative Incident Scenarios</td><td>Week 1 review</td></tr>
<tr><td>Break</td><td>Break</td></tr>
<tr><td>Unit 6: Hydrocarbon Derivatives (cont’d)

Activity 6.8: Hydrocarbon Derivative Incident Scenarios (cont’d)</td><td>Midterm Exam</td></tr>
<tr><td>Lunch Break</td><td>Break</td></tr>
<tr><td>Learning Checkpoint (Unit 6)

Unit 7: Gases

Activity 7.1: Gases Terminology</td><td>Unit 8: Flammability and Combustion</td></tr>
<tr><td>Break</td><td>Lunch Break</td></tr>
<tr><td>Unit 7: Gases (cont’d)

Activity 7.2: Determining Control Zones and Personal Protective Equipment

Learning Checkpoint (Unit 7)</td><td>Unit 8: Flammability and Combustion (cont’d)

Activity 8.1: Variables Affecting Flammability</td></tr>
<tr><td>Wrap-up/parking lot review</td><td>Break</td></tr>
<tr><td rowspan="3">Complete worksheets not completed in class.

Complete chemical family summary worksheets (optional).</td><td>Unit 8: Flammability and Combustion (cont’d)

Activity 8.2: Effect of Size, Polarity and Shape on Physical and Chemical Properties

Unit 9: Radioactivity</td></tr>
<tr><td>Wrap-up/parking lot review</td></tr>
<tr><td>Complete worksheets not completed in class.</td></tr>
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DAY 7	DAY 8
Day 6 review Learning Checkpoint (Unit 8) Unit 9: Radioactivity (cont'd) Activity 9.1: Radioactive Isotopes	Day 7 review Learning Checkpoints (Unit 9, 10 and 11) Unit 12: Toxicity and Chemical Agents (cont'd)
Break	*Break*
Unit 9: Radioactivity (cont'd) Unit 10: Corrosives Activity 10.1: Corrosives Definitions	Unit 12: Toxicity and Chemical Agents (cont'd)
Lunch Break	*Break*
Unit 10: Corrosives Activity 10.2: Corrosive Product Analysis and Neutralization Calculations	Unit 12: Toxicity and Chemical Agents (cont'd) Activity 12.2: Analysis of Toxicity Considerations
Break	*Lunch Break*
Unit 11: Oxidizers and Reactive Materials Activity 11.1: Analyzing Hazards of Oxidizers and Reactive Materials	Unit 13: Comprehensive Hazard Analysis Activity 13.1: The 50 Chemical Activity
Break	*Break*
Unit 12: Toxicity and Chemical Agents Activity 12.1: Toxicity Terminology	Unit 13: Comprehensive Hazard Analysis (cont'd) Activity 13.1: The 50 Chemical Activity (cont'd)
Wrap-up/parking lot review	*Break*
Complete worksheets not completed in class.	Activity 13.2: Hazard Analysis Briefing to Hazardous Materials Leadership
	Wrap-up/parking lot review
	Complete worksheets if not completed in class. Group Work on Activity 13.2 Study for Final Exam

DAY 9
Day 8 review Learning Checkpoint (Unit 12)
Break
Unit 13: Comprehensive Hazard Analysis (cont'd) Activity 13.2: Hazard Analysis Briefing to Hazardous Materials Leadership (cont'd)
Lunch Break
Unit 13: Comprehensive Hazard Analysis (cont'd) Activity 13.2: Hazard Analysis Briefing to Hazardous Materials Leadership (cont'd)
Break
Final Exam End of course/certificates

Course Resources (Instructional Materials)

In order to be fully prepared, obtain a copy of the required textbooks and other instructional materials prior to the first day of class.

Required Readings

The student must complete required readings during the course to be able to thoughtfully participate in discussions and activities.

None.

Suggested Reading/Resources

Suggested readings and resources are not evaluated, but may enhance the student's understanding, serve as additional sources for citation and promote discussion of course material.

None.

Required Resources (Course Textbook)

Student Manual.

Supplemental Resources (Supplemental Course Textbook)

None.

