Expert Report

Major Technical Issues Involving the Hazleton Creek Partners, LLC Site
Hazleton City/Luzerne County/Pennsylvania

Appeal
General Permit #WMGR085
General Permit #WMGRO85D001, (GPD001)

Before the
COMMONWEALTH OF PENNSYLVANIA
ENVIRONMENTAL HEARING BOARD
EHB Docket No. 2005-327-K

Produced at the Request of

JOHN WILMER
Attorney for Appellant
21 Paxon Hollow Road
Media, PA 19063
PA ID. No. 33119

By

Robert A. Gadinski, P.G.

105 Main Street
Ashland, PA 17921

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Introduction

This Expert Report was produced and the underlying research performed to develop it was done at the request of John Wilmer, Esq. Mr. Wilmer is an attorney retained by appellant in the appeals of General Permit #WMGR085 and WMGRO85D001, (GPD001) before the Commonwealth of Pennsylvania Environmental Hearing Board, EHB Docket No. 2005-327-K. The report presents the results of an investigation of the geologic aspects of contaminant migration from the proposed reclamation activity and the adequacy of the site characterization conducted by the applicant to investigate the site and determine the potential threats to the public health and the environment.

Summary

The Hazleton Creek Partners (HCP), LLC. Site is located to the west of Hazleton City, Luzerne County, Pennsylvania in the Valley and Ridge Physiographic Province in Eastern Middle Field of the Anthracite Coal Region of northeastern Pennsylvania. The site has been extensively deep and surface mined resulting in a complex hydrogeology relative to this site caused by the historic mining activities.

In addition, this site has been subjected to disposal of documented and undocumented municipal and hazardous wastes from 1940-1976. The city leased the property from a private real estate company until 1984. It has been reported that thousands of 55 gallon drums of hazardous wastes identified with waste characteristics as being toxic, ignitable and flammable and "Bulk Wastes" were illegally disposed of on this site. On January 21, 1981 "the landfill was ordered closed by the PADER because of fire and operational problems." By January 26, 1981"the fire had been extinguished and all solid waste was adequately covered" **(Health Consultation, Hazleton City Landfill, (May 24, 2001))**. PCB capacitors were recently found on this site and this matter is being handled by the United States Environmental Protection Agency (USEPA) Region III from an environmental standpoint.

General Permit No.WMGR085 (GP) was issued on March 2, 2004 and published in the Pennsylvania Bulletin on March 13, 2004, for the processing and allegedly beneficial use of freshwater, brackish and marine dredge material (dredge material); cement kiln dust and lime kiln dust (dust); and coal ash and cogeneration ash (coal ash) in mine reclamation.

HCP was issued a Determination of Applicability (DOA), General Permit No. WMGRO85D001, (GPD001) on October 5, 2005 and published in the Pennsylvania Bulletin on October 22, 2005, for use at a site bounded by Routes 924/309 and Broad Street, Hazleton, PA (Hazleton Site).

Normally, mine reclamation is accomplished by using available on site overburden (mine spoil) for backfilling. The above referenced permits would allow the applicants to use fill material from man-made sources in an attempt to achieve the same objective as overburden. Fly ash, kiln dust, river dredge and brackish water harbor dredge sediments are to be disposed directly into the pit without a liner or containment system. Fly ash sources are from coal fired power plants located throughout Pennsylvania, New York and New Jersey. Kiln dust sources are from cement and lime plants, located in eastern Pennsylvania. The dredge materials originate from freshwater, brackish and marine sources, including the Delaware River near Philadelphia, the New York Harbor, Chesapeake Bay and Baltimore Harbor. These man made materials contain numerous contaminants alien to the area and not contained in site overburden.

