COAL REFUSE

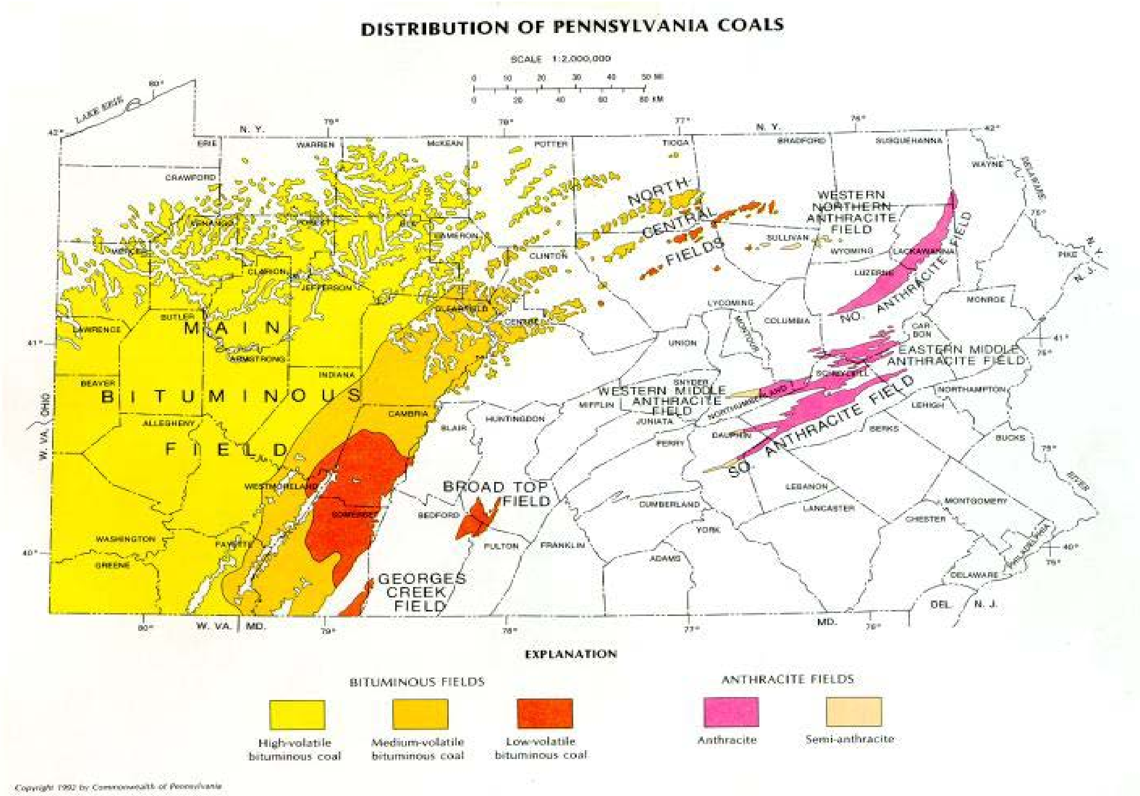
What is coal refuse?

The Environmental Protection Agency (EPA) describes coal refuse as waste products of coal mining, physical coal cleaning, and coal preparation operations containing coal, matrix material, clay, and other organic and inorganic material. Others have described coal refuse as a by-product of coal mining activities, not including overburden, which has been spread on the land. Coal refuse piles vary from a few to hundreds of acres of unreclaimed mine lands.

Pennsylvania regulations define coal refuse as "…any waste coal, rock, shale, slurry, culm, gob, boney, slate, clay and related materials, associated with or near a coal seam, which are either brought aboveground or otherwise removed from a coal mine in the process of mining coal or which are separated from coal during the cleaning or preparation operations. The term includes underground development wastes, coal processing wastes, excess spoil, but does not mean overburden from surface mining activities."

Where was and is coal refuse placed?

Because it is a by-product of coal mining operations, coal refuse is located throughout the coal regions of Pennsylvania and other coal producing states. The coal regions in Pennsylvania are shown in the map below.



