WORKER AND ENVIRONMENTALIST

GREEN CHEMISTRY AWARENESS

Training Curriculum

THE NEW ENGLAND CONSORTIUM

University of Massachusetts Lowell

Grant funded by The National Institute of Environmental Health Sciences Grant No. 3U45ES006172-18S2, titled: Administrative Supplements to Promote Partnerships For Environmental Public Health."

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ACKNOWLEDGMENTS

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Agenda

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Green Chemistry Training
Agenda: 4.5 hours

The goal of the Worker and Environmentalist Green Chemistry Awareness training is to provide workers and environmental activists with the tools to advocate for green chemistry and implementation of safer alternatives to reduce toxic contamination. In particular, the training seeks to help bring us together to:

- Understand some basic principles and concepts of green chemistry and how its application on a larger scale can help reduce and prevent the generation of hazardous wastes, as well as provide safer and healthier remediation of hazardous waste sites; and

- Engage in activities that will strengthen efforts to advance policy changes that promote greater support for making a transition to green chemistry.

Learning Objectives:

- Understand the limitations of current approaches to toxic substances management and regulation.
- Understand how the current way we design chemical products leads to toxic hazards and waste and how a different set of design principles can help avoid these problems in the first place.
- Understand how the green chemistry principles can be applied in practice to a particular environmental, health and safety problem: plywood in building construction.
- Understand how green chemistry principles can be integrated into existing campaigns and efforts to reduce toxic contamination.

What is Green Chemistry?
Green Chemistry is the design of chemical processes and products that are inherently safer and more sustainable. Chemists Paul Anastas and John Warner define green chemistry as "the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products." The goal of green chemistry is to reduce hazards throughout a chemical's life cycle by focusing on designing

away hazards rather than controlling them or cleaning up problems after they occur.

10 minutes	**Introduction, Goals and Ground Rules For the Training** **Ground rules for the day:** posted on the board or flip chart
50 minutes	**Activity One: Scope of the problem** Purpose: Participants will introduce themselves and share their opinions on the state of protections currently in place and how secure we feel about toxic exposures on our jobs, in our homes and in the environment.
60 minutes	**Activity Two: What is green chemistry?** **Learn by doing! Making glue – a recipe** Purpose**:** To introduce the 12 principles of green chemistry by experiencing the wasteful and non-environmentally friendly ways we have traditionally designed chemicals and products. Re-examine the familiar frameworks for environmental health and safety.
20 minutes	**Break**
45 minutes	**Activity Three: Applying the green chemistry principles: A case study of the history of manufacturing plywood** Purpose: To further explore industrial design and how worker health and safety and environmental protection need to be important considerations for product development.
75 minutes	**Activity Four: Working toward solutions** Purpose: Using a multi-layered timeline, participants will share experiences and a historical perspective to identify policy opportunities or current campaigns for utilizing green chemistry principles and actions needed to improve environmental safety and health in our workplaces, in our communities, and in the marketplace.
10 minutes	**Evaluation**

WORKER AND ENVIRONMENTALIST GREEN CHEMISTRY AWARENESS

Training Curriculum

Chapter 1

Scope of The Problem

Activity One

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Activity One - Worksheet

Scope of the Problem

Time: 50 minutes total

Purpose

To review the state of protections currently in place and how secure we feel about toxic exposures on our jobs, in our homes and in the environment.

This activity has three tasks.

Task 1: *15 minutes*

- Assign a "scribe" at your table who describe the tasks for the scope of the problem.
- Hand out the 10 "Scope of the Problem" fact sheets at your table until everyone has 1 or more fact sheets to read. Read the fact sheets.
- Each person at the table introduces themselves to the group (name, union/organization) and tells the group what they learned from the fact sheet (in order of how they were assigned).

Task 2: ***15 minutes***

- In pairs, read and discuss the fact sheet *Summary – Scope of the Problem*
- Share one example of how these gaps affect you at work, in your community, or in your family.

Task 3: *20 minutes*

- Introduce yourself to the large group and share your example in **one sentence**.

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Activity One

Scope of the Problem: Fact Sheet 1

Federal Regulations Fail to Protect Us

The 1976 Toxic Substances Control Act (TSCA), as chemicals policy, has failed to sufficiently protect human health and the environment. The health, safety, and environmental effects of the great majority of some 80,000 industrial chemicals in commercial use in the U.S. are largely unknown.

- The TSCA does not require producers to provide information about the hazards of their chemicals or products.

- Sixty-two thousand chemicals were grandfathered without further review of their hazards by the TSCA.

- Ninety-two percent of the highest production volume chemicals in use today consist of these substances.

All federal statutes combined regulate only about one thousand chemicals and pollutants.

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Activity One

Scope of the Problem: Fact Sheet 2

U.S. Chemicals Circle the World Eighty-Six Times

Each day, a total of 42 billion pounds of chemical substances are produced or imported in the U.S. for commercial and industrial uses.

An additional 1,000 new chemicals are introduced into commerce each year.

If converted to gallons they would fill 623,000 tanker trucks, which if placed back to back would circle the earth 86 times at the equator.

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Activity One

Scope of the Problem: Fact Sheet 3

Worker Health Suffers Severally Due to Chemical Exposure

Because many industrial processes involve exposure to hazardous substances, workers are disproportionately affected by chemically-caused diseases. Sixty percent of workplace chemicals suspected of causing cancer or reproductive harm are high production volume chemicals (produced or imported at more than one million pounds per year in the U.S.).

Estimates of the proportion of cancer that may be attributed to workplace exposures range from 5% to 20% and vary widely by cancer site. Each year from 2001 through 2005, an average of 35,280 work-related cancer cases were newly diagnosed in Massachusetts.

Nearly 500,000 adults in Massachusetts have asthma, and nationally, 15-30% of adults are estimated to have work-related asthma. More than 300 chemicals used in the workplace today can cause asthma. Much of this evidence comes from workers exposed on the job.

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Activity One

Scope of the Problem: Fact Sheet 4

Workplace Permissible Exposure Limits (PELs) Are Inadequate and Outdated

The Occupational Safety and Health Administration (OSHA) sets Permissible Exposure Limits (PELs) - the amount of exposure to a chemical allowed for a worker typically averaged over eight hours. There are PELs for just seven percent of the nearly three thousand high production volume chemicals in the U.S. Updating PELs is a slow process, so PELs frequently do not reflect recent toxicology data.

To further complicate matters, the National Institute of Occupational Safety and Health (NIOSH) has exposure standards, *Recommended Exposure Limits* (RELs), that are usually below OSHA PEL standards. And the American Conference of Governmental Industrial Hygienists (ACGIH) has created standards named Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) that are also generally below OSHA PEL levels.

More protective PELs set by OSHA in 1989 for 212 substances were "vacated" by a Court decision* moving them back to PELs established in 1971.

***July 1992, the 11th Circuit Court of Appeals in its decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992)**

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Activity One

Scope of the Problem: Fact Sheet 5

Two Hundred and Seventeen Thousand New Hazardous Waste Sites in the Next Twenty-Five Years

The number of hazardous waste sites in the United States continues to rise.

The U.S. EPA estimates that the country will require 217,000 new hazardous waste sites by 2033, a 180% increase over today's 77,000 existing sites.

Each year, more than $1 billion is spent on efforts to clean up hazardous waste Superfund sites.

Cleanup costs for future sites are estimated at about $250 billion.

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Activity One

Scope of the Problem: Fact Sheet 6

Our Children May Suffer the Most

The vast majority of industrial chemicals are new to human biology and ecosystems since WWII. They are now widely dispersed in the environment and in people: 287 chemicals and pollutants have been detected in umbilical cord blood.