Transport, storage, mixing and disposal of the imported waste materials to the mine pits will result in the escape to the environment of chemicals via runoff, dusts and leachates that are unnatural to the area and will compound the contamination already present. The effects of mixing of the imported with the on site contaminants is unknown and may have dire consequences (e.g. fires, release of noxious gases, etc.). Furthermore, the imported materials will cause contamination of the surrounding environment simply by its transport. The lack of an underdrain collection system in the surface mines will allow leachates to infiltrate directly to the abandoned deep mines that underlie this site eventually affecting groundwater, the mine pool and the Jeddo Tunnel discharge to the Nescopeck Creek.

Effective groundwater/vapor monitoring systems do not exist, therefore, threats to the public health and environment cannot be detected. Because of the disposal of large volumes of hazardous wastes at this site not only is there a threat from the contaminated groundwater/surface water but also from toxic vapors off gassing from the contaminated water and buried hazardous waste locations on site.

Opinions

1. The Site Characterization is Totally Inadequate to Understand the Site and to Design Effective Groundwater and Vapor Monitoring Systems.

2. The Lateral Vapor Pathway was Totally Ignored despite the Documented/ Undocumented Disposal of Large Volumes of Municipal and Hazardous Wastes on Site.

3. The Flawed Bark Camp Investigation has led to a False Sense of Confidence in the Use of Wastes in Mine Reclamation in Pennsylvania.

1. The Site Characterization Is Totally Inadequate to Understand the Site and to Design Effective Groundwater and Vapor Monitoring Systems.

Hydrogeology "encompasses the interrelationship between geologic materials and processes with water" Fetter (1980). Therefore, a complicated geology predisposes a site to a complex hydrogeology. In the case of the Hazleton Creek Properties site the complexity begins with: (a) A structural geology characterized by severe folding and faulting, (b) The presence of 9 coal seams that have been both surface and deep mined,

(c) The presence of overburden and spill banks of rock and waste coal produced by the mining activities, (d) The fact that the site was glaciated and covered with glacial drift, (e) The presence of wastes including: residential, industrial and hazardous that have been disposed on site in numerous locations both known and unknown, (f) The presence of surface depressions and mine openings that allow for the infiltration of surface water without any obvious outlets. Therefore, because of the variability of the geology, site materials, mining features and waste etc. due diligence to ensure a comprehensive understanding of the site would be of paramount importance. Furthermore, by virtue of the documented variability and complexity of the site one would expect a groundwater monitoring system designed with adequate monitoring wells spatially distributed, both laterally and vertically, to ensure the site was effectively monitored to make sure that human health and the environment were protected. The following will demonstrate that contrary to what would be expected as a sound technical approach was not undertaken and more importance was given to the sustainability of the project rather than protecting human health and the environment.

The applicant has failed to determine the existence of, or identify and characterize any and all water bearing zones from the surface to the mine pool; has failed to characterize and identify potential groundwater zones above the mine pool controlled by geologic structure at shallower elevations than the mine pool; has failed to determine the flow of surface water that has entered into mine openings or depressions on the property; has failed to evaluate each coal seam for potential sheet flow of water controlled by the bottom rock of each seam and barrier pillars. Because of these failures in evaluating the variables on site it can be said that with a reasonable degree of scientific certainty that the site has not been effectively characterized both laterally and vertically by the applicant.

Failure in conducting an appropriate site characterization was supported by an excerpt from Groundwater Sciences that states that "the deep mines in the Hazleton Basin are served by a drainage tunnel system which maintains the mine pool at a depth of approximately 500 to 600 feet below the current site surface elevation." However, the deepest monitoring well is GW-B5D at 169 feet total depth with all of the other monitoring wells having total depths of less than 100 feet, (Appendix B. Unit B Test Pit Logs and Well Logs). Furthermore, Groundwater Science notes that "the groundwater and leachate encountered in each of the wells (GWB-2S, GWB-3S and GWB-4S) is perched since these wells are located in areas where underlying coal veins were deep mined, and all infiltration and storm water eventually percolated down into the underlying mine pool**."(Volume I. Remedial Investigation/Feasibility Study Report, Unit B of Parcel A, City of Hazleton, Pennsylvania, Prepared for: Hazleton Redevelopment Authority, Prepared by: Groundwater Sciences Corporation. August 1995.)**