Pennsylvania's coal miners have extracted approximately 16.3 billion short tons of anthracite and bituminous coal from the state's mines since commercial mining began in 1800. While mines permitted under the 1997 Surface Mining Control and Reclamation Act (SMCRA) are required to be reclaimed after the coal is extracted and processed, many pre-SMCRA mines were abandoned without any reclamation. These sites are referred to as Abandoned Mine Lands (AML).

Typical coal refuse pile on abandoned mine lands. This site is Mine 37 located near Windber, PA along the Paint Creek.

In Pennsylvania, there are more than 5,000 abandoned, unreclaimed mining areas covering approximately 184,000 acres. The coal refuse piles at these abandoned mine lands cover an aggregated area of 8,500 acres and contain a total volume of more than 200 million cubic yards.

The total amount of coal refuse in Pennsylvania is unknown. Based on the known amount on abandoned mine lands and estimates of the amount of coal refuse associated with historical mining operations, the amount is between 200 million and 8 billion cubic yards. It has been speculated that the amount of coal refuse is approximately 2 billion cubic yards split almost equally between the anthracite and bituminous coal regions.

What problems do unreclaimed coal refuse sites cause?

Land

The coal refuse piles are scattered across the landscape next to communities, rivers and streams and sometimes fill entire valleys. These piles are unsightly and scar the landscape and some areas look like moonscapes. The piles also tend to attract dumping and other activities increasing the potential for nuisances such as starting the coal refuse piles on fire. Abandoned coal mines and coal refuse piles cause many adverse impacts to surrounding land. Unstable coal refuse piles may collapse and threaten the safety of nearby communities and the scenic and recreational quality of the landscape is ruined. Properly reclaimed coal refuse sites can and have returned the land to productive uses including wildlife habitat, recreational opportunities and commercial development.

Large coal refuse pile on an abandoned mine land located directly in the community of Nanty Glo, PA. These piles often attract use of recreational vehicles and other dangerous activities, which causes a safety concern.

Water

More than 3,300 miles of streams in Pennsylvania are impacted by Acid Mine Drainage (AMD), according to the United States Geological Survey (USGS). This is the result of AMD from both mine discharges as well acid runoff from coal refuse piles, as shown in this photograph. The acid mine drainage discharges result from the oxidation of pyrites and maracites (iron-sulfide minerals) from these sites which significantly impacts water quality in the streams into which these contaminated waters flow. The acidic discharges contain iron, manganese, aluminum along with other metals and materials which become more readily soluble due to the increased acidity. The run-off from precipitation in addition to being acidic and contaminated by metals, contains silt which is a pollutant as well. This acidic contaminated discharge creates water pollution and negatively affects the ability of a stream to support and aquatic life.

The chemistry of oxidation of pyrites in a coal refuse pile is very complex. Although a host of chemical processes contribute to acid mine drainage, pyrite oxidation is by far the greatest contributor. The net effect of these reactions is to release hydrogen ions (H^+), which lowers the pH and maintains the solubility of the ferric ion in the water. These reactions can occur spontaneously or can be catalyzed by microorganisms that derive energy from the oxidation reaction.

AMD entering a stream from a nearby coal refuse pile causes the stream to turn orange in color due to the iron precipitating out of solution as the solid iron hydroxide ($Fe(OH)2$). In many streams affected by AMD, the iron hydroxide covers the entire stream bed and rocks.

During 200 years of coal mining, Pennsylvania produced more than 25 percent of the nation's total coal output and presently ranks fourth in the nation in annual coal production by state. Pennsylvania's coal regions are located within, or extend into, the four major river basins in Pennsylvania--the Ohio, Susquehanna, Potomac, and Delaware River Basins. Bituminous coal deposits underlie western and north-central Pennsylvania, and anthracite deposits underlie east-central and northeastern Pennsylvania.

The estimated costs of restoring the land and water sheds is estimated at over $15 billion with over $5 billion needed to address AMD.

