ChemCom - Unit One: Water - Finding Solutions
PIAT (Putting It All Together)

PIAT DAY #1:

Goals: 1. Overview of the PIAT
2. Read Special Interest Group Summaries
3. Choose Special Interest Group
4. Graphing Assignment preparation for day #2

Overview of the PIAT:

In this final, culminating activity for Unit #1, the class will be divided into nine special interest groups representing the community of Riverwood. Each group will decide its position on the fish kill issue, and present their opinion at a Town Council meeting. Your grade for this assignment will be based on a rubric grading system. The entire project is worth 100 points.

Special Interest Groups:

Power Company Officials
Agricultural Cooperative Representatives
Company Representatives
Engineers
County Sanitation Commission Members
Mayor
Journalists
Riverwood Taxpayers
Mining

The purpose of this activity is to determine the following key issues:

1. Who is responsible for the fish kill?
2. What should be done to remedy the situation?
3. Who should have to pay for the costs associated with the fish kill?
4. Can this situation be avoided in the future?

Each special interest group will decide its position on the fish kill issue based upon:

a) the conclusions drawn from graphing Riverwood's river data (measuring concentration of various chemicals in the water, water temperature, etc.) and …
b) additional research on the part of the group.

In order to prepare for the presentations, each group will come up with a minimum of five statements to support their position on the fish kill. The group must also show multiple graphs of river water data (a visual aid) to help support their position. You should prepare a presentation to convince the mayor and town members that your special interest group is not responsible for the fish kill. The group must also prepare questions to ask of other groups at the meeting. Part of you presentation can be to accuse or infer another groups' guilt. However, you should have evidence from the graphs OR research of previous situations to support your claims.

In order to accurately account for all of the work that went into preparing for the town council meeting, documentation of work needs to be presented. The documentation for the work will be presented in an email after each day's work. This email will include worksheets, graphs, notes, visual aids used, and a script for the presentations.

Please note: This is a lot of work. All specific details are spelled out on the handouts and rubric. Please be aware of all details. Please ask questions. Please don't wait until the last minute. Exchange phone numbers and emails. Exchange information with your partners incase one of you is absent. If you are absent, a research paper may be assigned.

Special Interest Group Summaries:

Power Company Officials:

The power plant includes a dam and reservoir that ensure an adequate supply of cooling water. Your company's engineers control the rate of water release from the dam into the Snake River. Normally, only relatively small volumes of water are released at any particular time. However, releasing large quantities of water from the dam is a standard way of preventing flooding. The last time such a large volume of water was released from the dam was 30 years ago. A fish kill was reported then, but the cause remained unknown. On that occasion, Riverwood and surrounding area had experienced an unusually wet summer. The dam, constructed in the 1930s, had the most current design of that time. Since then, its basic structure has not been modified.

Agricultural Cooperative Representatives:

Cooperative members in the Snake River include farmers and ranchers managing a variety of crops and livestock. Your cooperative assumes a proactive role in informing its members of current best practices and regulations regarding the use of agrochemicals and the management of wastes and runoff from fields and pastures. Heavy rains present a problem for farmers. Although the rain is good for crops, it can wash away recently applied fertilizers and pesticides. This is not only expensive, but it can cause problems if these substances wash into the watershed.

Mining Company Representatives:

Riverwood began as a mining town on the Snake River, which provided early residents with a source of water. Your company intensely mined the hills surrounding Riverwood in the 1930s and 1940s. The important metals that came from this area included zinc and silver. The by-products of mining and processing the metal ores were collected in storage ponds built in accordance with the specifications and regulations of that time. In seasons with average rainfall, the runoff from the waste ponds contains heavy-metal ions at levels within the values specified by your company's EPA permit. Your company monitors effluent values and keeps the ponds secured. Your company's structural engineers are responsible for upkeep of storage ponds at abandoned mine sites. However, during heavy rainfall, some underground settling in the mines and avalanches in hilly areas of the Snake River have been noted.

Scientists:

You are responsible for explaining how the analyzed data support the proposed cause of the fish kill. You should be prepared to explain what the data mean and why data fluctuations are noted from month to month or year to year. You may be called on to explain concepts such as pH, solubility of molecular and ionic substances, units of concentration, water-purification techniques, the hydrologic cycle, and other water-related concepts. It is important that you help council members and other attendees understand how the analyzed data document the cause of the fish kill.