At the southern end of the project area adjacent to Route 309 (Unit C) a small synclinal structure has been identified that is elevated above the much deeper Hazleton Syncline. (**Draft. Phase I. Environmental and Geotechnical Assessment, City of Hazleton, Parcel A, Hazleton Pennsylvania, Groundwater Sciences Corporation, Ross Consulting Engineers and Lesny and Kitlinski Associates. May 17, 1994)**

This elevated synclinal structure may be a discrete mine pool (water bearing zone) above the regional mine pool. This shallower mine pool was never investigated nor was it determined if it was hydraulically connected to the Hazleton Shaft. These structural undulations may represent water bearing zones not even considered in the site characterization and may have a major role in transporting contaminated groundwater off the HCP property. It has been discovered during depositions that private wells exist along Route 309 and may be in communication with the HCP site. However, groundwater gradient has never been established between the site and the potential groundwater receptors located along Route 309. Not one potentiometric surface map, based on actual field data, depicting groundwater movement has been prepared for this site for review. Such a map is an intricate step in any valid site characterization.

"Barrier Pillars" in deep mines served specific mining purposes. Those purposes were: (a) provide boundaries between workings, (b) control water movement, (c) control air movement. Therefore, considering the purposes of "Barrier Pillars" their locations can and do have a major impact on site specific mine water movement. Their presence can only be verified by drilling because they were also subject to "Robbing". It may be true that the water may eventually exit the basin via the Jeddo Tunnel but the route it may follow is total speculation without drilling to verify the competency of the barrier pillars. No effort has been made in identifying the location of barrier pillars relative to site or the affect these structures had on mine pool water movement.

"Pillar Robbing" also known as Second Mining was a widespread practice in the Anthracite Coal measures. This practice involved the removing of support pillars after the completion of First Mining. First mining is the initial extraction process when entry was made into the virgin coal seam and half of the coal was left in place in a "Room and Pillar" pattern to support the roof rock. As the coal was exhausted the mining would retreat to the mine opening and in conjunction with this retreat the support pillars were removed and a roof fall would occur. In many cases this practice was depicted on mining maps; however, in many cases it was not and the presence of a pillar on a mine map is mere speculation unless the pillar is drilled to determine its presence. Mine maps showing the location of pillars in the mining operations was not provided.

The applicant has failed to conduct any active field investigations to determine the existence and effects of mine subsidence except for Unit C. Mine subsidence is a real problem in the Anthracite Coal Region because of the highly dipping beds which allows for the movement of debris down dip great distances and can result in significant surface damage and deformation. The same holds true of waste disposed on site without a liner. Wastes used for backfilling at this site can move great distances down into the mine workings and mine pool during a subsidence event. Without an adequate mine subsidence investigation and a effective groundwater monitoring system the extent and impacts of such an event would go undetected until serious consequences to the public health and/or environment was realized.

The consultant for the applicant has identified areas of subsidence potential but no active investigation either by using geophysical tools or drilling was conducted to determine the presence or effects of subsidences in the identified areas of Units A and B, if any. The drilling of mine subsidence potential zones is the proven method and is conducted frequently at permitted landfills in the Anthracite Region because of the dangers that can result from failing to investigate and ascertain this potentiality. Consequently, there are numerous unknowns regarding the subsidence potential at this site representing public safety and environmental issues.

The susceptibility of this site to mine subsidence was demonstrated on June 30, 2006 when a zone of subsidence was discovered during the joint HCP, SUFFER, CAUSE, PADEP, city of Hazleton site visit of June 30, 2006 accompanied by Hearing Examiner LeBuskas. This subsidence was in evidence in an area recently reclaimed by the PADEP. It is unknown if any investigation or mitigation of this subsidence occurred subsequent to the site visit.