Pennsylvania was projected to receive over $1 billion for the Federal Abandoned Mine Land Reclamation fund based on a fee structure that is calculated per ton of coal mined. The expenditures of these monies was prioritized based on health and safety needs before environmental concerns. Consequently, the reclamation of coal refuse sites became low priority and most likely will not be able to be reclaimed through the use of these funds.

Air

Depiction of uncontrolled combustion byproducts commonly referred to as “red-dog”.

Coal refuse sites historically and currently catch fire. Coal refuse fires typically start as a smoldering, oxygen starved fire producing the necessary oxygen from the generation of steam from the moisture in the coal refuse. Slowly, as the fire continues to develop, avenues for oxygen migration through the refuse expand resulting in flames. Combustion of the coal refuse allows uncontrolled toxic air pollutants and greenhouse gases to be emitted into the atmosphere. The toxic air pollutants are a particular health and safety problem in the proximity of the coal refuse fires.

Coal refuse disposal piles have been burning and causing air pollution since coal mining first started (Victor H. Sussman & John J. Mulhern (1964) Air Pollution from Coal Refuse Disposal Areas, Journal of the Air Pollution Control Association, 14:7, 279-284, DOI: 10.1080/00022470.1964.10468282).

The oxidation of pyrites produces an exothermic reaction which produces the heat that causes the carbonaceous material in the coal refuse pile to ignite and burn. The temperature within a coal refuse pile (or portions of a pile) will increase when more oxygen is available to cause oxidation but the amount of air circulating in the pile is insufficient to provide for the dissipation of heat. The temperature of the refuse increases until the ignition temperature of the carbonaceous material in the refuse is reached. At this point the coal refuse pile spontaneously combusts releasing the various uncontrolled air pollutants into the air of the near-by community.

Pennsylvania has identified more than 40 coal refuse piles that are currently burning and at some point will need to be addressed. This does not include underground mine fires. In 2014, the PADEP’s Abandoned Mine Land Program spent $2,213,477.80 in emergency funds to extinguish and reclaim the Anthracite Region’s Simpson Northeast coal refuse fire located in Fell Township, Lackawanna County.

Pennsylvania was the first state to pass a law to address the air pollution associated with coal refuse disposal entitled "The Coal Refuse Disposal Control Act, Act of September 24, 1968, P.L. 1040, No. 318." This has allowed the Commonwealth to address active coal refuse pile fires and to attempt to prevent additional coal refuse piles from catching fire. While the efforts have met with success, new coal refuse fires continue to occur.

The EPA (1978 Study) identified the uncontrolled emissions from burning coal refuse piles. The following pollutants were listed: (1) criteria pollutants (total particulates, respirable particulates, nitrogen oxides, sulfur dioxide, sulfur trioxide, hydrocarbons, carbon monoxide, and mercury); (2) non-criteria pollutants (ammonia, hydrogen sulfide, polycyclic organic materials); and (3) trace elements (arsenic, boron, silicon, iron, manganese, magnesium, aluminum, calcium, copper, sodium, titanium, lead, tin, chromium and vanadium)

The USGS Report entitled "Emissions from Coal Fires and Their Impact on the Environment" identified the following:

"…Self-ignited, naturally occurring coal fires and fires resulting from human activities persist for decades in underground coal mines, coal waste piles, and unmined coal beds. These uncontrolled coal fires occur in all coal-bearing parts of the world (Stracher, 2007) and pose multiple threats to the global environment because they emit greenhouse gases—carbon dioxide (CO2), and methane (CH4)—as well as mercury (Hg), carbon monoxide (CO), and other toxic substances…"

"…In the United States, the combined coast of coal fire remediation projects, completed, budgeted, or projected by the Office of Surface Mining Reclamation and Enforcement, exceeds $1 billion, with about 90% of that in two States—Pennsylvania and West Virginia… Altogether, 15 States have combines cumulative OSM coal-fire project costs exceeding $1 million…."