Consulting Engineers:

Your consulting firm was hired to do a detailed examination of the cause of the fish kill. Your task was to determine whether accident, human error, negligence, or an unforeseen circumstance was responsible for the Riverwood crisis. In addition, you were asked to prepare scenarios or suggest improvements that would prevent recurring fish kills. Your presentation should include the proposed solutions, the costs and benefits of each solution, and a detailed analysis of the cause. It is understood that you may not be familiar with cost analyses of major projects; however, you should try to make feasible estimates.

County Sanitation Commission:

You are responsible for the protection and safety of the Snake River water supply. You are the group that completes most of the routine water testing for the supply of drinking water in Riverwood. It is important to know the standards that specify the quality of drinking water mean and to explain how the water testing is done. You should be able to report maximum contamination levels (MCLs) for hazardous water contaminants. You should also know the allowable limits or expected ranges for other analyzed water data.

Riverwood Taxpayer Association:

Your organization is concerned about the financial effects of the fish kill on Riverwood citizens. Thus some of the important questions to be answered at the town council meeting should be addressed in your presentation. These questions include:

- Who will pay for the water brought into Riverwood during the water shutoff?
- Will taxes be increased to compensate local businesspeople for their financial losses? (Keep in mind that local merchants themselves are likely to be Riverwood taxpayers1)
- If the organization responsible for the fish kill takes measures to prevent its recurrence, will the costs be passed on to consumers? If so, how?

Chamber of Commerce:

Canceling the annual fishing tournament cost you and other Riverwood merchants a substantial sum of money. Close to one thousand out-of-town tournament participants were expected. Many would have rented rooms for at least two nights and eaten at local restaurants and fast-food establishments. In anticipation of this business, extra food supplies and support services were ordered. Fishing and sporting goods stores stockpiled extra fishing supplies. Some businesses have applied for short-term loans to help pay for their unsold inventories. Local churches and the high school planned family social activities as revenue makers during the tournament weekend. For example, the school band scheduled a benefit concert that would have raised money to send band members to the spring band competition. People are likely to remember the fish kill for many years. Tournament organizers predict that future fishing competition revenues in Riverwood will be substantially reduced due to this year's adverse publicity. Thus total financial losses resulting from the water emergency may be much higher than most current estimates predict. You should be able to discuss how merchants and businesses were affected by this event and summarize the availability of support (as well as lack of support) to help these issues.

PIAT DAY #1:

Goals: 1. Create the snake river water flow graph using excel

2. Create graph's 2 and 3, print them, and save them

3. Post the graphs on the back window for all to access

Creation of Graphs:

Each group will make three graphs using Microsoft Excel as designated below. The graphs should show the last two years data on the same graph as the data for Sept 1 through Sept 7.

Group	**Graph #1**	**Graph #2**	**Graph #3**
Scientists	Snake River Flow	***Water Temperature***	***Dissolved Oxygen***
Engineers	Snake River Flow	***Rainfall***	***PCB's***
Power Company	Snake River Flow	***PCB's***	***Organic carbon***
Agriculture Group	Snake River Flow	***Orthophosphates***	***Pesticide***
Mining Company	Snake River Flow	***Lead***	***Cadmium***
Sanitation	Snake River Flow	***Orthophosphate***	***Nitrate***
Chamber of Commerce	Snake River Flow	***pH***	***Mercury***
Taxpayers	Snake River Flow	***Arsenic***	***Organic carbon***
Town Council	Snake River Flow	***Lead***	***Rainfall***

PIAT DAY #2:

Goals: 1. Read the History of the Data

2. Inspect all the graph's on the back window.

3. Analyze the graphs, look for

4. Determine the cause of the Fish Kill using graphs

The History of the Data:

Since the early 1900s various groups have measured the Snake River watershed in a number of different ways. As a result, although some of the measurements and methods have changed, there is an excellent record of data for the past few years.

Joseph Fisker of the County Sanitation Commission has measured the river's pH, dissolved oxygen, and water temperature. For the past few years he has also measured water entering the utility water system daily. Using a portable meter Fisker measures the pH--the acidity or basicity of the water. Using a special probe and working under the bridge near Riverwood Hospital, he samples dissolved oxygen at a depth of one-half meter. Twice a month he verifies the readings with a chemical test. Knowing the water temperature allows Fisker to calculate the saturation of oxygen in the water.