In conjunction with the site inspection of June 30, 2006 groundwater gauging of monitoring wells was conducted. It must be noted that this site inspection that included representatives of HCP, SUFFER, CAUSE, the city of Hazleton and Hearing Examiner LeBuskas was conducted 2 days after record rainfall fell on the region (16" of rain). Except for the shallow wells located near the combined sewer outlet (CSO) onto site, which are shallow wells, all deep wells on site were dry despite the enormous rainfall event that caused major flooding in Schuylkill and Luzerne Counties. Additionally, except for the (CSO) area along the railroad tracks no standing water was located on site indicating immediate infiltration/percolation of surface water into the subsurface. Obviously, a groundwater monitoring system is useless if the system is comprised of dry wells. The PADEP **[Groundwater Guidance Manual (December 2001)]** states that "Monitoring wells should achieve one or more of the following: 1. Provide access to the groundwater system for collection of water samples; 2. Measure the hydraulic head at specific locations in the groundwater flow system; 3. Provide access for conducting tests or collecting information necessary to characterize the aquifer materials or other hydrologic properties" the monitoring wells at the HCP site accomplish none of the stated objectives. Furthermore, the stated purposes of a groundwater monitoring system as espoused by the PADEP are technically sound; however, it is reprehensible that these objectives were totally ignored by the PADEP in the permit approvals, including the groundwater monitoring system

The National Academy of Sciences (NAS) has taken the position that most combustion waste sites have not been adequately monitored and recommends that "multiple wells at multiple depths and multiple locations are necessary to monitor a Coal Combustion Residue site. Since flyash, CKD, LKD and dredge is proposed for this site this monitoring recommendation is appropriate. **Managing Coal Combustion Residues in Mines (2006) pg.142** that:

> An ideal groundwater monitoring system should include wells installed at multiple depths and multiple locations, concentrated primarily in the probable directions of groundwater flow with additional wells to characterize upgradient water quality. Overall, well screens should be placed in a range of materials, including coal spoils, CCRs, blended materials, and undisturbed geologic materials, to provide information that is representative of variations present at the site. Downgradient wells should be sited with an understanding of the travel times for contaminants to reach these monitoring points. Several monitoring points should be established along predicted flow paths at distances downgradient from CCR emplacement that will yield early (i.e., during the established bonding period) confirmatory information regarding predicted CCR leachate transport (e.g., advection, dispersion, dilution, attenuation). If uncertainty exists regarding the directions of groundwater flow or if ongoing mining and associated groundwater pumping could disrupt groundwater flow, additional wells may be necessary to capture the movement of any contaminant plume. As discussed above, if wells are placed only at the permit boundary, water quality monitoring for the length of the bonding period may not detect a contamination problem, even if one exists. If downgradient contamination is detected, additional wells may have to be installed to assess the impact of CCR on groundwater resources. At least one well (or a suction or pan lysimeter for unsaturated conditions), and preferably two wells, should be placed directly in the CCR to monitor local porewater chemistry and assess the field leaching behavior. These data should then be compared to the predicted flux rates in the site conceptual model.

Therefore, without the existence of monitoring wells that evaluate potential water bearing zones to include the mine pool it is impossible to determine the movement or quality of the groundwater both laterally and vertically at this site and the presence of any potential threats to the public health and the environment. The PADEP, **Groundwater Monitoring Manual (2001),** also emphasizes the need to monitor the mine pool and provides guidance on proper procedures and well construction. For some reason this guidance was not followed at the HCP site by either the PADEP or the applicant

It has been the position of the applicant and their consultants that the site was drained to the Jeddo Tunnel through a connection with the Hazleton Shaft, however, the depth to the mine pool was never established, the saturated thickness of the mine pool at the proposed disposal area was never determined, the pathway had never been explicitly defined and the suggested pathway was not verifiable because of the lack of site specific mine maps and water level data provided to ascertain this connection.

Based on a review of mine maps of the Diamond Coal Company that included the 9 coal seams found on site it was very apparent that the suggested pathway to the Jeddo Tunnel, as provided by the applicant and their consultants, was far too simplistic.