Although chemical exposures are relevant to the general population, children are particularly susceptible to harm. Even low levels of synthetic chemicals can disrupt the rapidly developing physiology of infants and children. Rising incidents of some cancers, asthma and developmental disorders may be due in part to chemical exposures, particularly in young children.

A variety of male reproductive abnormalities may also be linked to exposures to certain pesticides or endocrine-disrupting chemicals during pregnancy.

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Activity One

Scope of the Problem: Fact Sheet 7

Endocrine-Disrupting Chemicals Damage Children's Development

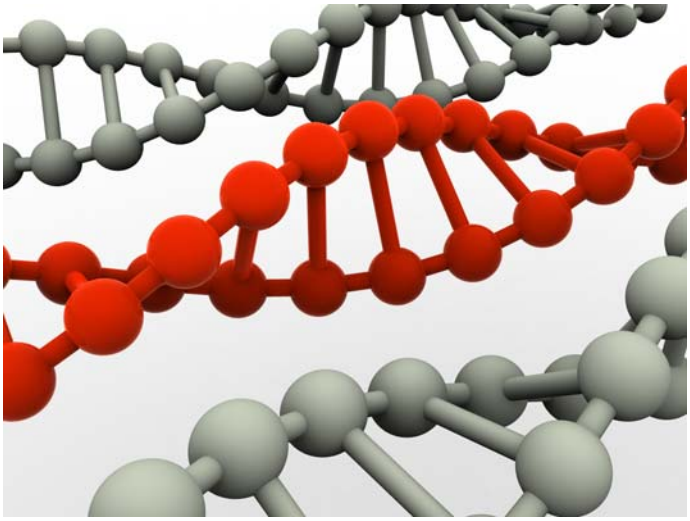
Certain synthetic chemicals commonly found in consumer products can disrupt the endocrine system, a complex network of hormones that affect the development of all organs in the human body.

Even small alterations in hormone levels by endocrine-disrupting chemicals (EDCs) can affect development of the body's neurological, reproductive and metabolic systems. These can produce permanent changes, affecting the body's responses to food, chemicals and hormones even later in life.

This reprogramming may contribute to:

- Obesity
- Pre-diabetic insulin resistance
- Breast and prostate cancers

It is estimated that up to four future generations in a family may be affected by these changes.



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Activity One

Scope of the Problem: Fact Sheet 8

The Data Gap

Manufacturers and businesses can sell a chemical or product without generating or disclosing adequate information about its potential health or environmental hazards.

Federal regulations resulting in failed public policies create a disincentive to produce health and safety data.

The Toxic Substance Control Act (TSCA) grandfathered the vast majority of chemicals in use today. Therefore companies have no incentive to research the health effects of these chemicals.

As a result of this lack of information:

- It is hard to choose products on the basis of their potential health and environmental impacts.
- Public agencies cannot identify chemical hazards of highest priority for human health and the environment.
- The deterrent functions of the product liability and workers' compensation systems are undermined because it is very difficult to prove the nexus between exposure and harm.

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Activity One

Scope of the Problem: Fact Sheet 9

The Safety Gap

Producers are not currently required to assume full responsibility for the health effects and environmental consequences that can occur over the life cycle of their products. As a result, there is little impetus to minimize the potential hazards associated with the manufacture, use or disposal of chemicals and products.

Without sufficient data to inform the demand for safer products, or a system for product stewardship, public agencies are limited to regulating the use and disposal of existing chemicals and products, rather than taking preventive measures. And workers and consumers have few tools to reduce their chemical exposure.

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Activity One

Scope of the Problem: Fact Sheet 10

The Technology Gap

The transition from a concept to a commercial application of sustainable chemistry requires that a company conduct extensive research and development, make potentially large capital investments, and assume the risks of being a leader in an emerging field.

This is often not done because of:

- Market and regulatory weaknesses caused by the data and safety gaps
- Lack of organizational and institutional motivation within industry
- Lack of public and private investment in sustainable chemistry research and education
- Corporate reluctance to take on these risks and responsibilities

The results are a technology gap that will have long-term implications for U.S. competitiveness in the global market for chemicals, products and sustainable jobs.

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Activity One
Fact Sheet
Summary – Scope of the Problem

The **data**, **safety and technology gaps** have produced a flawed market for chemicals and products, in which:

- The health effects of most chemicals are poorly understood.
- Hazardous chemicals and products remain cheaper to produce.
- The costs of health and environmental damage are carried by workers and the public.
- There is minimal industry investment in new technology.
- Government regulation does not adequately protect the public.
- There is virtually no attention given to sustainable chemistry education.

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WORKER AND ENVIRONMENTALIST GREEN CHEMISTRY AWARENESS

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Chapter 2

What is Green Chemistry?

Learn by doing!
Making glue – a recipe

Activity 2

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Activity Two
Learn by doing! Making Glue

An Introduction to the Twelve Principles of Green Chemistry

Time: 60 minutes total

Purpose: To introduce the 12 Principles of Green Chemistry by experiencing the wasteful and non-environmentally friendly ways we have traditionally designed chemicals and products. Review the Hierarchies For Preventing Pollution and Workplace Illness, Injuries and Fatalities.

Objectives:

- Think critically about a chemical process for making glue and how it might be improved
- Understand what the process tells us about the underlying basic twelve green chemistry principles and safer alternatives
- Re-examine the familiar frameworks for environmental health and safety: Hierarchies for Preventing Pollution and Workplace Illness, Injuries, and Fatalities

This activity has <u>three tasks</u>. The trainer will tell you when it is time to do each task in this activity.

<u>Task 1</u>: Making Glue: ***20 minutes***

- **<u>Worksheet 1</u>:** Working in teams, you will be assigned a process step to follow in order to help make the glue. **Note**: follow the instructions exactly. Each group will be asked to come to the front of the room and follow their numbered step. By the end of the process, the group will have made glue.

<u>Task 2</u>: Revising the Glue Making Process: ***20 minutes***

- **<u>Worksheet 2:</u>** Re-write your step with your group. You will be asked to share your revised step with the class. Make note of why you revised the step and how it helps make the process more efficient or less wasteful.
- Report back to large group.

<u>Task 3</u>: Reviewing Posters: ***20 minutes***

View and discuss the two posters: 12 Green Chemistry Principles and Hierarchies For Preventing Pollution and Workplace Illness, Injuries, and Fatalities.

- Discussion Questions:
    1. How can the green chemistry principles be used for pollution prevention and workplace health and safety?
    2. How would you use this in your workplace and community?

Activity Two
Learn by doing! Making Glue

Task #1: Making Glue
Worksheet 1

Materials needed for this task:

- ½ gallon of milk
- 1 container of vinegar
- 1 can of beets
- Can opener
- 1 small pan
- 3 bowls
- 1 plate
- Pair of tongs
- Measuring cup
- Measuring spoons (1 tablespoon, 1 teaspoon)
- 1 spoon
- 1 cheesecloth or strainer
- Bleach wipes
- 1 hot plate
- 1 container of baking soda
- 1 knife (butter knife)

Method:

1. Set hot plate on low and place on a flat surface close to the container of milk. Measure 1 cup of milk and pour it into the pan. Place the remaining milk in the pile to be discarded.
2. Open the can of beets and pour them into a bowl. Select four beet slices and place them in the milk. Place the remaining beets in the pile to be discarded.
3. Swirl the beets and milk mixture with a spoon while your partner pretends to hula-hoop with the rhythm of swirling. Keep this up for 30 seconds.
4. Remove the beets from the milk with the tongs and set them on the plate. Cut the beets into ½ inch cubes. Place the plate of beets in the pile to be discarded.
5. Measure 4 tablespoons of vinegar into the milk. Stir with a spoon for 1 minute while your partner says the alphabet backwards.