"…Direct hazards to humans and the environment posed by coal fires include emission of pollutants, such as CO, CO2, nitrogen oxides, particular matter, sulfur dioxide, toxic organic compounds, and potentially toxic trace elements, such as arsenic, Hg, and selenium (Finkleman, 2004). Mineral condensates formed from gaseous emissions around vents pose a potential indirect hazard by leaching metals from mineral-encrusted surfaces into nearby water bodies…"

What is Pennsylvania's experience with reclaiming coal refuse sites?

Over the last 50 years, Pennsylvania's experience has evolved. The commonwealth established and implemented "Operation Scarlift" in the 1960s and 1970s to address environmental damage from mining operations and today participates in the U.S. Department of the Interior's Abandoned Mine Land Reclamation Program, which utilizes money from industry to reclaim abandoned mine lands.

Reclamation costs, based on PADEP AML Program experience, varies between $40,000 per acre to $100,000 per acre. These costs are tied to the physical reclamation (grading, covering with soil, and planting vegetation) of a site. **These costs do not address the treatment of AMD or the elimination of the threat of future fires.** Using these cost-per-acre projections to reclaim sites, the physical reclamation of coal refuse sites of different acreage would be:

a. 20 acres $800,000 to $2,000,000
b. 50 acres $2,000,000 to $5,000,000
c. 100 acres $4,000,000 to $40,000,000

To reclaim these sites properly requires more than just planting vegetation such as beach grass. The sites need to be examined and plans developed to address water pollution problems, proper grading and controls and the proper use of vegetative sustaining cover using indigenous vegetation.

Frequently the PADEP's Abandoned Mine Land Program must utilize emergency funds to remediate coal refuse piles that have become a health or safety hazard. Examples include unstable or literally collapsed coal refuse piles as well smoldering or open flame fires. One experience occurred in 2014 with the Simpson Northeast Refuse Fire, Fell Township in Lackawanna County when the coal refuse pile that had been smoldering ignited in flames. The department had to expend $2,213,477.80 in emergency funds to extinguish the fire and reclaim the pile by grading, covering with soil and planting vegetation.

To extinguish a coal refuse fire, the burning coal refuse must be removed, spread out, and water or other chemicals used to quench the flames. After the fire is extinguished, the coal refuse is re-deposited by spreading and compacting, with the addition of alkaline materials as necessary to neutralize the residual acidic materials. The site is then covered with soil and re-vegetated. Hydrologic controls are also constructed, however, there is no money allocated to provide long-term discharge treatment for pollutants that have not been remediated.

What must be considered in the reclamation of coal refuse piles?

To properly reclaim coal refuse piles, the following, at a minimum, need to be addressed:

- water pollution from run-off and acid mine drainage discharges
- site stabilization including re-grading to insure the stability of the site as well as properly managed water run-off
- covering with vegetative supporting material
- planting with vegetation to support the final land use

The reclamation engineering design must include:

- Installation of hydrologic controls
- Installation of wet land treatment systems for small volume discharges
- Grading and compacting
- Covering of the site with 1 to 4 feet of soil
- Adjusting the soil acidity with alkaline materials
- Addition of fertilizers
- Vegetate consistent with the local flora

As the photograph shows, even after several years the site is still void of vegetation.   Reclamation of a coal refuse site requires far more effort and expenditures than simply planting a species such as beach grass that may survive in that hostile environment. In that situation, the surface water, ground water and air pollution issues still would exist. The only problem that may be addressed by that solution is purely a cosmetic one in that the view of the coal refuse pile is not as stark.

The photograph also shows water pollution in the form of run-off and mine drainage (orange tinted water to the right and bottom of the pile) that is being caused by this abandoned coal refuse site. It is a site that previously experienced a fire, as evidenced by the red-dog (red color material on the top and right side of the pile). The site also has steep slopes that are eroding and will cause future stability concerns. Further, water accumulates on the pile and causes concentrated mine drainage to flow in the nearby stream.

