

Incorporating chemical safety awareness as a general education requirement — Case study

An activity was added to the General Chemistry Laboratory to assess environmental awareness associated with the use of everyday consumer products. The activity promoted the reading and understanding of label information for different types of consumer products and helped students review information from a safety data sheet. The activity included the use of a mini-hazard analysis. As this is a case study of its initial implementation, the initial results have indicated that the students are better prepared for subsequent safety discussions of individual laboratories due to the timing of the activity at the beginning of the semester, and subsequent use of the skills developed. Student evaluations indicated that they increased their reading of labels and other information associated with the products they used.

By Frankie Wood-Black

INTRODUCTION

As part of the overall general education assessment for Northern Oklahoma College, the five-year strategic planning and assessment committees opted to highlight and follow student success related to cultural, societal, and environmental awareness. Each Division throughout the institution was required to measure and assess some aspect of how their programs and courses promoted general education competencies in these areas. Specifically, for this purpose, environmental awareness is broadly defined by focusing on aspects where the subject matter affects or influences cultural and societal issues thus environmental issues are not just strictly associated with environmental regulations but could focus on economic conditions, access to health care, or the safe and proper handling of chemicals. Activities for assessment were selected by

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each Division as the material related to the subject matter. For example, some courses added assignments specifically designed to have students read and report on aspects of environmental policy, reading items related to regulatory impacts, incorporating environmental and social topics into the oral communications courses.

In the science related Divisions, incorporation of new topics or focuses were not necessarily required, for example, the course in environmental science was directly on topic, and there had already been units relating environmental factors to various aspects of general biology. However, as general chemistry is considered a general education course for many degrees, the chemistry faculty had to select a specific topic or assignment to focus upon for the general data collection.

After much discussion, the faculty chose to focus on an increased awareness of chemicals and potential hazards associated with materials that students commonly use in their everyday lives. Chemicals, the proper and safe use, and handling, impact how various industries, and products are perceived. Additionally, a lack of understanding of the materials that are used daily by students could have potential harm to themselves and the

environment. Hence the focus presented by the chemistry faculty on this assignment as an assessment activity.

The purpose of the assignment was to have students read the labels, and safety information easily available on many consumer products as a means of promoting safety awareness and minimizing potential hazards associated with improper use or storage of the materials. It was believed that if students were required to read the labels and obtain specific safety information related to the materials commonly used that the students would have an increased awareness of the potential hazards and learn how to access information related to the proper use, storage, and other safety information provided by the manufacturers. Additionally, as part of the instruction, students would be introduced to the concepts of risk, hazards, and a hazard analysis process. The assignment was incorporated as part of the general safety laboratory and thus would reach the largest population of students.

THE ASSIGNMENT

As part of the general safety laboratory, students are familiarized with the chemistry laboratory. They are

provided instruction related the laboratory rules, e.g., appropriate attire and use of personal protective equipment, use, and location of specific safety equipment; e.g., location of exits, fire extinguishers, eye washes, safety showers; and an introduction to the laboratory equipment. Additionally, the safety laboratory includes an introduction to the chemicals that will be used during the laboratories, how safety information is conveyed for each laboratory, and an initial discussion of the difference between risk and hazard. Inclusion of the general assessment assignment, commonly referred to as the “scavenger hunt,” has allowed for a more detailed discussion about chemicals, their uses, and the potential risks and hazards associated with the materials that are used both in the laboratory and as part of the student’s everyday activities.

The specifics for the “scavenger hunt” are as follows: Students are provided with a worksheet (Figure 1) that requires them to transcribe information from the labels from four commonly used products, and pick one of the products to conduct a further analysis by obtaining the safety data sheet (SDS) for that product using the internet. The worksheet then requires the students to transcribe information from the SDS. After the information has been gathered on the worksheets, the students then complete a mini-hazard analysis (Figure 2) for the proper use of the material. The worksheets are then submitted to the laboratory instructor at the next scheduled laboratory meeting.

While students are allowed to pick the products, four categories of products are suggested; a detergent used in the kitchen, a toilet cleaner, a laundry product, and product generally found in the garage, i.e., a fertilizer, pesticide, or automotive product. The categories are chosen in hopes that the student will review a product that the label will have listed cautions and/or warnings, details for proper usage, and suggested safety precautions.

During the instructions for the activity, students are introduced to the general labeling requirements, i.e., the name of the product, the name of the manufacturer or distributor, contact

information, etc. The students are then introduced to some key vocabulary to allow them to assess the potential hazards associated with consumer products. Students are introduced to signal words such as “warning”, “caution”, “danger” and “poison”. They are introduced to words that indicate a potential hazard such as toxic, corrosive, irritant, sensitizer, flammable, and combustible. Students are to look for affirmative statements such as “harmful if swallowed”.

Students are asked specifically to look for information regarding any precautions that should be taken, instructions for actions to be taken if first aid treatment is required, and any specific instructions for use, handling, and storage. Additionally, students are encouraged to look for suggested personal protective equipment and other information that may help minimize any potential risks associated with the use of the material and to identify any counter-indications and/or potential hazards from mixing with incompatible materials. Examples provided in class include improper mixing of bleach, which can result in the production of chlorine gas and improper storage of pressurized materials can result in explosions.