Grading Methodology (Evaluation Procedures)

Evaluation Plan Summary

Each unit in the course has enabling objectives that build to the unit terminal objective. The unit terminal objectives are directly related to the course goal. Each enabling objective is evaluated on the two tests (the midterm and final exam) and/or a graded performance-based activity.

Students are also provided with a Learning Checkpoint for each unit. These checkpoints are self-administered and self-graded so that students have a tool to measure their progress. These student checkpoints are **not** calculated into the final grade.

Students who do not complete the entire course will be awarded an incomplete (I) grade. In accordance with NFA academic policies, an incomplete (I) grade must be removed by the end of the next semester following the course, or it automatically becomes a failing (F) grade.

If a student fails an on-campus course, the student will not be issued a stipend for that course. The student can reapply for the failed course, or any other NFA course, and go through the

random selection process. The student does not have to successfully complete the failed course before attending another NFA course.

https://www.usfa.fema.gov/nfa/admissions/attendance-failure.html.

Graded Components

Students are evaluated on two primary graded components: written exams and activities. These components are weighted as follows.

Evaluated Component	Weight
Midterm Exam and Final Exam (20% each)	40%
Graded Activities (see below)	60%
Total	100%

Graded Activities:

- Activity 4.2: Hazards of Inorganic Nonsalts (10% of final grade).
- Activity 6.8: Hydrocarbon Derivative Incident Scenarios (15% of final grade).
- Activity 12.2: Analysis of Toxicity Considerations (15% of final grade).
- Activity 13.2: Hazard Analysis Briefing to Hazardous Materials Leadership (20% of final grade).

EXAMINATION ADMINISTRATION PROCEDURES

Students will be given exams at the end of the class, and only the instructor will grade the exams. While the exams are being graded by the instructor, students will be asked to complete end-of-course evaluations.

Exams are to be completed individually and not as a group or a group activity, unless specifically directed within the instructor guide for the specific course. Students should use pencils to complete answer sheets if bubble sheets and a scoring key overlay are being used.

There should only be one answer for any given question marked by the student. A question with multiple answers is considered incorrect. Please mark number of incorrect answers on completed exam sheets, record score (percentage), and mark the appropriate letter grade.

Transfer the letter grades to the corresponding student name on the course roster.

If a student does not obtain a passing grade on the first attempt, the instructor will provide remediation[1] prior to a retest. Students who do no pass the first exam will be allowed to take one retest of a new exam before departing from the class. A second failure will result in a grade of "F" being recorded on the grade roster.

Once all exams have been graded, instructors should review the exam as a group.

In the event of unusual events (storm, fire response, family emergency) or early departure, the host agency or state representative may be asked to proctor the exam at a later date. The instructor is responsible to notify the Training Specialist as soon as practical of the situation and name of person responsible for the exams and testing process.

Course Outline

Introduction

Objectives

None.

Unit 1: Product Hazard Analysis and Risk-Based Response

Objectives

Terminal Objective

The students will be able to:

1.1 Conduct an initial product hazard analysis for multiple products with limited information.

Enabling Objectives

The students will be able to:

1.1 Identify the importance of physical and chemical terminology to the product hazard analysis.

1.2 Define risk-based response (RBR), as defined by National Fire Protection Association (NFPA) 470, *Hazardous Materials/Weapons of Mass Destruction (WMD) Standard for Responders*.

1.3 Define the four considerations in an RBR.

1.4 Describe the six evaluation points used to conduct an initial product hazard analysis.

Unit 2: The Periodic Table and Atomic Structure

Objectives

Terminal Objective

The students will be able to:

2.1 Use the periodic table to identify elements that may be encountered in incident response.

Enabling Objectives

The students will be able to:

2.1 Identify the element, symbol, family, parts, location, charges and weights of an atom.

2.2 Define an isotope.

2.3 Identify the impact of the Duet and Octet rules.

2.4 Identify the two types of bonding.

2.5 Identify the general characteristics of salts and nonsalts.

2.6 Identify potential hazards of selected elements on the periodic table.

Unit 3: Salts

Objectives

Terminal Objective

The students will be able to:

3.1 Conduct a hazard analysis for an incident involving a salt compound.

Enabling Objectives

The students will be able to:

3.1 Identify the hazards of binary salt, hydroxide salt, cyanide salt, peroxide salt, oxysalt and salts containing the ammonium cation, given the name or formula.