Alternative Solution for reclaiming coal refuse impacted areas

Another approach to reclamation of coal refuse piles and the areas affected by them is through the utilization of coal refuse as a fuel. This solution addresses water pollution, potential coal refuse fires, and reclamation of coal refuse affected sites. Coal refuse can be an effective fuel in facilities designed to burn coal refuse in a controlled manner minimizing environmental impacts. If coal refuse from these sites is used as fuel, the coal refuse is removed, processed, burned and the resultant ash beneficially used to remediate the residual acidity at the site. When reclaimed in this fashion, all of the problems associated with coal refuse piles are permanently addressed. The EPA has described the benefits of coal refuse-fired electric generating units:

> "Coal refuse (also called waste coal) is a combustible material containing a significant amount of coal that is reclaimed from refuse piles remaining at the sites of past or abandoned coal mining operations. Coal refuse piles are an environmental concern because of acid seepage and leachate production, spontaneous combustion, and low soil fertility. Units that burn coal refuse provide multimedia environmental benefits by combining the production of energy with the removal of coal refuse piles and by reclaiming land for productive use. Consequently, because of the unique environmental benefits that coal refuse-fired EGUs provide, these units warrant special consideration so as to prevent the amended NSPS from discouraging the construction of future coal refuse-fired EGUs in the U.S."

Below are examples of before and after pictures of coal refuse pile reclamation projects performed by coal refuse fired plants:

GALLITZIN SITE -- Allegheny Township, Blair County

BEFORE RECLAMATION

AFTER RECLAMATION

ERNEST SITE -- Rayne Township, Indiana County

BEFORE RECLAMATION

AFTER RECLAMATION

ACOSTA SITE -- Jenner Township, Somerset County Permit

BEFORE RECLAMATION

AFTER RECLAMATION

Northampton's Huber Site -- Hanover Township, Luzerne County

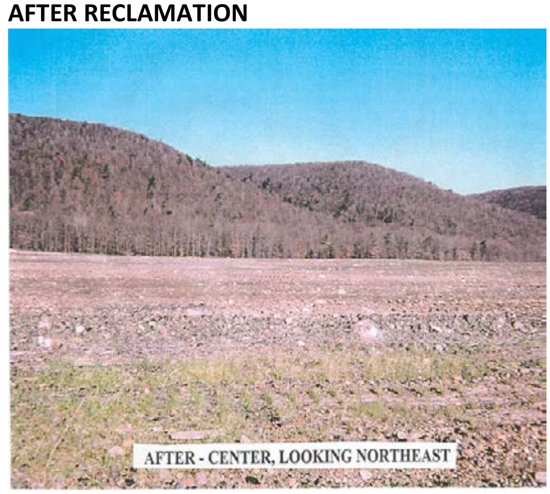
BEFORE RECLAMATION

AFTER RECLAMATION

Panther Creek – Nesquehoning Borough, Carbon County

BEFORE RECLAMATION

AFTER RECLAMATION

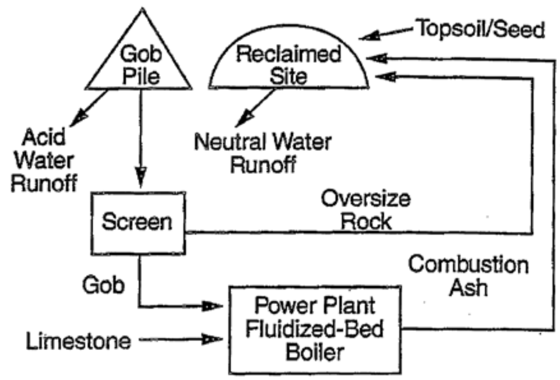


What processes do coal refuse-fired units use to solve the problems associated with abandoned coal refuse sites?