6. Place the cheesecloth over a clean bowl. Slowly pour the milk mixture into the cheesecloth-covered bowl while your partner is holding the cheesecloth in place. Fold the cheesecloth up and gently squeeze the liquid out of the cheesecloth. Scrape the clump you have left into an empty bowl.
7. Open the container of baking soda. Add 4 pinches of baking soda and stir well. Place the remaining baking soda in the pile to be discarded.
8. Clean up the area with a bleach wipe. Do two jumping jacks and one push-up.
9. Use the glue to make a stick figure of your instructor. Remember to turn off the hot plate.

Activity Two
Learn by doing! Making Glue

Task #2: Revised Glue Making Instructions
Worksheet 2

Rewrite the process. Remember to think of all the things that would help to make the process easier, less wasteful, and less hazardous.

Method:

1.

2.

3.

4.

5.

6.

7.

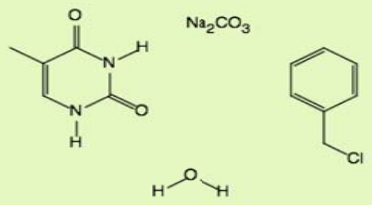
8.

9.

12 Green Chemistry Principles – In Action

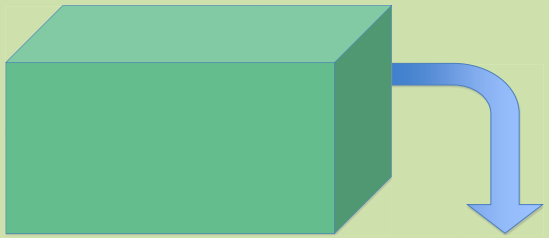
Raw Materials and Feedstocks:

- Atom Economy (2)
- Renewable Feedstocks (7)



The Product :

- Designing Safer Products (4)



End-of-Life:

- Recycle (1)
- Reuse (1)
- Regeneration (1)
- Compost/Biodegradable (10)
- Landfill (Pollution)

Processing Chemicals:

- Reduce Hazardous Processes (3)
- Energy Efficiency (6)
- Safer Solvents (5)
- Reduce Derivatives (8)
- Catalysis (9)
- Real-Time Analysis (11)
- Accident Prevention (12)

Pollution to Avoid:

- By-Products
- Unused Reagents and Raw Materials
- Spent Solvent
- Wasted Energy

Pollution Prevention:

- Reduce By-Product Formation (2)(8)
- Use Less/Safer Reagents and Raw Materials (3)
- Use Less/Safer Solvents (5)
- Reduce Energy Use (6)
- More Efficient Processes (9)

Activity Two – Fact Sheet
The Twelve Principles of Green Chemistry

1. **Prevention (Waste).** It is better to prevent waste than to treat or clean up waste after it is formed.

2. **Atom Economy.** Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.

3. **Less Hazardous Chemical Synthesis.** Whenever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment.

4. **Designing Safer Chemicals.** Chemical products should be designed to preserve efficacy of the function while reducing toxicity.

5. **Safer Solvents and Auxiliaries.** The use of auxiliary substances (solvents, separation agents, etc.) should be made unnecessary whenever possible and, when used, innocuous.

6. **Design for Energy Efficiency.** Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure.

7. **Use of Renewable Feedstocks.** A raw material or feedstock should be renewable rather than depleting whenever technically and economically practical.

8. **Reduce Derivatives.** Unnecessary derivatization (blocking group, protection/deprotection, temporary modification of physical/chemical processes) should be avoided whenever possible.

9. **Catalysis.** Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

10. **Design for Degradation.** Chemical products should be designed so that at the end of their function they do not persist in the environment and instead break down into innocuous degradation products.

11. **Real-time Analysis for Pollution Prevention.** Analytical methodologies need to be further developed to allow for real-time in-process monitoring and control prior to the formation of hazardous substances.

12. **Inherently Safer Chemistry for Accident Prevention.** Substance and the form of a substance used in a chemical process should be chosen so as to minimize the potential for chemical accidents, including releases, explosions, and fires.

Anastas, P.T.; Warner, J.C.,; Green Chemistry: Theory and Practice, Oxford University Press: New York, 1998, p.30. By permission of Oxford University Press.

Hierarchies for Preventing Pollution and Workplace Illnesses, Injuries, and Fatalities

Pollution Prevention: P2

Workplace Health & Safety: H & S

Eliminate or Reduce toxic substances and processes

Change the product; change the process; substitute non-toxic for toxic.

Eliminate Hazards

Substitute toxic and hazardous chemicals with safe or less toxic / hazardous chemicals

Reduce exposure to toxic substances by "control at the source"

Closed loop systems; isolation / total enclosure; process redesign

Best H & S and P2 for Chemicals

Engineering Controls

redesign process or job tasks; Use appropriate ventilation; enclose / isolate process

Recycling: Processing waste for reuse

Administrative Controls

H&S Committees; work organization; policies, practices; housekeeping & maintenance; training; medical monitoring

Treatment: Only if necessary – burning or using biological and/or chemical methods

Storage and Disposal: Responsible storage / disposal of unavoidable waste – taking strong measures to prevent contamination

Least Effective for H & S and P2

Personal Protective Equipment

respiratory protection, goggles; skin protection (gloves, suit, boots)

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Chapter 3

Applying the Green Chemistry Principles: A Case Study of the History of Manufacturing Plywood

Activity Three

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Activity Three

Green Chemistry Case Study
History of Manufacturing Plywood

Time: 45 minutes total

Purpose: To further explore industrial design and how worker health and safety and environmental protection need to be an important consideration for product development.

Learning Objectives

- Become familiar with the basics of a chemical process for a commonly used product
- Understand how green chemistry principles may apply to making a commonly used product
- Consider health, safety and environmental trade-offs between alternative product.
- Discuss opportunities for taking action to apply green chemistry in our jobs and community

Materials:

- Case study sheets
- Material safety data sheets for each type of product
- Worksheet 1

Tasks: This activity has **3 Tasks**

Task 1: *15 minutes*

- Working in group, you will be given the following:
  - Three case studies for the history of making plywood
  - The appropriate MSDS sheet corresponding to each case study
- Read through the case study. We suggest that you divide the reading up (parts 1-3 and MSDS's) and have readers report to your group what each of you learned.

Task 2: *15 minutes*

- Work together in your group to address the questions in Worksheet 1.

- Assign a “scribe” to take notes and fill out the worksheet. You will be asked to report back as a group.

Task 3: ***15 minutes***

- Assign someone in your group to report back to the large group on the case study.

Activity Three – Task 1

Case Study 1
The History of Manufacturing Plywood: The First Method

Background:
The history of plywood goes back to ancient Egyptian times, around 3500 B.C., where wooden articles were made from sawn veneers glued together crosswise.

Plywood is an engineered wood made from sheets of wood (plies or veneers), which are layered together with the grains at right angles to each other in adjacent layers. This makes the wood less prone to warping, shrinkage, and cracking. Plywood is typically very strong.

How is the plywood made?
The first plywood in the U.S. was put together by workers at the Portland Manufacturing Company in Oregon in preparation for the 1905 World's Fair. They were asked to prepare an exhibit featuring something "new and unusual" and what they decided upon was "plywood."

The plywood made at the Portland Manufacturing Company was made with animal glue. The workers mixed animal glue and kept the very odoriferous material warm and pliable over a coal fire (the glue smelled so bad that the men would often have to leave for air outside). Hand brushes were used to "paint" the glue on to the veneers. A wooden press was used. The work was slow and tedious; only one set of panels could be glued up at one time and the panels were set in a press overnight.