Every day the power company monitors water flow on the Snake River. The data is reported monthly in cubic feet per second. In the same fashion, the company also measures and reports the amount of rainfall in inches. The data is collaborated with measurements taken by the National Stream Water-Quality Monitoring Networks, part of the U.S. Geological Survey.

The Aurgent Mining Company, which once operated several zinc and silver mines in the area, still measures several metal ions in the river. Greta Black, Aurgent's supervisor of environmental programs, has provided data for the past two years. She also took daily measurements for the week following the discovery of the fish kill.

Finally, each week an environmental consulting firm, under contract to the Snake River Agricultural Cooperative measure the organic carbon, nitrates, phosphates, pesticides, and other dissolved molecular substances in the river. Don Walker, vice-president of the cooperative, has provided data on these measurements for the past two years. The amount of organic carbon indicates organic matter that has a biological origin, such as dead plant matter or animal wastes. Nitrates and phosphates generally get into the water from fertilizers, animal wastes, or treated wastewater from cities. Measuring pesticides and other dissolved molecular substances is more difficult; detecting these substances involves specialized tests.

This data is based on an actual fish kill. The data should point clearly to the cause.

Analyze the graphs:

Now we have data….What caused the fish kill? Your task today is to figure out the most likely cause of the Riverwood fish kill by comparing the data (graphs) to these indicators of these possible causes. Analyze the graphs to determine the following:

1. Were there low oxygen levels in the water?

Question	Yes or No
Heavy rainfall or large release from the dam?	
High water temperatures?	
Low dissolved oxygen levels?	
High nitrate levels?	
High phosphate levels?	
High organic carbon levels?	

2. Was a molecular Substance in the water?

Question	Yes or No
Heavy rainfall?	
Detectable levels of pesticide in water or fish	
Evidence of pesticide spill	

3. Did the fish suffer from gas bubble trauma?

Question	Yes or No
Large release from the dam?	
High, supersaturated dissolved oxygen levels?	
Low water temperatures?	

4. Were the fish exposed to heavy metal poisoning?

Question	Yes or No
Heavy rainfall or large release from the dam?	
High levels of mercury in the water?	
High levels of other heavy metals in the water?	
Low pH levels in the water?	

Determining the Cause of the Fish Kill:

Your group then needs to analyze the data by looking for anything that does not follow the pattern from the first two years of data. Your group needs to answer the four questions below. This should be in writing.

1. Look at the graphs and the analysis on the previous page. Is there any pattern apparent in the plotted data?

2. Explain any possible pattern or irregularities that you detect?

3. How might fish be adversely affected by the pattern that your group has identified?

4. What caused the fish kill? Explain.

PIAT DAY #2-3:

Goals: 1. Introduction of suggested research web sites

2. For your group, read the appropriate background information and research/ answer the research topics/questions

3. Exchange phone #'s, email, etc…

Scientists;

Background Information:

In putting together the cause of the fish kill, it is important that all the data be taken into consideration. Often the complex picture of what went on during the incident can only become apparent when the data is considered as a whole.

Research Topics/Questions:

1. What would cause the organic carbon, nitrates, phosphates and PCB's to be at high levels?

_____

_____

2. Find documented cases of the above factors affecting biological life.

_____

_____

3. Present FACTS in the situation, not your own opinions.

_____

_____

4. Develop data and graphs to present at the meeting to explain the cause of the fish kill.

_____

_____

5. Incorporate other documented cases like the one in Riverwood into your presentation.

_____

_____

Consulting Engineers:

Background Information:

Organic material can increase dramatically in rivers and streams in at least two ways. One is when an algal bloom occurs. If the water contains a high concentration of nutrients, such as nitrate and phosphate fertilizers, the algae can grow quickly, and when they die their decomposing structures add to the total amount of organic carbon in the water. A second way that organic carbon can increase is when undecomposed plant and animal material, which can lay undisturbed underneath mats of inert mud or soil, is flushed off the riverbed by strong rain or water flow. When strong water flow flushes the material out, it begins decomposing, a process that can consume relatively large amounts of oxygen.

Research Topics/Questions:

1. How are algal blooms in rivers prevented?

_____

_____

2. Improvements in dam design since the 1930s.

_____

_____

3. Determine the cause of the fish kill and the most likely source.

_____

_____

4. Suggest methods for avoiding a situation like this in the future.

_____

_____

Power Company Officials:

Background Information:
The month appears to be fairly normal in terms of the operation of the dam and the city electrical system. Temperatures were very hot on the days preceding the fish kill and also the days that followed, causing an increase in electricity demand for residential air conditioning. Water temperature of the river was also high.