3.2 Identify the types of salts and associated hazards, given a scenario involving salt compounds.

Unit 4: Inorganic Nonsalts

Objectives

Terminal Objective

The students will be able to:

4.1 Justify scene control, detection, personal protective equipment (PPE) and decontamination considerations, given a scenario involving an inorganic nonsalt compound.

Enabling Objectives

The students will be able to:

4.1 Analyze a name or a formula to identify the families of inorganic nonsalt compounds and their hazards.

4.2 Recommend scene control, detection, PPE and decontamination considerations based on a product hazard analysis for an incident involving an inorganic nonsalt compound.

Unit 5: Hydrocarbons and Hydrocarbon Radicals

Objectives

Terminal Objective

The students will be able to:

5.1 Justify scene control, detection, personal protective equipment (PPE) and decontamination considerations, given a scenario involving hydrocarbon families.

Enabling Objectives

The students will be able to:

5.1 Analyze a name or formula to identify the hydrocarbon family and associated hazards.

5.2 Identify hydrocarbon radicals, given a name or formula.

Unit 6: Hydrocarbon Derivatives

Objectives

Terminal Objective

The students will be able to:

6.1 Justify scene control, detection, personal protective equipment (PPE) and decontamination considerations, given a scenario involving hydrocarbon derivatives.

Enabling Objectives

The students will be able to:

6.1 Identify the functional group within the compound.

6.2 Define hydrogen bonding and polarity.

6.3 Analyze a name or formula to identify the hydrocarbon derivative family and associated hazards.

6.4 Demonstrate the basics of communicating the hazards of the product.

6.5 Conduct a hazard analysis for an incident involving hydrocarbon derivatives.

Unit 7: Gases

Objectives

Terminal Objective

The student will be able to:

7.1 Develop response objectives for products that exist as gases in their ambient state.

Enabling Objectives

The students will be able to:

7.1 Identify the laws and physical properties of gases.

7.2 Differentiate between compressed gases, liquefied compressed gases and cryogenic liquids.

7.3 Conduct a product hazard analysis for an incident involving a gas.

7.4 Determine recommended control zones and personal protective equipment (PPE) requirements.

Unit 8: Flammability and Combustion

Objectives

Terminal Objective

The students will be able to:

8.1 Summarize the significance of terms related to flammability and combustion in determining response objectives.

Enabling Objectives

The students will be able to:

8.1 Identify how physical and chemical properties affect the degree of flammability or combustibility.

8.2 Analyze the effects of molecular size, polarity and shape on vapor pressure (Vp), flash point (Fp), boiling point (Bp), vapor concentration/content (Vc), vapor density (Vd) and heat output.

8.3 Identify the chemical families that may have energetic properties.

Unit 9: Radioactivity

Objectives

Terminal Objective

The students will be able to:

9.1 Determine protective measures based on an analysis of the hazards of ionizing radiation.

Enabling Objectives

The students will be able to:

9.1 Identify isotopes and radioactive elements.

9.2 Identify three common forms of ionizing radiation.

9.3 Compare and contrast the units of measure of ionizing radiation.

9.4 Apply the concepts of safety for ionizing radiation.

Unit 10: Corrosives

Objectives

Terminal Objective

The students will be able to:

10.1 Create response objectives based on a hazard analysis of an incident involving corrosive materials.

Enabling Objectives

The students will be able to:

10.1 Define terms related to corrosivity (pH, strength, concentration, acid, base, neutralization).

10.2 Determine the type and amount of neutralization materials required.

Unit 11: Oxidizers and Reactive Materials

Objectives

Terminal Objective

The students will be able to:

11.1 Analyze the hazards of products classified as oxidizers or reactive materials.

Enabling Objectives

The students will be able to:

11.1 Create response objectives based on a hazard analysis of oxidizers and reactive materials.

11.2 Determine protective measures for an incident involving oxidizers and reactive materials.

Unit 12: Toxicity and Chemical Agents

Objectives

Terminal Objective

The students will be able to:

12.1 Conduct a briefing concerning the hazards of a substance involved in an incident with a focus on the toxicity consideration that is appropriate for the target audience.