How is the glue made?
Animal tissue, bones and hides are conditioned in a water solution with lime (calcium hydroxide). The pH is adjusted by adding dilute mineral acid and rinsing with water. The water solution is "cooked" (heated) and the proteins (which make up the glue) are extracted and filtered. The protein is collected, dried and ground up as final product.

The glue is applied to cut and dried wood veneers by warming to about 145 degrees and it is set by slowly cooling to room temperature, followed by evaporation during the following 12 to 24 hours.

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Case Study 1 MSDS: Animal Glue

MSDS

Material Safety Data Sheet

1. MATERIAL IDENTIFICATION Date: August 21, 1996

Product: **J.E. Moser's Rabbit Skin Glue – 849-790**
CAS NO. 9000-70-8

Synonyms: Animal Glue, Rabbit Hide Glue

Distributed By:

Woodworkers Supply, Inc.
1108 North Glenn Road
Casper, Wyoming 82601
Information Telephone Number: 800-645-9292

For Chemical Emergency
Spill Leak Fire Exposure or Accident
Call CHEMTREC Day or Night
DOMESTIC NORTH AMERICA 800-424-9300
INTERNATIONAL, CALL 703-527-3887 (collect calls accepted)

EMERGENCY OVERVIEW

Tan granular solid with low odor. Although not a combustible solid, this material will char if involved in a fire, releasing typical carbon oxides. No significant health effects are associated with this material.

2. COMPOSITION (Hazardous Compounds)

NO REPORTABLE QUANTITIES OF HAZARDOUS INGREDIENTS ARE PRESENT.

Case Study 1 MSDS: Animal Glue

MSDS

3. HAZARDS IDENTIFICATION

Potential Health Effects

- Inhalation Health Risks and Symptoms of Exposure: Inhalation of dust may cause irritation of throat and respiratory tract.
- Skin and Eye Contact Health Risks and Symptoms of Exposure: Skin irritation may occur.
- Possible dermatitis on prolonged or repeated contact. Hot solutions may cause burns.
- Skin Absorption Health Risks and Symptoms of Exposure: No information.
- Ingestion Health Risks and Symptoms of Exposure: Not a primary route of entry.

4. FIRST AID MEASURES

Eyes: Flush eyes with water until all foreign matter is completely removed. Get medical attention.
Skin: Wash dry material from skin with soap and water. Wash away solutions under running water, and treat for any burns.
Inhalation: Remove affected persons to fresh air and consult physician.

5. FIRE FIGHTING MEASURES

- Extinguishing Media: Water Fog, CO2 Foam, Alcohol Foam, Dry Chemical.
- Special Fire Fighting Procedures: Use Smoke Mask
- Unusual Fire and Explosion Hazards: None. When exposed to open flame or extreme heat, this material will char and eventually disintegrate with emission of smoke, leaving only a residual ash.
- Glue dust dispersed into the air may form explosive mixtures.
- Flash Point: 260-270°C Decomposition/Evolved Gas Flammable.

6. ACCIDENTAL RELEASE MEASURES

Sweep up dry material. Allow solutions to cool completely and gel; then strip from surface. Clean up residue with warm water.

Dispose in accordance with local, state and federal environmental regulations. Small amounts of solution may be washed into sanitary sewers, if local disposal district regulations allow.

Case Study 1 MSDS: Animal Glue

MSDS

7. HANDLING and STORAGE

Store in a cool dry place. Empty packaging carefully to avoid dispersing dust into the air. Sweep up dust accumulations, if they occur. Industrial vacuum cleaner is preferred in order not to re-disperse dust into the air. Avoid contact with water prior to use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

- Respiratory Protection: Dust mask while emptying packaging. Smoke mask recommended when this material is exposed to extreme heat (260-270ºC)
- Protective Gloves: Rubber or plastic while handling.
- Eye Protection: Glasses with side shields.
- Other Protective Clothing or Equipment: Eyewash fountain.
- Work/Hygienic Practices: Wash after handling and before eating, smoking or using restrooms. Maintain good housekeeping.
- Other precautions: Do not take internally. Avoid contact with skin and eyes, and inhaling dusts.

9. PHYSICAL and CHEMICAL CHARACTERISTICS

- Boiling Point: N/A (dry material)
- Vapor Density: N/A
- Evaporation Rate: N/A
- Coating V.O.C.: N/A
- Material V.O.C.: None
- Solubility in Water: In all proportions.
- Appearance and Odor: Tan granular solid. Low Odor.
- Specific Gravity(water = 1): 1.27

10. STABILITY and REACTIVITY

- Stability: Stable
- Conditions to Avoid: No information.
- Incompatibility(Materials to Avoid): No information
- Hazardous Decomposition or By-products: Oxides of carbon when burned.
- Hazardous Polymerization: None

Case Study 1 MSDS: Animal Glue

11. TOXICOLOGICAL INFORMATION

- Chronic Health Hazard and Target Organ Effects: No information.
- Carcinogenicity: NTP? No
  IARC Monographs? No
  OSHA Regulated? No
- Medical Conditions Generally Aggravated by Exposure: Skin disorders.

12. ECOLOGICAL INFORMATION

No data is available on the adverse effects of this material on the environment. Neither COD and/or BOD data is available. Based on chemical composition of this material it is assumed that the material can be treated in an acclimatized biological waste treatment plant system in limited quantities.

13. DISPOSAL CONSIDERATIONS

This material is not considered a hazardous waste under Federal Waste Regulations. Pleased be advised, however, state and local requirements for waste disposal may be more restrictive or otherwise different from federal regulations. Consult state and local regulations regarding the proper disposal of this material. It is recommended that this material waste be landfilled or incinerated securing Environmental Regulatory Agency and landfill operations approval.

14. TRANSPORT INFORMATION

This material is not a DOT Hazardous Material.

15. OTHER INFORMATION

Label information: NFPA

Fire - 0
Health - 0
Reactivity - 0
Specific Hazard -None

Disclaimer

This information is furnished without warranty, representation, inducement, or license of any kind except that it is accurate to the best of Woodworker's Supply knowledge or obtained from sources believed by us to be accurate. Woodworker's Supply does not assume any legal responsibility for the use or reliance upon the same. Customers are encouraged to conduct their own tests.

Activity Three – Task 1

Case Study 2
Modernized Process UF/PF Plywood

Background:
Improvements to the production of plywood occurred with the discovery of new synthetic resins which are able to "cure" more quickly than animal glues. This, along with the invention of automated machinery, revolutionized the way plywood was made.

How is the plywood made?
The process includes "peeling" the logs, drying the wood, patching any imperfections and then gluing the wood together. An automatic spreader spreads the resin for gluing. The wood layers (plies) are bonded together under high heat and pressure with an adhesive such as urea-formaldehyde (UF) (used for indoor purposes) or phenol-formaldehyde (PF) (more water-resistant for outdoors). The high heat and pressure allow for the two adhesive components to stick together and produce nicely layered plywood.

How are the UF/PF resins made?
Preparation of UF and PF resins (glues) are made in similar manners. Urea (or phenol) is combined with excess formaldehyde in alkaline (basic) conditions.

Supporting information:
Formaldehyde can be toxic, allergenic, and carcinogenic. At concentrations above 0.1 ppm in air formaldehyde can irritate the eyes and mucous membranes; cause headaches, a burning sensation in the throat, and difficulty breathing; and trigger or aggravate asthma symptoms. Formaldehyde is classified as a probable human carcinogen by the U.S. Environmental Protection Agency. The International Agency for Research on Cancer (IARC) has determined that there is "sufficient evidence" that occupational exposure to formaldehyde causes nasopharyngeal cancer in humans.

Phenol can be highly irritating to human skin, eyes and mucous membranes via inhalation and skin exposure. Phenol is very toxic to humans via oral exposure (1 g reported to be lethal). Long-term (chronic) exposure symptoms can include effects on the skin, liver, and kidneys, and the respiratory, cardiovascular and central nervous systems.