The re-mining of coal refuse piles in accordance with surface mining regulations provides for the reclamation of the energy remaining in this material. Because these sites had discharges to surface and ground waters, the companies are required to develop abatement plans. These abatement plans rely upon the use of acid-forming coal refuse being used as fuel in a fluidized bed combustion boiler or circulating fluidized bed boiler (CFB). The removal of the coal refuse results in the elimination of the AMD. The CFB Units are designed to fire coal refuse with limestone to control acid gas emissions, primarily sulfur dioxide (SO2), while producing an alkaline byproduct (coal ash) that can be beneficially used for mine land reclamation.

The figure below depicts the typical processes used to reclaim a coal refuse site using a coal refuse-fired CFB boiler. The coal refuse material is processed at the mine site by screening to remove rock and other inert materials. The finer material is used as fuel for the alternative energy power plant where limestone is added to the furnace to control acid gas emissions. The resulting ash material, which meets the beneficial use criteria, is returned to the mine site and mixed with any unusable coal refuse material as a means to neutralize any remaining acidic materials. The materials are then compacted in place to contours as described in the surface mining permit.

Typical Reclamation Process with a coal fired CFB boiler



The reclamation of the piles remediates the acidic drainage that comes from the coal refuse pile in two ways. Typically 75 percent or more of the coal refuse is moved off site as fuel for the alternative energy plant meaning the majority of the acidic materials and the resultant water pollution is removed from the nearby waterways. The remaining acidic material is neutralized by the beneficial use ash and compacted in place according to the contours defined in the surface mining permit. In addition, most of the water runoff in the area is diverted to flow around the reclaimed area rather than through the site. Consequently, the previous pollution released from an unreclaimed coal refuse pile is addressed both by reducing the quantity of water flow from the now reclaimed pile as well as by the improved quality of the runoff. The quality of the runoff is improved by removing the acidic materials that would normally dissolve the metals that exist in the coal refuse piles as well as through the change in the solubility of these materials due to the change in acidity at the site. As such the concentration of the acidity as well as the metals such as iron, aluminum, and manganese in surface and groundwater releases are significantly reduced.

What is the air emission profile of a coal refuse fired CFB boiler?

Coal refuse-fired units convert coal refuse into steam and electricity by burning the fuel in a highly controlled and regulated fashion, using a specialized type of technology, circulating fluidized bed boiler (CFB) with limestone injection for acid gas control. These units are also equipped with fabric filter systems to control filterable particulate matter (FPM) emissions. The coal refuse-fired units control emissions of SO2, nitrogen oxides (NOx), air toxics, FPM and total particulate matter (TPM).

These units are some of the lowest emitters of mercury and FPM. That is evidenced in their use in the development of the MATS rule. Multiple coal refuse-fired units were included in Maximum Achievable Control Technology (MACT) Floor calculations (top 12% performing units) used to establish the emission standards for mercury and non-mercury metals. The result of the inclusion of these coal refuse-fired units resulted in lower MATS emission standards for mercury and non-mercury metals (including the FPM surrogate) than would have otherwise been established. While the coal refuse may be higher in mercury content, coal refuse fired units are very low emitters of mercury and are a primary reason why the MATS mercury emission rates are low for all coal-fired units.

In addition, the emissions of greenhouse gases from these units can be considered as offset due to the eventual in-place burning of the coal refuse piles. Coal refuse fires also result in the uncontrolled release of the same pollutants that these plants control with high removal rates. Because these units provide electricity to the grid they also reduce emissions from other fossil fuel-fired EGUs which otherwise would be operating. The reclamation and re-vegetation of coal refuse sites also results in the expansion of green spaces which aids in the sequestration of GHGs.

What is coal ash or Coal Combustion Residuals (CCR) and how can they be beneficially used for reclamation of coal refuse sites?

EPA has classified coal combustion residuals (CCRs), also called coal ash, as non-hazardous. Further, EPA has stated that due to the unique characteristics of surface mine reclamation the regulations are not applicable to the utilization of coal ash in coal mine land reclamation but EPA will be working with the Federal Office of Surface Mining Reclamation and Enforcement in the development of their rules. This office has been reviewing and analyzing various state programs including Pennsylvania as part of their process to develop rules that reflect best practices. Under the Pennsylvania Regulatory Program, the beneficial use of coal ash in coal mine land reclamation is a two-fold program.

