

Course Learning Outcomes for Unit IV

Upon completion of this unit, students should be able to:

4. Examine management principles related to industrial and hazardous waste issues.
 - 4.1 Appraise the principles of pollution prevention in management decision-making.
 - 4.2 Assess options for management's optimal decision-making.

Course/Unit Learning Outcomes	Learning Activity
4.1, 4.2	Unit Lesson Article: "Eco-Efficiency Analysis of a Lithium-Ion Battery Waste Hierarchy Inspired by Circular Economy" Article: "'Cleansing the Air at the Expense of Waterways?' Empirical Evidence From the Toxic Releases of Coal-Fired Power Plants in the United States" Unit IV Article Critique

Required Unit Resources

In order to access the following resources, click the links below.

Richa, K., Babbitt, C. W., & Gaustad, G. (2017). [Eco-efficiency analysis of a lithium-ion battery waste hierarchy inspired by circular economy](https://libraryresources.columbiasouthern.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=123543545&site=eds-live&scope=site). *Journal of Industrial Ecology*, 21(3), 715–730. Retrieved from <https://libraryresources.columbiasouthern.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=123543545&site=eds-live&scope=site>

Bi, X. (2017). ["Cleansing the air at the expense of waterways?" Empirical evidence from the toxic releases of coal-fired power plants in the United States](https://libraryresources.columbiasouthern.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=121884293&site=ehost-live&scope=site). *Journal of Regulatory Economics*, 51(1), 18–40. Retrieved from <https://libraryresources.columbiasouthern.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=121884293&site=ehost-live&scope=site>

Unit Lesson

Introduction

Welcome to Unit IV, which covers management principles and advanced environmental concepts related to work as an industry professional. This lesson will highlight the roles of several types of employees working for a large industrial corporation. The roles are president, mining manager, manufacturing manager, and chemical production manager. These employees work for a fictitious company called ManyProducts, Inc. In their efforts to expand production, the managers look to optimize their decision-making by considering the company mission statement, pollution prevention concepts, and options presented by their teams.

Corporate History

As a background of our fictitious company, ManyProducts, Inc. was incorporated in the 1930s. It did significant business with the U.S. military in the 1940s and then continued expanding in the 1950s at a high rate, an average of 20% growth per year. The business became fairly stable but with a slower growth of 5% in the 1960s and 70s. In the 1970s, the company learned to work with new environmental regulations such as the Resource Conservation and Recovery Act (RCRA), which was enacted in 1976, the Clean Air Act

(enacted in 1970), and the Clean Water Act (enacted in 1972). These laws resulted in significant changes to ManyProducts' business practices because of the laws' impact on environmental aspects of the company—since the company's mining, chemical products, and manufacturing divisions have air emissions, wastewater, mine tailings, solid waste, and chemical wastes.

As the company was working to comply with the 1970s laws and updates (amendments) through the 1980s, the 1990 Pollution Prevention Act (PPA) was actually seen as a confirmation of company practices. The PPA encouraged companies to seek company-wide, big-picture efforts to incorporate pollution prevention throughout all aspects of a corporation. ManyProducts, Inc. had already adopted this mind-set. As ManyProducts, Inc. embraced environmental laws and pollution prevention, its bottom line stayed at about 5% per year, steady, but not as high as desired. We will now paint a picture of the company in the present, around 2019.

ManyProducts, Inc. in 2019

With the economy recovered from the 2008 recession, ManyProducts, Inc., is doing well financially. However, its growth means more production and, potentially, more waste. The company president's views are in line with the company's mission statement, which promotes pollution prevention and being a good steward of the environment. However, the board of directors and stockholders always put pressure on the president to continue to perform financially. In meetings with managers, the president conveys the side effects of increased production.