Mine maps of the Mammoth Vein indicated a bottom rock elevation of less than less than 900’ (lowest elevation of 874.6’) for the West Gangway “A” 8th Lift the lowest mine structure in this coal seam. This gangway extends from the proposed disposal area on site in the direction of the Hazleton Shaft, directly beneath the city of Hazleton, in basically an east northeast direction. Tunnel X in the Hazleton Shaft has an invert elevation of 1080’ and the invert elevation of the Jeddo Tunnel discharge was at 1030’. Consequently, the bottom rock of the Mammoth Vein, West Gangway “A” 8th Lift, places it more than 100’ deeper than the invert elevation of the Jeddo Tunnel and nearly 200’ deeper than the invert elevation of Tunnel X that connects to the Jeddo Tunnel in the Hazleton Shaft.

In order for groundwater/mine pool water from the proposed disposal area to reach the Jeddo Tunnel discharge, it must have a hydraulic head greater than 1080’, the invert elevation of Tunnel X. Because of the elevation of the West Gangway “A” 8 th Lift a hydraulic connection with the Hazleton Shaft capable of draining the entire mine workings beneath site becomes impossibility. Obviously, the project area is not fully drained to the Hazleton Shaft because up to 200’ of mine workings at the project site have elevations less than the invert elevation of Tunnel X (1080’) and the Jeddo Tunnel (1030’). Furthermore, there are 3 coal seams (Buck, Gamma and Wharton with the Buck Vein being the lowest mined unit) below the Mammoth Vein.

Furthermore, because of the documented and undocumented disposal of hazardous wastes at this site it becomes more imperative to establish the depth to site specific groundwater and/or the mine pool and determine the quality of this water to ascertain if contaminants are present that could jeopardize human health and the environment. It is unconscionable to ignore the possibility of historical contamination existing in the mine pool and now, to dispose of wastes on the site that can compound the contamination already present. The applicant has failed in adequately characterizing the site to develop a full understanding of the subsurface. Consequently, it is unknown if appropriate monitoring systems (vapor and groundwater) must be implemented to monitor the water and vapor pathways. In this case not one effective monitoring well has been advanced to the mine pool to ascertain the depth to the mine pool or to establish mine pool quality relative to the proposed disposal area. Hence, how could this determination be made regarding the presence of complete or incomplete pathways?

The applicant and his consultant has proposed using the Hazleton Shaft as a monitoring point for the HCP site, however, because of the distance, the dilution from the rest of the Hazleton Syncline , and the total depth of the Hazleton Shaft it is a totally inappropriate monitoring point for a project of this magnitude. Conventionally, monitoring wells are drilled as close to the waste as possible to determine if leakage is occurring from the disposal site to ascertain the threat and to implement appropriate mitigative action(s). This is especially true in this situation in which the mine pool underlies a populated area of the city of Hazleton and discharges via the Hazleton Shaft to the Jeddo tunnel. Without site specific wells at site that are capable of monitoring all water bearing zones to and including the mine pool any detection of historic contaminants and future contaminants in the shaft cannot be tracked back to the source. A technically sound monitoring system as discussed, located as close to the waste as possible, was required at every permitted waste facility located in the coal measures both lined and unlined but for some reason not at this site.

The proposal to use the Hazleton Shaft was a major ‘Step Back” in environmental/ human protection without site specific wells because the quality of groundwater beneath and proximal to the mine pool at site has not been ascertained. Outstanding questions are: What historical contaminants are presently found at site? What contaminants are currently in transport and in what zones? At what elevation does the water from the HCP site enter into the Hazleton Shaft? As in a monitoring well a determination of vertical stratification of contamination entering into the shaft should be determined **(Groundwater Monitoring Manual-December 1, 2001).** A sample taken from the top of the water column without considering the entry points of water entering and potential stratification of contamination in the Hazleton Shaft is totally unacceptable. What are the risks to residents living above the mine pool or groundwater flow zones above the mine pool? A connection between the site and the Hazleton Shaft has been suggested by the applicant and their consultants; however, without mine maps and hydraulic head measurements from site specific monitoring wells and the Hazleton Shaft this is a total assumption and is totally unverifiable.