Enabling Objectives

The students will be able to:

12.1 Identify terms important to the evaluation of the toxicity of products.

12.2 Analyze the toxicity of various chemical families and chemical agents.

12.3 Develop response objectives for an incident involving potentially toxic products.

Unit 13: Comprehensive Hazard Analysis

Objectives

Terminal Objective

The students will be able to:

13.1 Analyze chemical information in an accurate and timely manner in order to determine the hazards and the relative severity of the hazards of the given compounds.

Enabling Objectives

The students will be able to:

13.1 Predict physical and chemical properties of a compound based on knowledge of the chemical composition, chemical family and hazards associated with the chemical compound.

13.2 Predict hazards posed by various compounds.

13.3 Prioritize severity of hazards.

13.4 Present a clear, concise and accurate summary of hazard analysis information to a technical audience.

Policies

Class Attendance and Cancellation Policy

Attendance

- You are required to attend all sessions of the course. If you do not, you may not receive a certificate.

- If you need to depart the training facility early and miss any portion of the course, you must make the request in writing to the sponsoring agency (e.g., State training director, etc.). The State training director may waive the attendance requirement in order to accommodate you with extraordinary circumstances as long as you complete all course requirements.

Course Failure

You can reapply for the failed course or any other NFA course and go through the random selection process. You don't have to successfully complete the failed course before attending another NFA course.

Student Code of Conduct Policy

Students, instructors and staff are expected to treat each other with respect at all times. Inappropriate behavior will not be tolerated.

Writing Expectations

Student writing will conform to the generally accepted academic standards for college papers. Papers will reflect the original work of the student and give appropriate credit through citations for ideas belonging to other authors, publications or organizations. Student written work should be free of grammatical and syntax errors, free of profanity or obscene language or ideas, and reflect critical thinking related to the course subject matter.

Citation and Reference Style

Attention Please: Students will follow the APA, Sixth Edition as the sole citation and reference style used in written work submitted as part of coursework to NFA. Assignments completed in a narrative essay, composition format, abstract, and discussion posts must follow the citation style cited in the APA, Sixth Edition.

Late Assignments

All assignments must be turned in by the established deadline. Late submissions could result in a 10 percent decrease in grade.

Disclaimer Statement

Course content may vary from the outline to meet the needs of this particular group.

Grading

Please review the following rubrics that explain how grades will be awarded.

Students who do not complete the entire course will be awarded an Incomplete (I) grade. In accordance with National Fire Academy academic policies, an Incomplete (I) grade must be removed by the end of the next semester following the course, or it automatically becomes a Failing (F) grade.

https://www.usfa.fema.gov/training/nfa/admissions/student_policies.html

Academic Honesty

Students are expected to exhibit exemplary ethical behavior and conduct as part of the NFA community and society as a whole. Acts of academic dishonesty including cheating, plagiarism, deliberate falsification, and other unethical behaviors will not be tolerated.

Students are expected to report academic misconduct when they witness a violation. All cases of academic misconduct shall be reported by the instructor to the State training director or host agency and to the NFA Training Specialist.

If a student is found to have engaged in misconduct and the allegations are upheld, the penalties may include, but are not limited to one or a combination of the following:

- expulsion,
- exclusion from future classes for a specified period; depending on the severity it could range from 1-10 years, and/or
- forfeiture of certificate for course(s) enrolled in at NETC.

Refer to NFA-specific Standard Operating Procedure 700.1 – *Academic Code of Conduct and Ethics* for more information.