The mining manager is seeking additional land to mine. With the additional mining comes the need to handle the mine tailings and effluent. The chemical manager is under pressure to reduce air emissions because other companies in the state have put the state near nonattainment status under the Clean Air Act. The side effect of being a good environmental steward over the years has, ironically, allowed competitors to emit more pollution into the air. Now, if ManyProducts, Inc. wants to grow, it cannot emit more pollution due to nonattainment status under the Clean Air Act. The manufacturing division has markets for more products. Its manufacturing challenges tend to be excess production of solid waste.

Mining Manager

Since the manufacturing division of ManyProducts, Inc. uses raw materials that come from the mine, the mining manager is figuring out where and how to obtain additional land to mine. However, finding the land is just one challenge. Mining has many environmental impacts, and all laws must be followed. One of the main environmental laws related to mining is the Clean Water Act. Toxic chemical loads (pounds per day) and concentrations (milligram/liter) cannot exceed regulatory limits.

Due to the regulatory limits, many of the byproduct minerals that are typically suspended or dissolved in the mining effluent must be captured and not allowed to go into receiving waters (such as streams or rivers) until treated sufficiently. The mining manager must decide what processes to implement in order to capture the byproduct minerals.



Settling ponds due to construction and leachate ponds from industrial sites
(Garrett, 1999; Photosmith2011, 2011)

From past experience, the company has typically used settling ponds to capture byproduct minerals. Settling ponds are typically operated in series. The first pond must be large enough to allow time for suspended minerals to settle out. The liquid outflow from the settling pond will flow into a secondary settling pond. Into this pond, oxidizing chemicals and alkaline chemicals may be added in order for the dissolved byproduct minerals to form precipitates and settle out. If designed properly, this series of ponds will have sufficiently clean effluent so that it can be discharged into a receiving river. The company will prepare engineering reports and complete permits for submission to local, state, and federal agencies for approval (Kuipers, 2015).

Chemical Products Manager

While the mining manager is directing staff to locate a mining site and determining how to treat mining effluent for compliance with laws such as the Clean Water Act, the chemical products manager is in a position that seems unfair. ManyProducts, Inc. had been implementing emissions controls on its stacks over the past decades—doing even more than simply complying with the laws. However, other companies operating in the same county built chemical, power, and manufacturing plants that have recently put the county on the brink of nonattainment with the Clean Air Act's National Ambient Air Quality Standards (NAAQS) for several chemicals including sulfur dioxide (SO_2) and nitrogen dioxide (NO_2), which the company will emit from its proposed expansion (United States Environmental Protection Agency [EPA], 2014).

While ManyProducts, Inc. would like to produce more chemicals for its markets, the chemical products manager has impressed upon the company president that the state's environmental regulatory agency will not issue the company expansion permits if it emits additional SO_2 or NO_2 without offsets. After some conversations among the president, the chemical products manager, and other staff, the company decided on a strategy. So long as the total NO_2 and SO_2 produced in the county will not increase, ManyProducts, Inc. can expand its facility. However, there must be a reduction in emissions somewhere else in the county to offset the additional new emissions.

Though ManyProducts, Inc. felt that it had been a good environmental steward over the years and that other companies have essentially taken advantage of its good will, the chemical products manager's team developed a strategy where they would install state-of-the-art NO₂ and SO₂ treatment at one of their old chemical plants, which will reduce the emissions from that plant. The new plant will also have state-of-the-art NO₂ and SO₂ treatment and utilize slightly different feed chemicals and more efficient overall processes within the plant. Thus, the total SO₂ and NO₂ emissions from the old, retrofitted plant and the new chemical plant combined will be lower than prior to building the new plant. The plan was acceptable to the state agency.

Manufacturing Manager

During the same timeframe that the mining manager and chemical products manager were working on plans to increase their production while meeting environmental requirements, the manufacturing manager was having meetings to determine how manufacturing could be increased to meet demand. Though manufacturing has some air and liquid emissions, its main challenge is reducing its solid waste handling costs. Simply sending solid waste to a municipal landfill is expensive for their large quantity of waste. For cost savings—and to be true to the company's environmental stewardship mission—the manufacturing manager prefers to use the pollution prevention hierarchy to approach the solid waste challenge. The hierarchy, in preferential order, is source reduction, recycling, energy recovery, treatment, then disposal (EPA, 2015).