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AV203

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AV203

SYNONYMS
urea formaldehyde resin woodworking adhesive
Syntec

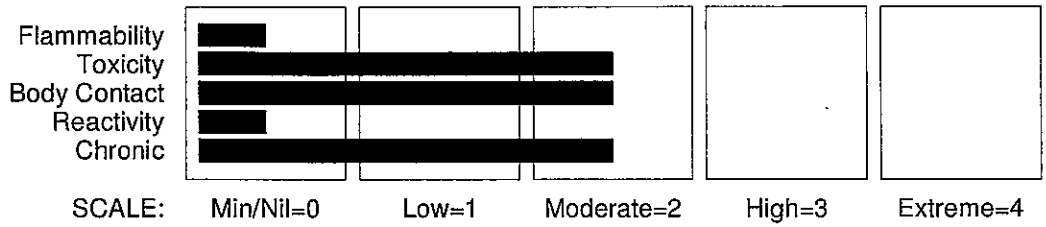
PRODUCT USE
Woodworking adhesive.

SUPPLIER

Company: AV Syntec Pty Ltd
Address:
30 Futura Road
Keysborough
VIC, 3173
AUS
Telephone: +61 3 9798 4944
Emergency Tel: +1800 039 008
Emergency Tel: +61 3 9573 3112
Fax: 03 9798 5877

Company: AV Syntec Pty Ltd
Address:
15-21 Argon Street
Carole Park
QLD, 4300
AUS
Telephone: +61 7 3271 3411
Emergency Tel: +1800 039 008
Emergency Tel: +61 3 9573 3112
Fax: 07 3271 1852

HAZARD RATINGS



Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS.
CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO DIRECTIVE 1999/45/EC AND ITS AMENDMENTS.
CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.
According to the Criteria of NOHSC, and the ADG Code.

POISONS SCHEDULE
None

continued...

RISK

Harmful by inhalation, in contact with skin and if swallowed.
Irritating to eyes, respiratory system and skin.
Limited evidence of a carcinogenic effect.
May cause SENSITISATION by skin contact.
Cumulative effects may result following exposure*.
Possible respiratory sensitiser*.
* (limited evidence).

SAFETY

Do not breathe gas/fumes/vapour/spray.
Wear eye/face protection.
Use only in well ventilated areas.
Keep container in a well ventilated place.
Keep container tightly closed.
Take off immediately all contaminated clothing.
In case of contact with eyes, rinse with plenty of water and contact Doctor or Poisons Information Centre.
If you feel unwell contact Doctor or Poisons Information Centre. (Show the label if possible).

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
urea/ formaldehyde resin	9011-05-6	> 60
formaldehyde.	50-00-0	2-5
water	7732-18-5	Balance

NOTE: Manufacturer has supplied full ingredient information for CHEMWATCH assessment.

Section 4 - FIRST AID MEASURES

SWALLOWED

- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Seek medical advice.

EYE

If this product comes in contact with the eyes:
- Immediately hold eyelids apart and flush the eye continuously with running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

If skin contact occurs:

continued...

- Immediately remove all contaminated clothing, including footwear
- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor.

NOTES TO PHYSICIAN

Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

- There is no restriction on the type of extinguisher which may be used.

FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves for fire only.
- Prevent, by any means available, spillage from entering drains or water courses.
- Use fire fighting procedures suitable for surrounding area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

FIRE/EXPLOSION HAZARD

- The material is not readily combustible under normal conditions.
- However, it will break down under fire conditions and the organic component may burn.
- Not considered to be a significant fire risk.
- Heat may cause expansion or decomposition with violent rupture of containers.
- Decomposes on heating and may produce toxic fumes of carbon monoxide (CO).
- May emit acrid smoke.

Other decomposition products include carbon dioxide (CO_2) , nitrogen oxides (NOx) and aldehydes

FIRE INCOMPATIBILITY

Avoid contamination with strong oxidising agents as ignition may result

HAZCHEM

None

Personal Protective Equipment

PERSONAL PROTECTION EQUIPMENT
Breathing apparatus.
Gas tight chemical resistant suit.
Limit exposure duration to 1 BA set - 30 mins.

continued...

Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS

Slippery when spilt.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable labelled container for waste disposal.

MAJOR SPILLS

Slippery when spilt. Minor hazard.
- Clear area of personnel.
- Alert Fire Brigade and tell them location and nature of hazard.
- Control personal contact by using protective equipment as required.
- Prevent spillage from entering drains or water ways.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite and place in appropriate containers for disposal.
- Wash area and prevent runoff into drains or waterways.
- If contamination of drains or waterways occurs, advise emergency services.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
- Limit all unnecessary personal contact.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

SUITABLE CONTAINER
- Lined metal can, Lined metal pail/ can
- Plastic pail
- Polyliner drum
- Packing as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY

Avoid storage with oxidisers and acids

STORAGE REQUIREMENTS
- Store in original containers.

continued...

- Keep containers securely sealed.
- Store in a cool, dry, well ventilated area.
- DO NOT allow to freeze.
- Store away from incompatible materials.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

Store below 30 deg. C.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³
Australian Exposure Standards	Formaldehyde	1	1.2	2	2.5		

No data available for urea/ formaldehyde resin as (CAS: 9011-05-6) / (CAS: 39327-95-2) / (CAS: 56779-89-6) / (CAS: 57608-68-1) / (CAS: 57657-45-1) / (CAS: 57762-61-5) / (CAS: 60267-46-1) / (CAS: 60831-80-3) / (CAS: 7732-18-5)
None assigned. Refer to individual constituents.

EXPOSURE STANDARDS FOR MIXTURE

"Worst Case" computer-aided prediction of vapour components/concentrations:

Composite Exposure Standard for Mixture (TWA) (mg/m³): 1.2 mg/m³
If the breathing zone concentration of ANY of the components listed below is exceeded, "Worst Case" considerations deem the individual to be overexposed.
Component Breathing Zone ppm Breathing Zone mg/m³ Mixture Conc: (%)

Component	Breathing zone (ppm)	Breathing Zone (mg/m³)	Mixture Conc (%)
formaldehyde.	1.00	1.2000	5.0

Operations which produce a spray/mist or fume/dust, introduce particulates to the breathing zone.
If the breathing zone concentration of ANY of the components listed below is exceeded, "Worst Case" considerations deem the individual to be overexposed.
At the "Composite Exposure Standard for Mixture" (TWA) (mg/m³): 5 mg/m³

Component	Breathing Zone (mg/m³)	Concentration (%)
urea/ formaldehyde resin	22.8000	95.0

INGREDIENT DATA

UREA/ FORMALDEHYDE RESIN:
TLV TWA: 10 mg/m³ (Value for particulate matter containing no asbestos and <1% crystalline silica,Inhalable fraction) [ACGIH]
TLV TWA: 3 mg/m³ (Value for particulate matter containing no asbestos and <1% crystalline silica,Respirable fraction) [ACGIH]
Dusts not otherwise classified, as inspirable dust;
ES TWA: 10 mg/m³

FORMALDEHYDE.:
PEL TWA: see 1910.1048 [OSHA Z1]
TLV C: 0.3 ppm, 0.37 mg/m³ (A2) SENSITISER

continued...