Grading Rubrics

Activity 4.2: Hazards of Inorganic Nonsalts (10% of final grade)

Assessment area	Needs improvement (1)	Below expectations (2)	Meets expectations (3)	Exceeds expectations (4)	Points
Hazard analysis Did the group accurately identify decision-making related to the potential hazards based on analysis of the information given?	The group failed to identify two or more potential hazards affecting decision-making.	The group analyzed the scenario and the product involved, did not provide accurate technical data, identified most hazards correctly, but did not provide appropriate decisions.	The group analyzed the scenario and the product involved, presented accurate technical data, and accurately identified all hazards present at the scene described in their scenario, but were unable to defend their rationale for their decision-making.	The group analyzed the scenario and the product involved, estimated the potential hazards accurately, and made sound decisions related to the incident considerations and the severity of the hazards.	____/4 x2 = ____/8
Communication of hazards Did the group present a clear, concise and accurate summary of hazard analysis information appropriate to their audience? Could group members answer questions posed by their audience regarding the chemicals and their hazards clearly and concisely?	Communication was not clear. Information was not well organized. Group members were unable to answer questions.	Information was somewhat organized, but contained some inaccuracies, exaggerations or excessive technical jargon, making details of the presentation inaccessible to their audience. Group members were able to answer some questions when asked by instructor or other students.	Information was very well organized. Group members were able to answer most questions posed by instructor and other students.	The group analyzed the scenario and the chemicals involved, estimated the potential hazards accurately, and made sound decisions related to the prioritization of the severity of the hazards.	____/4 x2 = ____/8
Group collaboration Did group members contribute equally? Did group members effectively collaborate to achieve group objectives?	One or two members of the group did all the work. Some refused to participate or were not allowed to help.	One or two members of the group didn't help complete tasks. Group was constantly covering for group members or not encouraging them to participate. Most members presented.	All group members worked on their own assignments. No one did more work than anyone else. Some communication, but mostly worked separately. All members presented.	All group members worked on their assignments, but also collaborated frequently. Clear connection and communication between the group members. All members presented.	____/4
				Total points:	**____/20**

Assessment area	Needs improvement (1)	Below expectations (2)	Meets expectations (3)	Exceeds expectations (4)	Points
Incident consideration Did the group accurately identify decision-making related to the potential hazards based on analysis of the information given?	The group failed to identify potential hazards affecting decision-making.	The group analyzed the scenario and the product involved, did not provide accurate technical data, identified most hazards correctly, but did not provide appropriate decisions.	The group analyzed the scenario and the product involved, presented accurate technical data, and accurately identified all hazards present at the scene described in their scenario, but were unable to defend their rationale for their decision-making.	The group analyzed the scenario and the product involved, estimated the potential hazards accurately, and made sound decisions related to the incident considerations for the severity of the hazards.	____/4 x2 = ____/8
Presentation Did the group present a clear, concise and accurate summary of hazard analysis information appropriate to their audience? Could group members answer questions posed by their audience regarding the chemicals and their hazards clearly and concisely?	Presentation was not clear. Information was not well organized. Group members were unable to answer questions.	Information was somewhat organized, but contained some inaccuracies, exaggerations or excessive technical jargon, making details of the presentation inaccessible to their audience. Group members were able to answer some questions when asked by instructors or other students.	Information was very well organized and mostly clear, concise and accurate. Group members were able to answer most questions posed by instructors and other students.	Information was exceptionally well organized, clear, concise and accurate. Group members were able to answer all questions posed by instructors and other students.	____/4 x2 = ____/8
Group collaboration Did group members contribute equally? Did group members effectively collaborate to achieve group objectives?	One or two members of the group did all the work. Some refused to participate or were not allowed to help.	One or two members of the group didn't help complete tasks. Group was constantly covering for group members or not encouraging them to participate. Most members presented.	All group members worked on their own assignments. No one did more work than anyone else. Some communication was evident, but the group mostly worked separately. All members presented.	All group members worked on their assignments, but also collaborated frequently. Clear connection and communication between the group members was evident. All members presented.	____/4
				Total points:	**____/20**