Besides the plaintiffs in this matter at least one federal agency, the Agency for Toxic Substances and Disease Registry (ATSDR), has taken a position on the reclamation of this site in the **<u>Health Consultation</u>, Hazleton City Landfill, Hazleton, Luzerne County, Pennsylvania, EPA Facility ID: PAD980693964 (May 24, 2001**), various Conclusions and Recommendations were proposed by this agency:

<u>Conclusions:</u>

"We conclude that the current site poses an indeterminant health hazard. Although there are reports of drums being disposed of on site, there is no thorough and complete documentation of actions being taken to confirm or address that issue. Additionally, there is insufficient surface, soil and leachate data to allow a complete evaluation of potential exposure under current or future use scenarios." Based on this conclusion insufficient data was available to conduct a Risk Assessment at this site and the possibility of health impacts could not be ascertained.

<u>Recommendations:</u>

"We recommend that steps be taken to eliminate access to the site by trespassers (e.g. fencing, posting signs, etc. The physical hazards and potential chemical hazards on site are sufficient to warrant these recommendations."

"We recommend that the site be completely characterized (e.g., soil, soil gas, buried waste, etc. before any redevelopment activities are initiated**. A comprehensive groundwater study needs to be done if development of the area is to proceed**."

It must be further noted that in 2001 when the Health Consultation was released the use of dredge, flyash, CKD, LKD and biosolids was not considered as part of the reclamation. Obviously, with the introduction of the proposed wastes, ATSDR should be consulted regarding their previous position and if this position had changed because of the proposed waste stream intended for site.

From the conclusions and recommendations derived by ATSDR it is apparent that the site has not been adequately characterized from a health perspective. If ATSDR was of the position that site characterization activities were inadequate it is difficult to understand how a state agency (PADEP) could derive contrary conclusions based on non existent data. It must be noted that the position of ATSDR is consistent with the plaintiffs in this matter because public health is more important than the disposal of wastes at this site.

The magnitude and extent of groundwater/mine pool contamination is unknown since not one well has been advanced to the mine pool or used to evaluate other water bearing zones above the mine pool. Additionally, contaminants associated with the proposed waste backfill can contaminate site groundwater/mine pool and will go undetected because of a technically deficient groundwater monitoring system which has not been advanced to the mine pool under site. Therefore, because of the shortcomings in site characterization listed above, I can say with a reasonable degree of scientific certainty, that the site has not been adequately characterized and the threats to the public health and the environment is possible; but will remain unknown because of ill advised/scientifically deficient approvals for site development. Hopefully, the residents of the city of Hazleton will not become a living monitoring system for this site that will detect impacts either by sensory detection or as a result of health impacts. Ideally, an early warning system capable of detecting and measuring potential health impacts to the public and the environment should be used rather than the human alternative.

2. The Lateral Vapor Pathway Was Totally Ignored Despite the Documented/ Undocumented Disposal of Large Volumes of Municipal and Hazardous Wastes On Site.

The HCP site has been subjected to disposal of municipal and hazardous wastes from 1940-1976. The city leased the property from a private real estate company until 1984. It has been reported that thousands of 55 gallon drums of hazardous wastes identified with waste characteristics as being toxic, ignitable and flammable and "Bulk Wastes" were illegally disposed of on this site. On January 21, 1981 "the landfill was ordered closed by the PADER because of fire and operational problems." By January 26, 1981"the fire had been extinguished and all solid waste was adequately covered" **(Health Consultation, Hazleton City Landfill, (May 24, 2001))**. PCB capacitors were recently found on this site and this matter is being handled by the USEPA Region III from an environmental standpoint.

