SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ONTARIO

Sault College

COURSE OUTLINE

COURSE TITLE: ENVIRONMENTAL CONTROL

CODE NO. : PPE 164 **SEMESTER:**

PROGRAM: PULP and PAPERMAKING OPERATIONS

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APPROVED:

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DEAN **DATE**

TOTAL CREDITS: 3

PREREQUISITE(S): NONE

HOURS/WEEK: 3

I. COURSE DESCRIPTION:

This course is designed to provide the student with basic knowledge of the nature of liquid and gaseous waste streams arising from the manufacture of pulp and paper. Concepts of suspended and dissolved solids, biological and chemical oxygen demand (BOD and COD), toxicity, particulates and total reducible sulphur (TRS) will be briefly dealt with.
Current and innovative waste treatment processes, pollution laws, control orders and pollution economics will be covered. Provincial and Federal Environmental Acts and how they relate to employee responsibilities will also be dealt with.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Demonstrate a knowledge of how pulp and papermaking processes create effluents.

   Potential Elements of the Performance:

   List four obvious causes for the generation of effluents by the pulp and paper industry.
   Name the two most important reasons for the generation of effluents in the pulp and paper industry.
   Explain the difference between pulp yield and bleached shrinkage.
   Name the major wood chemical difference between hardwoods and softwoods.
   Explain why the major wood chemical difference is important.
   List the properties of hemi-celluloses that make them more likely to be lost during pulping.
   Explain why the thermoplastic nature of lignin is important in mechanical pulping.
   Name two important events that happen to lignin during chemical pulping.
   Give two examples of what problems can be caused by extractives during pulping or bleaching.
   Give two examples of how wood components are lost during mechanical pulping.
   Name the additional effluent problems that can occur in CTMP that do not occur in TMP or SGW.
   In general terms, name the amount of wood components removed by chemical pulping.
   List the three conditions that must be met in order for chemical

pulping processes not to create environmental hazards.
Explain why the bleaching of low yield pulps potentially causes effluents to be produced.
Explain why effluents from low yield pulp bleach plants are generally kept from the recovery furnace.
List the amount of raw pulp dissolved during the bleaching process.
Explain what happens to suspended solids in mill effluent streams.
Name four ways that cellulose oxygen bonds can be broken.
Explain how the hydrophobic nature of lignin is overcome in chemical pulping.
List five problems caused by extractives.
Name the wood components lost during mechanical pulping.

2. Indicate of knowledge of the regulated classes of pollutants.

Potential Elements of the Performance:

Name two problems that arose from the on-site production of chlorine in earlier mills.
Define Minamata disease.
Name four factors that led to changes in the way the pulp and paper industry dealt with effluents.
Name seven regulated classes of pollutants from the pulp and paper industry.
Explain the similarity between tests for suspended solids and consistency.
List five reasons for suspended solids entering pulp or paper mill effluents.
Explain the difference between aerobic and anaerobic bacteria.
Define BOD_5.
Explain what happens to water-living organisms if BOD is too high.
Define AOX.
Identify the main source of AOX in a bleached chemical pulp mill.
Identify the term 2,3,7,8 TCDD.
Name the two components in chemical pulp bleaching needed to form dioxins.
Describe how a toxicity test is carried performed.
Name the three sources of particulate in any mill.
Name three sources of SO_2 or TRS in a mill.
Define a control order.
List four reasons why mills were built on or near water.
Perform calculations to measure total suspended solids, inorganic suspended solids and organic suspended solids.
Calculate the BOD_5 of a mill effluent.
List the percentage of total estimated dioxins released to the atmosphere that are due to pulp mills.

Explain LC50.

3. Indicate a knowledge of Canadian environmental legislation.

Potential Elements of the Performance:

List four general intents of government regulations relating to environmental protection.
Name the circumstances under which the Federal Fisheries Act has effect in respect to environmental pollutants.
Outline four important parts of the Canadian Environmental Protection Act.
Name the person or persons responsible for taking every possible action to prevent or minimize the impact of any environmental spill.
Name the act under which most charges are laid pertaining to effluent discharge violations in Ontario.
Name four effluent quality parameters whose limits are set by a control order.
Outline your course of action if your employer has failed to notify the MOEE of a spill.
Name the major chemical pollutants of concern under MISA regulations.
Name the person or persons responsible to control effluent quality.
Name the maximum fine for each day of a spill for a first offence.
Explain how a control order differs from a stop order.
Name four activities under which a control order might dictate compliance.

4. Indicate a knowledge of the process variables that control pollutants.

Potential Elements of the Performance:

Define a "process variable" and give one example.
Cite the argument to support wet debarking.
Describe the economic benefit of using dry debarking.
Explain the importance of water conservation techniques.
Explain why improved filler retention is important in controlling in controlling suspended solids.
Describe the importance of spill control and containment in terms of a mill’s environmental impact.
Explain why cooking to a lower kappa number reduces overall load from a chemical pulp mill.
Describe the impact of poor chemical pulp washing on AOX formation.
Explain why the preferred use of freas wood in mechanical pulping causes toxicity problems.

Explain how true oxygen delignification helps reduce AOX formation.
Name six classes of variables usually found in a fishbone diagram for bleaching variables.
Name the toxicity problem caused by recycling.
Explain why dioxins and furans are not produced by BCTMP mills.
Explain how scrubbers remove both particulates and gaseous emissions from stack gasses.
Define "fishbone diagram".
List the five most important areas for controlling suspended solids.
Explain why biomass burning promotes suspended solid recovery.
Explain how the reuse of fines can have a positive effect on paper properties.
Cite the negative side of white water reuse.
Explain the problem with allowing paper machine fillers to escape.
Name the positive benefit of having calcium carbonate in your suspended solids.
List five means of reducing or controlling AOX.
Define secondary treatment.
List five steps a mill could take to reduce chlorine consumption.
Define “sapstain”.