The second part of the activity is to take one of the four materials used during the label review and obtain specific information from the SDS of the material. The purpose of this exercise is to get the students to investigate deeper information about the product and to see and review an SDS. Students gather more specific information, i.e., a listing of all the hazardous ingredients, emergency contact information, special protections and precautions, reactivity information, health and physical hazards, disposal instructions, etc. The students are asked questions about the SDS as well. This provides the students with an introduction as to what information is available.

Finally, the students are asked to conduct a mini-hazard analysis for the particular product for which they have obtained the SDS. The analysis requires them to list any hazardous ingredients and the warnings/cautions from the label and SDS. They are required to check the potential adverse

reactions and/or events that may occur using the product. The students also have to identify the recommended personal protective equipment and safety equipment.

RESULTS FROM USE OF THE SCAVENGER HUNT

Upon completion of the activity, students were encouraged to discuss what they learned through the exercise. The labeling of baking soda, a common item used by the students, is typically highlighted. Baking soda has two different types of labels; one is associated with food labeling and the other associated with pharmaceutical uses. This does allow for the discussion about the different types of labeling, for example, the difference between a consumer and an industrial product label. In most classes, it is up to the instructor to highlight the differences between the consumer product labeling and the global harmonized system label. The one group of students that seem to immediately notice the differences in labeling and comment on those differences are students pursuing a degree in process or engineering technology as these students encounter chemicals and hazard analyses as part of their work.

As the activity is not difficult, the students generally perform well on the assignment. In most cases, low or poor scores are the result of failing to completely fill out the worksheet or perform some aspect of the mini-hazard analysis. However, there have been longer lasting impacts of the assessment activity observed during the course of the semester. Students in the laboratory seem to be more attentive to the safety discussions at the beginning of each laboratory. For each laboratory, the laboratory instructor reviews the safety information for that particular laboratory, and many of the laboratories have specific safety-related questions that need to be answered as part of the laboratory. Over the first semester where this activity has been included, the responses to these safety questions have improved, and the students are more engaged with the safety information.

Chemical Information Scavenger Hunt
Data Collection Sheet

Step 1

- Find the following items:
- A detergent
 - A toilet cleaner
 - A laundry product
 - An automotive product

Item 1 - Detergent

Name: _____

Manufacturer: _____

Suggested Uses from Label: _____

Warnings and/or Cautions

Contact Information (Phone No. and/or Website)

Item 2 - Toilet Cleaner

Name: _____

Manufacturer: _____

Suggested Uses from Label: _____

Warnings and/or Cautions

Contact Information (Phone No. and/or Website)

Item 3 - Laundry Product

Name: _____

Manufacturer: _____

Suggested Uses from Label: _____

Warnings and/or Cautions

Contact Information (Phone No. and/or Website)

Item 4 - Automotive Product

Name: _____

Manufacturer: _____

Suggested Uses from Label: _____

Warnings and/or Cautions

Contact Information (Phone No. and/or Website)

Step 2

Pick one of the Items from Step 1 - Conduct an internet search to find the Safety Data Sheet (SDS) for that material. Complete the follow table:

Name of the Material: _____

Internet Location of the SDS: _____

List the Hazardous Ingredients with CAS#:

Step 2 - Continued

Emergency Contact Information:

Special Protection and Precautions (Recommended Handling Practices)

Is the material reactive? i.e. Are there in dangers associated with mixing the product with other materials or heating or cooling the product?

_____ Yes _____ No

If yes - what materials should not be mixed with the product or what conditions should be avoided:

What health hazards are identified?

Step 2 - Continued

If the material is not used completely how should the unused product be disposed?

How many sections were included in the SDS and list:

Number of Sections: _____

Figure 1. Worksheet for the chemical scavenger hunt.

Hazard Analysis

Are there any hazards associated with the materials being used?

	Material to be Used	Warnings/Hazards Known	Warnings/Hazards Known from Label	Warnings/Hazards Known from Safety Data Sheet or other Source
1.				
2.				
3.				
4.				
5.				

What adverse reaction and/or event might occur when using this material?

Spills Fire Explosion Heat
 Cold Solids Projectiles Loud Noise
 Other: _____
 Other: _____

What are the potential bad outcomes from the experiment if something goes wrong?

What safety equipment should be used based upon the hazards of the materials and the anticipated behavior and/or outcome of the activity?

Splash Goggles Safety Glasses Gloves – Type: _____
 Science Smock Fire Extinguisher Barricade/Perimeter – Type: _____
 Spill Clean-up First Aid Kit Other: _____
 Other: _____

Figure 2. Mini-hazard analysis.

During the classroom portion of the course, there has been an anecdotal increase in questions related to consumer products and their use or misuse. Additionally, student evaluations indicated that the scavenger hunt activity increased their reading of labels. One student reported that by reading the label he had realized that the reason he had observed the performance of a particular product

declining over time was that he had been improperly storing it, thus reducing its effectiveness. Students indicated that by reading the labels, they were saving money by comparing products, and or using them as directed, thus reducing waste.

While a more detailed study is required, and as the assessment will be implemented over the next several semesters to provide for the general

education and strategic goal data, it appears that the activity is achieving the desired outcome, i.e., increasing awareness associated with the products that the students use on a day-to-day basis. The initial activity presented during the fall of 2018 has been modified slightly, primarily for ease of use by the students and the instructor, not the content. It will be used for subsequent semesters.