The manufacturing manager's team met with in-house engineers, environmental specialists, and consulting firms. After many discussions and a meeting with the company president on this topic, manufacturing determined that a combination of greener and fewer chemicals could be used to substitute the usual types and quantities used. Also, recycling could be implemented for the steel and aluminum waste shards that would be produced. Energy recovery would not be cost-effective because it would require building a furnace. Treatment to clean and reuse rags and some chemicals would be implemented. These pollution prevention efforts would reduce the amount of solid waste by 80%.

Conclusion

This lesson has presented a fictional account of management's decision-making at a large corporation. It presented a scenario of the pressures on the managers exerted by the company president to expand operations in accordance with laws and the company's mission of environmental stewardship.

The mining manager dealt with the challenge of expanding the company's mining activities so that the materials mined could be used in other divisions of the company. Additional mining affects the environment, so environmental laws must be followed to minimize environmental impact. Also, the chemical products manager faced the challenge of expanding chemical production. Unfortunately, the expansion came at a time when other companies had pushed the county's air emissions to its ambient air quality limits. This forced the company to be creative. The decision was made to retrofit an existing plant in order to build a new plant and satisfy air emissions standards. Lastly, the manufacturing manager had solid waste disposal challenges associated with growing its product line. The company was able to use the pollution prevention hierarchy to optimally manage and reduce its solid waste costs and impact on the environment.

The lesson addressed management principles related to industrial and hazardous waste. It presented an appraisal of principles of pollution prevention in management's decision-making and assessed options so that management could make the optimal decisions.

References

- Garrett, D. (1999). *Settling pond construction* [Photograph]. Retrieved from https://commons.wikimedia.org/wiki/File:Settling_pond_construction.jpg
- Kuipers, J. (2015). *Mine tailings fundamentals: Current technology and practice for mine tailings facilities operations and closure, Part 1 – mine tailings facility design and operations* [PowerPoint slides]. Retrieved from https://clu-in.org/conf/tio/mining_051915/slides/Kuipers_Day_One_5-18-15.pdf

Photosmith2011. (2011). *Mopani mine Zambia* [Photograph]. Retrieved from https://commons.wikimedia.org/wiki/File:Mopani_Mine_Zambia.jpg

United States Environmental Protection Agency. (2014). NAAQS table. Retrieved from <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

United States Environmental Protection Agency. (2015). TRI pollution prevention overview. Retrieved from <https://www.epa.gov/enviro/tri-pollution-prevention-overview>

Suggested Unit Resources

In order to access the following resources, click the links below.

The following website presents the Clean Air Act's National Ambient Air Quality Standards.

United States Environmental Protection Agency. (2014). [NAAQS table](https://www.epa.gov/criteria-air-pollutants/naaqs-table). Retrieved from <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

The following website presents the Toxic Release Inventory's pollution prevention hierarchy.

United States Environmental Protection Agency. (2015). [TRI pollution prevention overview](https://www.epa.gov/enviro/tri-pollution-prevention-overview). Retrieved from <https://www.epa.gov/enviro/tri-pollution-prevention-overview>

The following website presents nonattainment areas for the Clean Air Act's National Ambient Air Quality Standards.

United States Environmental Protection Agency. (2016). [Nonattainment areas for criteria pollutants \(Green Book\)](https://www.epa.gov/green-book). Retrieved from <https://www.epa.gov/green-book>

This U.S. Environmental Protection Agency-sponsored document goes into detail about mine tailings fundamentals.

Kuipers, J. (2015). [Mine tailings fundamentals: Current technology and practice for mine tailings facilities operations and closure, Part 1 – mine tailings facility design and operations](https://clu-in.org/conf/tio/mining_051915/slides/Kuipers_Day_One_5-18-15.pdf) [PowerPoint slides]. Retrieved from https://clu-in.org/conf/tio/mining_051915/slides/Kuipers_Day_One_5-18-15.pdf