WARNING: This substance has been classified by the ACGIH as A2 Suspected Human Carcinogen.
ES TWA: 1 ppm, 1.2 mg/m³; STEL: 2 ppm, 2.5 mg/m³ SENSITISER (Under review)
WARNING: This substance is classified by the NOHSC as Category 2 Probable Human Carcinogen
PROPOSED CHANGE
ES Peak 0.3 ppm, 0.37 mg/m³ SENSITISER Category 2 Probable Human Carcinogen
MEL TWA: 2 ppm, 2.5 mg/m³; STEL: 2 ppm, 2.5 mg/m³
Odour Threshold Value: 0.98 ppm (recognition)
IDLH Level: 20 ppm
NOTE: Detector tubes for formaldehyde, measuring in excess of 0.2 ppm are available commercially.
Formaldehyde vapour exposure:
Primary irritation is dependent on duration of exposure and individual susceptibility.
The following are typical symptoms encountered at various exposure levels.
0.1 ppm - Lower level of mucous eye, nose and throat irritation
0.8 ppm - Typical threshold of perception
1-2 ppm - Typical threshold of irritation
2-3 ppm - Irritation of eyes, nose and throat

WATER:
No exposure limits set by NOHSC or ACGIH

PERSONAL PROTECTION

EYE

- Safety glasses with side shields; or as required,
- Chemical goggles.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

HANDS/FEET

- Barrier cream and Neoprene rubber gloves

Safety footwear

OTHER

- Overalls.
- Eyewash unit.

RESPIRATOR

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-face Respirator	Full-Face Respirator
1000	10	BAX-AUS P-	-
1000	50	-	BAX-AUS P-
5000	50	Airline *	-

continued...

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

5000	100	-	BAX-2 P-
10000	100	-	BAX-3 P-
	100+		Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

Use in a well-ventilated area
Area where polymer is heat processed should be ventilated to remove vapour, fumes released during all stages of processing.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

White liquid with mild formaldehyde odour. Mixes with water.
Viscosity: 100-900g (K/s)

PHYSICAL PROPERTIES

Liquid.
Mixes with water.

Molecular Weight: Not applicable.
Melting Range (°C): Not available.
Solubility in water (g/L): Miscible
pH (1% solution): Not available
Volatile Component (%vol): 36 approx.
Relative Vapour Density (air=1): Not available.
Lower Explosive Limit (%): Not applicable
Autoignition Temp (°C): Not applicable
State: Liquid

Boiling Range (°C): Not available.
Specific Gravity (water=1): 1.23-1.27
pH (as supplied): Not available
Vapour Pressure (kPa): Not available.
Evaporation Rate: Not available
Flash Point (°C): Not applicable
Upper Explosive Limit (%): Not applicable
Decomposition Temp (°C): Not available.

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

Considered an unlikely route of entry in commercial/industrial environments
The liquid is discomforting to the gastro-intestinal tract if swallowed
Ingestion may result in nausea, abdominal irritation, pain and vomiting

continued...

EYE

The liquid may produce eye discomfort causing transient smarting, blinking and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/ or other transient eye damage/ ulceration
The vapour is discomforting to the eyes

SKIN

The liquid is highly discomforting and adhesive to the skin and is capable of causing skin sensitisation
The material may accentuate any pre-existing dermatitis condition
Sensitisation may result in allergic dermatitis responses including rash, itching, hives or swelling of extremities.

INHALED

The vapour is discomforting to the upper respiratory tract
Inhalation hazard is increased at higher temperatures.

CHRONIC HEALTH EFFECTS

Principal routes of exposure are by accidental skin and eye contact and by inhalation of vapours especially at higher temperatures.

AV203
Not available. Refer to individual constituents.
unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances

UREA/ FORMALDEHYDE RESIN:

TOXICITY	IRRITATION
Oral (rat) LD50: 8394 mg/kg	Skin (rabbit): 500 mg/24h-SEVERE
Inhalation (rat) LC50: >167 mg/m3/4h	Eye (rabbit): 0.1 ul/24h -SEVERE
Dermal (rat) LD50: >2100 mg/kg	
Oral (mouse) LD50: 6361 mg/kg	

Somnolence, impaired liver function tests, changes in leucocyte (WBC) count recorded.
NOTE: Substance has been shown to be mutagenic in at least one assay, or belongs to a family of chemicals producing damage or change to cellular DNA.

FORMALDEHYDE.:

TOXICITY	IRRITATION
Oral (woman) LDLo: 108 mg/kg	Skin (human): 0.15 mg/3d-I mild
Oral (man) TDLo: 643 mg/kg	Skin (rabbit): 2 mg/24H SEVERE
Oral (rat) LD50: 100 mg/kg	Eye (human): 4 ppm/5m
Inhalation (human): TCLo 17 mg/m3/30M	Eye (rabbit): 0.75 mg/24H SEVERE
Inhalation (man) TCLo: 0.3 mg/m3	
Inhalation (rat) LC50: 203 mg/m3	
Dermal (rabbit) LD50: 270 mg/kg	

WARNING: This substance has been classified by the IARC as Group 1: CARCINOGENIC TO HUMANS.
Tenth Annual Report on Carcinogens: Substance anticipated to be Carcinogen
[National Toxicology Program: U.S. Dep. of Health & Human Services 2002]

WATER:
No significant acute toxicological data identified in literature search.

continued...

Section 12 - ECOLOGICAL INFORMATION

No data for AV203.
Refer to data for ingredients, which follows:

UREA/ FORMALDEHYDE RESIN:

Slowly, but not readily biodegradable.
TOC - removal 28 days; 61% BOD28; 0.62 mg/mg substance.
Nitrification 28 days; 0.45 mg NO3-N/mg substance.

FORMALDEHYDE.:

No data for formaldehyde..

WATER:

No data for water.

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Management Authority for disposal.
- Bury residue in an authorised landfill.
- Recycle containers if possible, or dispose of in an authorised landfill.

Section 14 - TRANSPORTATION INFORMATION

Shipping Name:
NONE
Dangerous Goods Class: None
UN/NA Number: None
ADR Number: None
Packing Group: None
Labels Required:
Additional Shipping Information:
International Transport Regulations:
IMO: None

HAZCHEM

None

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE

None

REGULATIONS

urea/ formaldehyde resin (CAS: 9011-05-6) is found on the following regulatory lists:
Australian Inventory of Chemical Substances (AICS)

formaldehyde. (CAS: 50-00-0) is found on the following regulatory lists:
Australian Inventory of Chemical Substances (AICS)
Australian Poisons Schedule

water (CAS: 7732-18-5) is found on the following regulatory lists:

continued...

AV203

Australian Inventory of Chemical Substances (AICS)

Section 16 - OTHER INFORMATION

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Issue Date: Thu 1-Mar-2001
Print Date: Thu 26-May-2005

Activity Three – Task 1

Case Study 3
Safer Alternative: Soy-based Plywood

Background:
Inspired by the superior properties of the protein that mussels use to adhere to rocks, researchers at Oregon State University, along with industrial partners, developed a wood adhesive based on soy flour. The amino acids in soy protein were modified to give adhesive properties similar to that of the mussel's adhesive protein.

How is the plywood made?
The plywood is made using a process similar to what is typically used. The main difference is the resin (glue) used in pressing and securing the layers together.

How are the soy-based resins made?
The soy-based resins are made by extracting proteins from soy flour through a water-based extraction process. The protein is then modified slightly with either dopamine or maleic anhydride in water-based conditions. The modified protein is mixed into a water/protein mix for preparation for spreading and gluing of the plywood layers.

Supporting information:
Columbia Forest Products (CFP) has replaced 47 million pounds of UF resins since 2006 and has reduced emissions of hazardous air pollutants from each CFP plant by 50 to 90 percent. The protein-based plywood is now sold under the label PureBond® by Columbia Forest Products.