The first component of Pennsylvania regulatory program is the certification and ongoing recertification of the coal ash for having a beneficial use in coal mine land reclamation. The coal ash certification process involves a comprehensive review of the source of the coal ash and an ongoing evaluation of the physical, chemical and leaching properties of the ash both at the point of generation and the where the coal ash is placed. Coal ash and coal ash leachate are analyzed for 37 different chemical constituents and properties. The ash leachate must consistently contain concentration levels lower than the certification requirements set forth in the regulations in order to be approved for statewide beneficial use at coal mine sites.

The second component of this regulatory program is integrating the beneficial use of the coal ash in coal mine land reclamation through Pennsylvania's Coal Mine Primacy Regulatory Program or through contract when the utilization is tied to the reclamation of abandoned mined lands. The programs are designed to insure that the management of the coal ash at the coal mine site will result in the reclamation of the land and improve water quality.

Over the past fifty years, the Pennsylvania's program have demonstrated its effectiveness. This is especially true for the coal refuse sites that have been re-mined and reclaimed.

Are there examples of the benefits provided by this reclamation?

There are numerous case studies regarding the reclamation of coal refuse sites and the benefits achieved. The REVLOC Site and Maple Coal Site are two such examples:

REVLOC, PENNSYLVANIA

Revloc, PA is located in Cambria County approximately 90 miles east of Pittsburgh in the heart of the western Pennsylvania coalfields. The mining town centered the Revloc mine built in 1916-17. The Revloc mine later became Bethlehem Steel's Mine 32 and Beth Energy operated the mine until it was closed in the 1980s.

REVLOC Site – Pre-1989

In 1989, Ebensburg Power Company obtained a surface mining permit from the PA DEP for the re-mining and reclamation of the western side of the Revloc coal refuse pile. The reclamation project required the processing of the coal refuse to produce usable fuel by separating out some reject material that could not be burned in the CFB. The larger sized reject material consisted of the rock, clays, and "red dog", or the material left from the in-place burning of the coal refuse over the last century.

The fuel was trucked to Ebensburg Power Company's coal refuse-fired power plant and used for the production of alternative electric energy. The fuel was combusted with limestone, which controls acid gases in a circulating fluidized bed boiler. The ash that that is produced meets all criteria for beneficial use for coal mine land reclamation. This beneficial use ash was returned to the Revloc site and mixed with the reject material, compacted and contoured as defined in the surface mining permit.

In 1997, at the request of the local townspeople and the PADEP, Ebensburg submitted and received a surface mining permit for the re-mining and reclamation of the eastern side of the Revloc coal refuse pile.   This part of the coal refuse pile was burning and on days when the wind was blowing from the east, the fumes would inundate the Revloc community. As part of the re-mining and reclamation work, Ebensburg Power Company extinguished the fires and ended the air pollution from the coal refuse pile that had occurred over the last century.

That coal refuse pile contained approximately 4,120,000 tons of material and covered approximately 53 acres of land. The eastern and western parts of the pile were separated by the South Branch of the Blacklick Creek. The runoff from the coal refuse pile would all flow into this creek resulting in the stream being devoid of aquatic life. The runoff from the coal refuse pile before reclamation discharged 226 tons per year of acidity, 0.5 tons per year of iron, 1 ton per year of manganese and 33 tons per year of aluminum.

The reclamation project was completed in 2011. During the project life, approximately 3,200,000 tons of usable coal refuse was removed from the site, and approximately the same number of tons of beneficial use ash was returned to neutralize the remaining acidic compounds contained in the reject material. The cost of the project was approximately $24 million.