Research Topics/Questions:

1. What is cooling water used for at a power plant?

_____

_____

2. Where is it disposed of after it is used?

_____

_____

3. Could an increase in electricity demand affect the temperature of the water released?

_____

_____

4. What are reasons for releasing water from a dam?

_____

_____

5. How do dam releases impact the pollution levels in the rivers they serve?

_____

_____

6. Be prepared to defend your decision to go forward with the heavy release of water. If possible, incorporate data into your argument.

_____

_____

7. Be prepared to discuss the elevated temperature levels of the river water.

_____

_____

County Sanitation Commission:

Background Information:
City officials regularly monitor the amount of dissolved oxygen, water temperature, and pH of the river. All of these measurements have been done for a number of years, and the data is very reliable. The Sanitation Commission staff has even had technicians win awards for their knowledge and techniques. The amount of dissolved oxygen in a body of water is determined by complex factors. Be prepared to explain some of the factors that can determine the amount of D.O. in the water.

Research Topics/Questions:

1. Research drinking water standards. Maximum contamination levels for substances such as PCB's, phosphates, nitrates, and organic carbon.

_____

_____

2. How are the specific contaminants are removed from the drinking water?

_____

_____

3. Explain to the Town Council the quality of the water in the Snake River. Is it dangerous for humans?

_____

_____

4. Can the water be sufficiently treated as to make it potable?

_____

_____

Agricultural Cooperative Representatives:

Background Information:

The Coop contracts with an environmental consulting firm to monitor the levels of phosphate, nitrates, pesticides, PCB's, and organic carbon in the river. Near the time of the fish kill some of these levels were very high. Although fertilizers use can increase the levels of phosphates and nitrates in waterways, it is hardly in the best interest of the farmers if fertilizers wash away during rainstorms. After all, fertilizers are a major expense in growing crops. However, such incidents all around the country are well documents to have occurred each year. Another source of phosphate is home wastewater. Phosphates-based cleaners were major contributors of this substance until they were banned in most places.

Research Topics/Questions:

1. When are fertilizers used?

_____

_____

2. What are best practices to keep agrochemicals out of natural waters?

_____

_____

3. What is the source of PCB's?

_____

_____

4. Develop some type of "proof" that you are not responsible for the fish kill.

_____

_____

Chamber of Commerce Members:

Background Information:

You are concerned that the negative publicity surrounding the fish kill is very bad for the community image. If the annual fishing tournament is tainted with the prospect fish, it could end the tournament. It is in your best interest to get this settled as quickly, fairly- and quietly-as possible.

Research Topics/Questions:

1. What is the purpose of the Chamber of Commerce?

_____

_____

2. How do you support businesses faced with losses due to environmental issues?

_____

_____

3. Discuss how merchants and businesses were affected by the fish kill.

_____

_____

4. Suggest possible recovery of business losses based on actual situations.

_____

_____

5. Suggest an alternate way for businesses to minimize the impact the cancellation of the fishing tournament.

_____

_____

Mining Company Representatives:

Background Information:

There is no evidence of any toxic organic substances such as PCB's or pesticides in any of your holding ponds or drainage areas. A recent inventory of substances in the soil and holding ponds amply documented this fact. Even though there is no direct evidence linking your company to the fish kill, it is always difficult for you to convince the public that your company is not at fault. You are considering a new advertising campaign to help convince people that mining is beneficial to them personally.

Research Topics/Questions:

1. What are some standards that are practice in the mining industry to prevent polluting the environment?

_____

_____

2. What are zinc and silver used for?

_____

_____

3. Develop some type of "proof" that you are not responsible for the increase in pollutants in the Snake River.

_____

_____

4. Explain why mining is personally beneficial to people.

_____

_____

Riverwood Taxpayer Association Members:

Background Information:

Tax revenue is going to suffer as a result of this incident. It is very important to you that the responsible individual is identified and made to pay for the damages. The city cannot really afford the tax revenue it is going to lose. If this matter is not resolved quickly, there could also be implications for next year's fishing tournament.