Activity 12.2: Analysis of Toxicity Considerations (15% of final grade)

Assessment area	Needs improvement (1)	Below expectations (2)	Meets expectations (3)	Exceeds expectations (4)	Points
Incident consideration Did the group accurately identify decision-making related to the potential hazards based on analysis of the information given?	The group failed to identify potential hazards affecting decision-making.	The group analyzed the scenario and the product involved, did not provide accurate technical data, identified most hazards correctly, but did not provide appropriate decisions.	The group analyzed the scenario and the product involved, presented accurate technical data, and accurately identified all hazards present at the scene described in their scenario, but were unable to defend their rationale for their decision-making.	The group analyzed the scenario and the product involved, estimated the potential hazards accurately, and made sound decisions related to the incident considerations for the severity of the hazards.	____/4 x2 = ____/8
Presentation Did the group present a clear, concise and accurate summary of hazard analysis information appropriate to their audience? Could group members answer questions posed by their audience regarding the chemicals and their hazards clearly and concisely?	Presentation was not clear. Information was not well organized. Group members were unable to answer questions.	Information was somewhat organized, but contained some inaccuracies, exaggerations or excessive technical jargon, making details of the presentation inaccessible to their audience. Group members were able to answer some questions when asked by instructors or other students.	Information was very well organized and mostly clear, concise and accurate. Group members were able to answer most questions posed by instructors and other students.	Information was exceptionally well organized, clear, concise and accurate. Group members were able to answer all questions posed by instructors and other students.	____/4 x2 = ____/8
Group collaboration Did group members contribute equally? Did group members effectively collaborate to achieve group objectives?	One or two members of the group did all the work. Some refused to participate or were not allowed to help.	One or two members of the group didn't help complete tasks. Group was constantly covering for group members or not encouraging them to participate. Most members presented.	All group members worked on their own assignments. No one did more work than anyone else. Some communication was evident, but the group mostly worked separately. All members presented.	All group members worked on their assignments, but also collaborated frequently. Clear connection and communication between the group members was evident. All members presented.	____/4
				Total points:	**____/20**

Assessment area	Needs improvement (1)	Below expectations (2)	Meets expectations (3)	Exceeds expectations (4)	Points
Hazard analysis Did the group accurately identify and prioritize potential hazards based on analysis of the information given?	The group failed to identify two or more potential hazards.	The group analyzed the scenario and the chemicals involved, provided accurate technical data, and identified most hazards correctly.	The group analyzed the scenario and the chemicals involved, presented accurate technical data, and accurately identified all hazards present at the scene described in their scenario, but were unable to defend their rationale for prioritization of the relative severity of hazards.	The group analyzed the scenario and the chemicals involved, estimated the potential hazards accurately, and made sound decisions related to the prioritization of the severity of the hazards.	____/4 x2 = ____/8
Presentation Did the group present a clear, concise and accurate summary of hazard analysis information appropriate to their audience? Could group members answer questions posed by their audience regarding the chemicals and their hazards clearly and concisely?	Presentation was not clear. Information was not well organized. Group members were unable to answer questions.	Information was somewhat organized, but contained some inaccuracies, exaggerations or excessive technical jargon, making details of the presentation inaccessible to their audience. Group members were able to answer some questions when asked by instructors or other students.	Information was very well organized and mostly clear, concise and accurate. Group members were able to answer most questions posed by instructors and other students.	Information was exceptionally well organized, clear, concise and accurate. Group members were able to answer all questions posed by instructors and other students.	____/4 x2 = ____/8
Group collaboration Did group members contribute equally? Did group members effectively collaborate to achieve group objectives?	One or two members of the group did all the work. Some refused to participate or were not allowed to help.	One or two members of the group didn't help complete tasks. Group was constantly covering for group members or not encouraging them to participate. Most members presented.	All group members worked on their own assignments. No one did more work than anyone else. Some communication was evident, but the group mostly worked separately. All members presented.	All group members worked on their assignments, but also collaborated frequently. Clear connection and communication between the group members was evident. All members presented.	____/4
				Total points:	**____/20**