Increasing evidence shows that soy production is creating other hazards for the environment. Soy agriculture has become a monoculture, meaning it is taking over large tracts of land. According to the International Labor Organization, the creation of soy and biofuel plantations in Brazil is destroying rainforest and creating slave conditions for over 40,000 workers. Adding to the environmental problems is the fact that much of the world's soy is genetically engineered to be resistant to herbicides that are sprayed on fields to kill the weeds. Studies have shown that this has led to an increase in weed killing-pesticides because farmers don't have to worry about damaging the crops.

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columbia FOREST PRODUCTS

PureBond® Material Data Safety Sheet

May 12, 2008 | Supersedes: March 15, 2008 | Number of pages: 4

PART I: PRODUCT IDENTIFICATION

Product:	Decorative hardwood plywood assembled with cores of all veneer; phenolic particleboard, phenolic medium density fiberboard or phenolic combination core construction; Sierra Pine Meditell® MDI medium density fiberboard; in assemblies laminated with Columbia's proprietary, formaldehyde-free, soy-based PureBond assembly process.
Synonyms:	NAF (No added formaldehyde) or NAUF (No-added urea formaldehyde) decorative hardwood plywood, LEED NC EQ 4.4 compliant hardwood plywood.
Trade Names:	PureBond®, JayCore® KayCore®, Classic Core® (with phenolic cross bands)
Manufacturer:	Columbia Forest Products Corporate Office 222 SW Columbia, Suite 1575 Portland, OR 97201 1-800-547-4261 www.columbiaforestproducts.com
Contact: Emergency phone:	Ang Schramm, Technical Services Manager 334-616-7745

PART II: HAZARDOUS INGREDIENTS

Component: **Wood dust**[1] (Generated as waste by-product of further fabrication by user)
CAS No.: None

Exposure limits:	PEL	STEL
ACGIH TLV Softwoods and most hardwoods (except Beech, and Oak)	5 mg/m^3 TWA	10 mg/m^3 (15 min)
ACGIH TLV Certain Hardwoods (i.e. Beech and Oak)	1 mg /m^3 TWA	N/A
OSHA All soft and hard woods (except Western Red Cedar)	5 mg/m^3 TWA	10 mg/m^3
OSHA Western Red Cedar	2.5 mg/m^3 TWA	N/A

PART III: PHYSICAL PROPERTIES

Description:	Solid wood flooring and hardwood veneers, unfinished and UV Finished multi-ply composite wood panels consisting of various combinations of hardwood or decorative veneer faces, bonded to other wood veneers or strawboard using adhesives containing no added formaldehyde. Generally used in cabinets, furnishings, flooring, and in other non-structural applications. Typically provided as solid wood strip flooring, 50"X100" lay-on hardwood veneers, and 4' X 8' hardwood panels. Other dimensions of hardwood plywood and veneers are available. Thickness of products range from 1/42" of an inch to over 1".
Specific gravity:	Usually less than 1, but varies depending on wood species and moisture content.
Boiling point:	Not applicable.
Solubility in water:	Insoluble.
Appearance/Odor:	Normal for natural wood. Light to dark in color. Color and odor vary by species and expired time since processing.

PART IV: FIRE AND EXPLOSION DATA

Flash point:	600° F for wood.
Autoignition temp.:	Varies (typically 400° F to 500° F)
Explosive limits in air:	N/A for hardwood plywood. 40 g/m^3 (LEL) for wood dust.
Extinguishing media:	Water, carbon dioxide, sand
Special fire fighting procedures:	Follow established procedures for extinguishing wood source fire.
Unusual fire and explosion hazard:	Hardwood plywood does not present an explosion hazard. Sawing, sanding, or machining of hardwood plywood can produce wood dust as a by-product which may present an explosion hazard if a dust cloud contacts an ignition source. An airborne concentration of 40 grams of wood dust per cubic meter of air is often used as the LEL for wood dust.

PART V: REACTIVITY DATA

Stability:	Stable under normal conditions.
Incompatibility:	Avoid contact with strong oxidizing agents and drying oils. Avoid open flame. Product may ignite at temperatures in excess of 400° F, depending on length of time of exposure.
Hazardous decomposition products:	Thermal and/or thermal oxidative decomposition of wood can produce irritating and toxic fumes and gases, including carbon monoxide, hydrogen cyanide, aldehydes, organic acids, and polynuclear aromatic compounds.
Conditions to avoid:	Avoid open flames or other ignition source.
Storage:	In a cool, dry place, away from ignition sources. Provide adequate ventilation.

PART VI: HEALTH AND HAZARD DATA:

Eye contact:	Wood dust can cause mechanical irritation.
Skin contact:	Wood dust from various species of wood may evoke allergic contact dermatitis in sensitized individuals.
Ingestion:	Not likely to occur.
Inhalation:	Wood dust may cause nasal dryness and/or irritation. Coughing, sneezing, wheezing, sinusitis, prolonged colds, and headaches have also been reported. May aggravate preexisting respiratory conditions or allergies. Wood dust may cause nasal obstruction.
Chronic effects:	Depending on species, wood dust may cause dermatitis on prolonged, repetitive contact. Wood dust may cause respiratory sensitization and/or irritation. Pre-existing respiratory disorders may be aggravated by exposure.

Prolonged exposure to wood dust has been reported by some observers of European furniture workers to be associated with nasal cancer. IARC classifies wood dust as a carcinogen to humans (Group 1). This classification is based primarily on IARC's evaluation of increased risk in the occurrence of adenocarcinomas of the nasal cavities and paranasal sinuses associated with exposure to wood dust. IARC did not find sufficient evidence to associate cancers of the oropharynx, lung, lymphatic, and hematopietic systems, stomach, colon, or rectum with exposure to wood dust. The National Toxicology Program (NTP) has also listed wood dust as a known human carcinogen. Wood dust is not listed as a carcinogen by ACGIH or OSHA. A large case control nasal cancer mortality study in North Carolina, Mississippi, Washington and Oregon (1962-1977) did not

demonstrate an association between nasal cancer and occupations normally associated with wood dust.

PART VII: PRECAUTIONS AND SAFE HANDLING

Ventilation:	Provide adequate ventilation and exhaust to keep airborne contaminant concentration levels below the OSHA PELs.
Personal protective equipment:	Wear goggles or safety glasses when manufacturing or machining any wood product. Wear NIOSH/MSHA approved respirator when the allowable limits may be exceeded. Other protective equipment, such as gloves and outer garments may be needed, depending on dust conditions.
Fire prevention:	Avoid open flames or other ignition sources. Keep fire extinguisher readily available.

PART VIII: EMERGENCY AND FIRST AID PROCEDURES

Eyes:	Flush with large amounts of water. Remove to fresh air. If irritation persists, seek medical attention.
Skin:	Wash affected area with soap and water. If rash, persistent irritation, or dermatitis occurs, seek medical attention.
Inhalation:	Remove to fresh air. Get medical advice if persistent irritation, severe coughing, or breathing difficulty occurs.
Ingestion:	Not applicable.

PART IX: SPILL, LEAK, STORAGE, AND DISPOSAL

Pick up, vacuum, or sweep spills for recovery and/or disposal. Avoid creating dusty conditions. Provide good ventilation where dust conditions cannot be avoided during cleanup. Place recovered wood dust in a container for proper disposal. Dispose in accordance with Federal, State, and Local regulations. Disposal is the responsibility of the generator.

