Introduction
In the United States today, coal provides a substantial fuel source utilized to power our society. About 52 percent of the energy produced in the United States arises from combustion of coal (EIA.gov). The power sector alone accounts for 90 percent of coal consumption (EIA.gov). Although coal is relatively inexpensive, it bears costs in the arenas of both environmental and public health. The coal-fired power plant at the University of Wisconsin-Eau Claire is one of many power plants in the nation that contribute annually to emissions associated with coal combustion. As of February 2010, the Wisconsin Sierra Club sued the Department of Natural Resources, claiming the agency failed to provide requested records on several state-owned coal plants in regard to compliance with the Clean Air Act. The University of Wisconsin-Eau Claire was one of the plants that records were requested and this study was designed to determine potential health risks associated with the plant. In order to do so, both environmental impacts from coal extraction and transport were investigated, as well as the human health impacts associated with combustion of coal.

Coal Production in the United States

![Graph showing coal production in the United States from 1890 to 2005.]

Environmental Health Issues
The extraction, transportation, and combustion of coal all incur health impacts to the environment. Transportation and combustion primarily affect air quality by emitting Sulfur dioxide (SO2), Particulate matter less than 10 microns in size (PM10), Nitrogen oxides (NOx), Carbon monoxide (CO), and Carbon dioxide (CO2) aggregating health concerns and contributing to global warming. Also, many harmful heavy metals such as selenium and mercury are emitted and can bioaccumulate throughout the food chain. Although underground coal extraction methods exist, surface mining is more prevalent and expanding. [Coal] production in the western region increased by more than 800 percent from 1973 to 2003, dominated by surface production [(http://www.eia.doe.gov/emeu/coal/page/coal_production_review.pdf)]. Of the different surface mining methods, mountain top removal-valley fill (MTM/VF) poses the greatest environmental impact. The process of MTM/VF involves removal of coal from a mountain top and collection from the pile that results in the valley below. Evidence shows that concentrations of chemical ions are, on average, about 10 times higher downstream of MTM/VF than in streams in unmined watersheds [(http://www.eia.doe.gov/emeu/coal/page/coal_production_review.pdf)].

Environmental Health Impact from Mountain Top Removal Method

![Image of a watershed view of a mountain top and valley fill.]

Reported Emissions

2001 Emissions from UWEC Power Plant (Annual Tons)

<table>
<thead>
<tr>
<th>Source</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bituminous Coal</td>
<td>23</td>
<td>27</td>
<td>170.0</td>
<td>29.6</td>
</tr>
<tr>
<td>Residual Oil</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Distillate Oil</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>28</td>
<td>170.0</td>
<td>29.6</td>
</tr>
</tbody>
</table>

Source: United States Environmental Protection Agency

Eau Claire County Emissions Total (Annual Tons)

<table>
<thead>
<tr>
<th>Year</th>
<th>NOx</th>
<th>CO</th>
<th>SO2</th>
<th>PM10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>211.36</td>
<td>111.33</td>
<td>170.11</td>
<td>45.07</td>
</tr>
<tr>
<td>2006</td>
<td>216.51</td>
<td>269.54</td>
<td>143.91</td>
<td>50.48</td>
</tr>
</tbody>
</table>

Source: Wisconsin Division of Health Services, Environmental Public Health Tracking Network

Table 1. Outlines the percentage breakdown of underground and surface coal mining methods from 1973-2003.

<table>
<thead>
<tr>
<th>Year</th>
<th>Underground Percentage</th>
<th>Surface Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>1983</td>
<td>38</td>
<td>62</td>
</tr>
<tr>
<td>1993</td>
<td>36</td>
<td>64</td>
</tr>
<tr>
<td>2003</td>
<td>38</td>
<td>62</td>
</tr>
</tbody>
</table>

Sources

Human Health Impacts from Coal Combustion

Respiratory symptoms, hospitalization for heart or lung disease, and even prematur death are primary human health concerns arising from by-products of incomplete coal combustion. Also, the effects of climate change are exacerbated from increased carbon emissions associated with coal-fired power plants. It is noteworthy that certain populations such as children, the elderly, and asthmatics are sensitive populations. Below are criteria air pollutants most heavily emitted by the UWEC coal-fired power plant and their respective health effects.

Sulfur Dioxide (SO2):
- Increased respiratory symptoms (coughing, wheezing, difficulty breathing)
- Decreased lung function
- Aggravated asthma
- Development of chronic bronchitis
- Angina pectoris
- Non-fatal heart attacks
- Premature death in people with heart or lung disease

Nitrogen Dioxide (NO2 or NOx):
- Increased respiratory symptoms
- Increased cardiovascular mortality

Carbon Monoxide (CO):
- Reduced oxygen delivery to brain
- Chest pain in those who suffer from heart disease
- Reduced ability to exercise
- Increased respiratory symptoms
- Can cause death at high concentrations

Asthma and Myocardial Infarction rates in Eau Claire County and Wisconsin

Health Risks Associated with the UW-Eau Claire Coal-Fired Heating Plant

Conclusion and Recommendations

Although asthma and myocardial infarction hospitalization rates have been relatively low in Eau Claire County and the increased risk of death associated with the University of Wisconsin-Eau Claire coal-fired power plant is seemingly small, measures could be taken in order to minimize environmental and human health impacts. Utilizing alternative fuel sources, such as geothermal, biofuels, natural gas, solar, wind, and nuclear may decrease the burden on environmental and human health. It is noteworthy that each of the aforementioned alternatives has associated benefits and costs. Overall, we must decide which energy source is most feasible and practical to power our university and society, while keeping in mind both the environmental and human health impacts that will affect current and future generations.