5. Indicate a knowledge of the environmental impact of loses from a mill.

Potential Elements of the Performance:

Complete a process cell diagram.
Identify aqueous wastes from a kraft cook as products, wastes or inputs for the recovery furnace.
Compare photosynthesis to respiration.
Explain why respiration is important for breaking down BOD.
Cite the usual amount of dissolved oxygen found in fast running streams in Ontario and Quebec.
List three effects of the aquatic ecosystem caused by decreased dissolved oxygen in water.
Explain why suspended solids are considered an economic loss to the mill.
List three negative aspects of dissolved solids in terms of their effect on receiving waters.
Define turbidity.
Name the environmental impact that is caused by water turbidity.
Name three major sources of toxic material from a pulp mill.
Describe the difference between acute and chronic toxicity.
Name a mill problem that would cause a loss of carbon particles.
Explain why the loss of particulates can be considered an economic loss to the mill.

Explain the environmental impact of sulphur dioxide gas.
Name two environmental problems caused by TRS.
Explain why dissolved solids are undesirable.
List the effects of chronic toxicity.
List the problems caused by saltcake as a particulate.
Name four compounds that are total reduced sulphurs.

6. Demonstrate a knowledge of the methods of primary treatment in the pulp and paper industry.

Potential Elements of the Performance:

Explain why primary treatment causes a reduction in BOD.
Define the term high solids sewer.
Name four different types of equipment used for suspended solids in primary treatment.
Name two reasons why a strainer may be used in primary treatment.
List two reasons why a mill might use a settling a settling basin as its primary treatment system.
Name two important functions of a gravity clarifier.
Explain the roll of the feedwell in a gravity clarifier.
Explain the function of the settling zone in a gravity clarifier.
Explain the purpose of blades on the rake arm of a gravity clarifier.
Name three factors that affect the settling of suspended solids.
Name the characteristic of a gravity clarifier that controls clarification.
Explain the function of a flocculating agent in a clarifier.
Name the three factors that determine clarifier size.
Define the term “rise rate”.
Explain how a flotation clarifier works.
Name two methods of sludge disposal and one disadvantage of each.
Cite the percentage of the settleable portion of suspended solids typically removed by primary treatment.
Explain the drawback to settling basins.
Name the four functional zones of a gravity clarifier.
Name the characteristic of a gravity clarifier that controls the thickness of sludge and explain how this is done.
Explain why flotation clarifiers are more expensive to operate.
Cite the maximum dryness one could expect from dewatered sludge under the best circumstances.
List four factors to be considered when using landfill sites for sludge disposal.

7 Demonstrate a knowledge of secondary treatment parameters.

Potential Elements of the Performance:

Explain why secondary treatment is considered a biological process.
List four factors that control aerobic respiration.
Explain what is meant by a mass-time relationship.
Explain how a mass-time relationship applies to secondary treatment.
Explain how anaerobic digestion differs from aerobic respiration.
Name three critical parameters of oxidation lagoons.
Explain why the depth of an oxidation lagoon is important.
Explain why aeration lagoons can be deeper than oxidation lagoons.
Give the relative areas of oxidation and aeration lagoons for a 500 BDMT/D bleached kraft mill.
Name three methods for aerating an aeration lagoon.
Explain what happens to BOD removal efficiency in the winter.
List the nutrients added to an activated sludge system.
Explain why it is important to control pH and temperature of effluent before it enters an activated sludge system.
Explain why a secondary clarifier is needed in an activated sludge system.
Explain the purpose of a rotary disc biological filter.
List four disadvantages of an activated sludge system.
Define tertiary treatment and give one example of the use of such a process.
Cite the number of days it typically takes to reduce BOD by 85-90 % in an oxidation lagoon.
Explain how a rotary disc biological filter works.

III. TOPICS:

1. Losses of Wood Components.
2. Regulated Classes of Pollutants.
3. Canadian Environmental Legislation.
4. Process Variables that Control Pollutants.
5. Potential Environmental Impact of Mill Pollutants.
6. Primary Treatment.
7. Secondary Treatment

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Sugden, Adam, and Bethune, Jack, Course Manual for PPE 164 Environmental Control, Sault College of Applied Arts and Technology, Sault Ste. Marie, 2002

V. EVALUATION PROCESS/GRADING SYSTEM:

A final grade for this course will be based on the results of three tests weighted equally.

For testing purposes, course material will be divided as follows:

Test 1 on Module 1 All Lessons
Test 2 on Module 2 All Lessons
Test 3 on Module 3 All Lessons

The following semester grades will be assigned to students in all credit courses:

Grade	Definition	Grade Point Equivalent
A+	90 - 100%	4.00
A	80 - 89%	4.00
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% or below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field/clinical placement or non-graded subject areas.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject areas.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

Under extreme circumstances, students receiving a final grade of 45-49% may be permitted to write a supplementary exam for a maximum grade of D provided they receive a minimum grade of at least 60% on the average of the other two tests.

VI. SPECIAL NOTES:

Special Needs:
If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493, 717, or 491 so that support services can be arranged for you.

Retention of course outlines:
It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Plagiarism:
Students should refer to the definition of "academic dishonesty" in *Student Rights and Responsibilities*. Students who engage in "academic dishonesty" will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course outline amendments:
The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.