Research Topics/Questions:

1. Examples of towns that have had a similar situation, and how they resolved their monetary concerns.

_____

_____

2. What are the average citizen's rights when environmental problems occur in their community?

_____

_____

3. Prepare your position on who needs to pay to remedy the situation and get Riverwood back on track.

_____

_____

Town Council Members:

Tasks:

1. Decide on the order of speakers. Groups providing factual information should come before those offering opinions.

2. Create time cards to notify speakers of remaining time.

3. Create a diagram of the physical arrangement of the presentation area.

4. Create signs for each group so that groups know their location in the presentation area.

5. Explain the rules and consequences.

6. Explain the rebuttal process.

7. Outline the meeting and timing

8. Outline your expectations of the presentations of the speaking goups.

PIAT DAY #3-4:

Goals: 1. Discuss the town council meeting and visual aids
2. Finish Research
3. Write "presentation points", etc…
4. Collect pictures, graphs, articles, etc… for construction of the visual

PIAT: Town Council Meeting:

• In this activity, the eight special interest groups will present their opinion at a Town Council meeting. The groups include: Scientists, Power Company Officials, Agricultural Cooperative Representatives, Mining Company Representatives, Engineers, Chamber of Commerce Members, County Sanitation Commission Members, and Riverwood Taxpayer Association Members.
• The purpose of this activity is to determine the following key issues:
1. Who is responsible for the fish kill?
2. What should be done to remedy the situation?
3. Who should have to pay for the costs associated with the fish kill?
4. Can this situation be avoided in the future?
• Each special interest group will decide its position on the fish kill issue based upon the data provided from the graphing exercise and additional research.
• Each group may choose from several possible approaches to present their position at the Town Council meeting:
1. Analytical: Answers questions such as: What and Who caused the problem? Who should pay?
2. Defensive: Explains why your group is not at fault and therefore should not have to pay.
3. Offensive: Places blame on another group, and expects them to pay for the damages and correct the cause of the problem.
4. Other: A combination of any of the above, or your own style.
• In order to prepare for the presentations, each group will come up with a minimum of five "presentation" statements to support their position. The group must also prepare one question and one backup question to ask each of the other groups. If any other group asks your question, the examiner must be ready with the backup question. Each special interest group must complete the above in writing *before* the Town Council meeting, using the forms provided.

Roles: Each special interest group must elect a "spokesperson." This person will address the Town Council and present arguments to the other citizens of Riverwood. Each group must also have an "examiner." This person will question the arguments of other groups.

Rebuttal: After all groups have made their presentations and answered questions, each group will have one minute for rebuttal. A rebuttal is your group's chance to clarify its position, defend its actions, explain why it is not at fault, or suggest another group to be at fault. The spokesperson will address the rebuttal or, alternatively, a third person may be assigned to this task.

The Final Decision: After all of the arguments and rebuttals, the town council will make a decision on the matter and suggest a course for further action.

The format for the Town Council Meeting is as follows.

Group Presentation (spokesperson) (prepared statement).	2 MIN
Group Questioning (examiners) (worksheet two)	1 MIN
-Repeat for all groups.-	
Rebuttal (refute others' claims and bolster your own)	1 MIN

Presentation Points:
(note that the town council members and journalists should be creating an article /ad of the meeting)

Special Interest Group:_____

Spokeperson:_____

Examiner:_____

Other Group Members:_____

Position on the fish kill issue:_____

_____

Presentation Point 1:_____

_____

_____

Presentation Point 2:_____
_____

_____

Presentation Point 3:_____
_____
_____

Presentation Point 4:_____
_____

_____

Presentation Point 5:_____

_____

_____

PIAT DAY #4:

Goals: 1. Discuss the visual aid. The visual aid must include: the name of the interest group and members, Graphs/Pictures/Articles***,*** Presentation Points ***(***All writing must be typed)

2. Discuss the rubric

3. Discuss the format of the town council meeting

4. Write two questions that you are going to ask other groups..

5. Construct the visual aid

Questions for Other Groups:

Power Company:

1. _____
2. _____

Agricultural Cooperative:

1. _____
2. _____

Mining Company:

1. _____
2. _____

Consulting Engineers:

1. _____
2. _____

Chamber of Commerce:

1. _____
2. _____

County Sanitation Commission:

1. _____
2. _____

Taxpayers Association:

1. _____
2. _____

Scientist:

1. _____
2. _____

Engineers:

1. _____
2. _____

PIAT DAY #5: *The Town Council Meeting. Be prepared. If you are absent you will be assigned a research paper which covers all of these topics.*