The process reclaimed about 56 acres, of which 20 acres are available for industrial development. The coal refuse piles and fires are gone forever and approximately six miles of the South Branch of the Blacklick Creek has returned to a quality which supports aquatic life, including trout. The reclamation process reduced the acidity from the baseline by 93 percent, reduced iron by 92 percent, reduced manganese by 71 percent and reduced aluminum by 95 percent.

REVLOC Reclaimed

On December 12, 2008, the local paper the Johnstown Tribune-Democrat described and proclaimed the Revloc Reclamation Project as a **"**huge success**"**.

MAPLE COAL Site

Maple Coal Company – Colver Refuse Site, Barr and Blacklick Townships, Cambria County, PA.
Elk Creek (North Branch of Blacklick Creek; Blacklick Creek; Conemaugh River; Kiskiminetas River; Allegheny River; Ohio River)

Maple Coal Company (Maple), a wholly owned subsidiary of Inter-Power/AhlCon Partners, LP, provides coal refuse fuel to the Colver Power Plant (located in Cambria County, Pennsylvania).

The Maple Coal Company currently has three surface mining permits to mine coal refuse for use in their circulating fluidized bed boiler at the Colver Power Plant, the resulting alkaline ash is beneficially utilized to reclaim the area previously occupied by the acidic coal refuse. During the mining and reclamation activities, "red dog" was encountered providing evidence that the coal refuse had previously burned in-place.

Site reclamation of the Colver refuse site began in 1995 and has continued to this date. The majority of the coal refuse has been removed and the vast majority of the alkaline coal ash placement has been completed in the areas that were producing the AMD related to the first two Surface Mining Permits (SMP). Maple is now developing the area related to third SMP which will address the last remaining source of AMD in this portion of the drainage basin.

Pre-1965 Coal Refuse Mining and Reclamation

The Subchapter "F" monitoring stations (SW-2B, SW-4A and SW-23) on the Colver Refuse Site SMP #11900201 and the Rail Yard Refuse Site SMP #11970201 provide evidence that the water quality was severely impacted by AMD prior to the commencement of Maple's reclamation operations. At the time of the original permit application, it was assumed that the removal of the acidic coal refuse and the beneficial use of the alkaline coal ash during their reclamation activities would improve the quality of the receiving stream (Elk Creek) by improving the water quality of the Subchapter "F" water monitoring stations (SW-2B, SW-4A and SW-23).

The pre-mining water quality from abandoned mine discharges to Elk Creek and its tributaries from the above referenced surface mining permits (abandoned coal refuse sites) accounted for 843.5 total tons of acidity, iron, manganese, and aluminum for the water samples collected and analyzed April 13, 1995, through April 8, 1996. The loadings in pounds per day is the average for the entire year based on twenty five samples/bi-monthly monitoring at each monitoring point.

Pre-Mining Loading on Elk Creek

April 13, 1995 through April 8, 1996

Acidity	689,149 lb/yr	344.6 tons/year
Iron (Fe)	23,932.9 lb/yr	11.97 tons/year
Manganese (Mn)	3,952.95 lb/yr	1.98 tons/year
Aluminum (Al)	47,779 lb/yr	23.89 tons/year
	TOTAL	382.44 tons/year

The most current data (December 18, 2013 through December 8, 2014) collected at these same monitoring stations indicate that the total tonnage of acidity, Fe, Mn, and Al is 1.0 tons or a reduction of 381.44 tons (99.73%). The loadings pounds per day is the average for the entire year based on thirteen samples, one sample per month per sampling point.

Post Refuse Removal – Site Utilization of Beneficial CFB Ash Placement

December 18, 2013 through December 8, 2014

			% Improvement Over Baseline
Acidity	799.8 lb/yr	0.40 tons/year	99.9%
Iron (Fe)	573 lb/yr	0.28 tons/year	97.6%
Manganese (Mn)	32.85 lb/yr	0.16 tons/year	99.2%
Aluminum (Al)	32.85 lb/yr	0.16 tons/year	99.9%
	TOTAL	1.0 tons/year	99.73%

Present Coal Mining and Reclamation Activities