PART X: KEY TO COMMONLY USED ACRONYMS

ACGIH:	American Conference of Government and Industrial Hygienists
EPA:	Environmental Protection Agency
HUD:	US Department of Housing and Urban Development
IARC:	International Agency for Research on Cancer
LEL:	Lowest explosion limit
Mg/m^3:	Milligrams per cubic meter
MSDS:	Material Safety Data Sheet
NTP:	National Toxicology Program
OSHA:	Occupational Safety and Health Administration
PEL:	Permissible exposure limit
PPM:	Parts per million
STEL:	Short term exposure limit
TLV:	Threshold limit value
TWA:	Time weighted average

PART XI: USER RESPONSIBILITY

Important: This information is offered in good faith. It is believed to be accurate and has been compiled from sources believed to be reliable. It is offered for your consideration, investigation, and verification. Columbia Forest Products makes no warranty of any kind, expressed or implied, concerning the accuracy or completeness of the information and data herein. Furthermore, Columbia Forest Products will not be liable for claims relating to any party's use of, or reliance on information and data contained herein, regardless of whether it is claimed that the information and data are inaccurate, incomplete, or otherwise misleading.

It is the responsibility of the user to comply with local, state, and/or federal regulations concerning the storage, use, processing, and disposal of the product or subsequently generated waste. It is the responsibility of the user to ensure that this MSDS is the most current version.

IMPORTANT FOOTNOTE[1]

CONCERNING OSHA PELS FOR WOOD DUST

In AFL-CIO v. OSHA 965 F. 2d 962 (11th Cir. 1992), the court overturned OSHA's 1989 Air Contaminants Rule, including the specific PELs for wood dust that OSHA had established at that time. The 1989 PELs were: TWA - 5 mg/m^3; STEL (15 min.) - 10.0 mg/m^3 (all soft and hard woods except Western red cedar); Western red cedar TWA-2.5 mg/m^3.

Wood dust is now officially regulated as an organic dust under the Particulates Not Otherwise Regulated (PNOR) or Inert or Nuisance Dust categories at PELs noted under PART II of this MSDS. However, a number of states have incorporated provisions of the 1989 standard in their state plans. Additionally, OSHA has announced that it may cite companies under the OSH Act General Duty Clause under appropriate circumstances for non-compliance with the 1989 PELs.

Activity Three – Task 2

Plywood Case Study
Worksheet 1

1. What are the job or community hazards in the different parts of the case study?

2. What green chemistry principles apply in this case study?

3. What would you change to improve the process or product?

4. What opportunities for taking action to improve health and the environment did this case study raise for your group?

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WORKER AND ENVIRONMENTALIST GREEN CHEMISTRY AWARENESS

Training Curriculum

Chapter 4

Working Toward Solutions

Activity Four

THE NEW ENGLAND CONSORTIUM

University of Massachusetts Lowell

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Activity Four – Task 1

Working Toward Solutions

Time: 75 minutes total

Purpose: Using a multi-layered timeline, participants will share experiences and a historical perspective to identify policy opportunities or current campaigns for utilizing green chemistry principles and actions needed to improve environmental safety and health in our workplaces, in our communities, and in the marketplace.

This activity has two tasks:

<u>Task 1</u>: (***25 minutes total***) **Put yourself on the Map!**
Gather at the timeline poster and review the content.

(*10 minutes*) Working in pairs: Look at the history the timeline displays for chemical use, its consequences, and the social movements that developed over time.

- Share a milestone or significant experience from work, home or community that impacted you, and the outcome.
- Write a few words about that experience on a sticky note and post it on the map.

(*15 minutes*) Large group discussion*:* read sticky notes and hear participants' experiences.

What else do you see on the timeline that tells us how we have managed toxic chemicals over the years?

<u>Task 2</u>: (*50 minutes total)* Taking Action

(35 minutes)

- Divide into small groups.
- Choose a "scribe" to record your group's main points.
- Complete the worksheet

(*15 minutes*) Large group discussion*:* read sticky notes and discuss policy actions.

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Activity Four - Task 2

Worksheet

Taking Action – What needs to be added to the timeline?

A) In order to address our concerns as citizens for safe and healthy workplaces, communities and marketplace, what campaigns or policy actions are you involved with or what opportunities are there to use some of the Green Chemistry Principles to advance safer chemicals and products?

- *Record one campaign, policy action or other opportunity on each sticky note which will be added to the map during the report-back time.*

B) Earlier in the training we discussed three policy gaps in addressing chemical policy in our workplaces, in our communities, and in the marketplace. Review the factsheet: Three Chemicals Policy Goals.

- How will your campaign, policy action or other opportunity address these policy goals?

- Who are you working with now? Who else do you need to be working with?

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Historical Events

1900 - 1949 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010

Great Depression

IMF, World Bank Created

World War II

"Cold War" and Anti-Communism

Korean War

Vietnam War

9/11 and "War on Terrorism"

Increasing Globalization

First Iraq War

Consequences of a Chemical Economy

First Case of Lung Disease Due to Asbestos

Chemical Industry in Rapid Development with Little Government Attention

Hole in the Ozone Layer

Bhopal, India (Gas Leak)

Deepwater Horizon Oil Spill

Pesticide Markets Boom

Leaded Gasoline in Use

Computer Chip Invented

Woburn, MA (Water Contamination)

Times Beach, MO (Dioxin)

Hurricane Katrina

Libby, Montana (Asbestos)

Love Canal, NY (Toxic Waste)

(US Chemical Production 1945-2005)

Legal & Political Events

EPA Green Chemistry Program

CAFTA

Safe Drinking Water Act

Pollution Prevention Act

Consumer Product Safety Act Amended

Clean Air Act

NAFTA

OSHA

Toxic Substances Control Act

EU Implements REACH

Clean Water Act

HSWA (Hazardous Waste)

FIFRA (Pesticides)

Clean Air Act Amended

NIOSH

RCRA (Hazardous Waste)

US Green Chemistry Bill

Superfund

SARA: Right to Know & TRI Established

Supreme Court Overturns "Fetal Protection" Ruling

1900 - 1949 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010

Social Movements: Labor, Environment, and Civil Rights

1900 - 1949 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010

Black Lake Urban Environmental Conference

Montgomery Bus Boycott

Defense of Civil Liberties

Congress of Industrial Organizations (CIO) Founded

Anti-War Movement

Civil Rights Movement

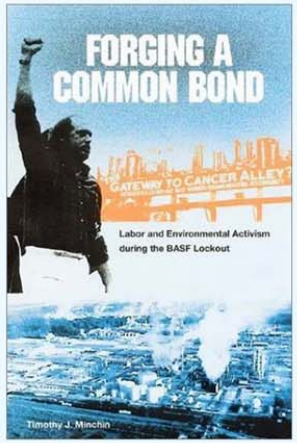
Environmental Justice Movement

Taft-Hartley Act

Black Power Movement

Formation of Blue Green Alliance

PATCO Strike



AFL-CIO Merge

Battle of Seattle –vs- WTO

Nuclear Freeze Movement

AFL-CIO Splits

Change to Win Created

Health & Safety and Environmental Movements

Civil Rights March

OCAW BASF Strike

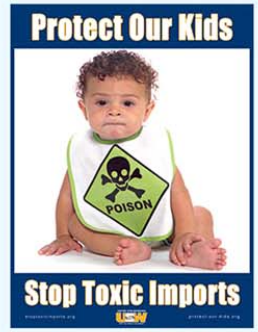
Immigrant Workers Freedom Ride

First Earth Day

Publication of *Green Chemistry*

Toxic Toy Recalls

United Farmworkers Organizing Committee



Publication of *Silent Spring*

OCAW Shell Oil Strike

(US Union Density)

1900 - 1949 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010

Activity Four – Task 2

Fact Sheet
Three Chemicals Policy Goals

We propose **three chemicals policy goals** that will advance our work for safer chemicals and products.

Close the Data Gap: Ensure that chemical producers generate, distribute, and communicate information on chemical toxicity, eco-toxicity, uses, and other key data.

Close the Safety Gap: Strengthen government tools for identifying, prioritizing, and mitigating chemical hazards.

Close the Technology Gap: Support research, development, technical assistance, entrepreneurial activity, and education in green chemistry science and technology.

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