Needless to say this site has been exposed to the disposal of all types of waste and in order to determine if a risk exists it is necessary to evaluate every potential pathway that can impact human health and the environment. ATSDR in the" **[Health Consultation, Hazleton City Landfill, and (May 24, 2001)]** "defines an exposure pathway as having 5 parts: (1) Source of contamination, (2) environmental media and transport mechanisms, (3) point of exposure (4) route of exposure, and (5) receptor population. Exposure pathways are identified as completed, potential, or eliminated. In completed exposure pathways, the 5 elements exist, and so exposure has occurred, is occurring or will occur. In potential exposure pathways, however, at least one of the 5 elements is missing or could exist. Potential pathways indicate that the exposure to a contaminant could have occurred in the past, could be occurring now or could occur in the future. An exposure pathway can be eliminated if at least one of the 5 elements is missing and will never be present."

At the HCP site all 5 parts exist for a complete exposure pathway:

(1) Source of contamination

At this site there are numerous sources of contamination that have been documented and other sources (e.g. PCB capacitors) have recently been identified by concerned citizens in the area. There is the potential that other unknown sources exist at this site and without further intrusive work to determine the location of other areas of contamination site workers are at risk if such an area is accidentally uncovered. As stated previously the wastes did ignite at site in 1981 which resulted in the closure of the landfill.

(2) Environmental Media and Transport Mechanisms

Both groundwater/mine pool water and air are the media of concern and migration from the disposal sites via the mine pool and deep mine workings represent the major paths of potential migration.

(3) Point of Exposure

The residents of the city of Hazleton living adjacent to and above the mine pool and abandoned mine workings. Residents of Hazleton City along Route 309 that are groundwater users and may be exposed to vapors emanating from contaminated groundwater.

(4) Route of Exposure

A combination of exposure routes are present including: contaminant plume migrating in the mine pool or perched water above the mine pool that can off gas and intrude into homes found above the mine pool/mine workings and or discharge to surface water by the Jeddo Tunnel. Additionally, groundwater receptors have been found along Route 309 to the east of site and without a comprehensive site characterization it is unknown if these receptors are at risk.

The potential of chemicals migrating in the vapor phase from areas of disposal to receptors in the city of Hazleton has not been evaluated. Flux Chambers only capture gases that are migrating upward vertically and not in a lateral sense.

(5) Receptor Population

The residents of the city of Hazleton, living above the mine pool and or mine workings, that may be exposed to vapor intrusion via mine workings, bedrock fractures and borings to the deep mines; The residents living adjacent to the Jeddo Tunnel discharge who would be directly impacted by contaminant discharges from the tunnel; The biota and wildlife living downstream of the Jeddo Tunnel discharge.

Based on the above discussion it should be apparent that a complete pathway potentially exists but was not fully investigated because of an inadequate site characterization. It is irresponsible to simply assume that the pathway is incomplete because of cost considerations and/or expedience. Such irresponsibility may jeopardize public health and the environment because of the lack of data/ site information capable of determining the presence of threats to potential receptors (human population and the Environment). Furthermore, it is unknown and will remain unknown, without a proper site characterization and appropriate monitoring systems, if future impacts will be realized as a result of the application of the proposed wastes on site.

Once again the problem at this site is an inadequate site characterization of both groundwater and vapors. Problems with the groundwater characterization have been outlined in the above discussion regarding groundwater. Both of these pathways must be evaluated together but yet separately. The advancing of borings and monitoring wells helps identify the location of wastes, groundwater depth and quality, mine pool depth and quality, deep mining structures, etc. and this information is necessary to select appropriate zones to monitor for migrating water and vapors, both laterally and vertically. It must be remembered that this site is undermined and the mining activities have greatly altered the underground hydrology and pathways. The pathways are now preferential in nature predicated on the presence of shafts, barrier pillars, gangways and slopes and any characterization must focus on the mining features and how they have modified the normal contaminant pathways.

Gadinski, Robert A., Groundwater Monitoring Strategies Of The Wyoming Valley, Anthracite Region of Pennsylvania, International Groundwater Symposium On Hydrogeology Of Cold and Temperate Climates And Hydrogeology of Mineralized Zones, Halifax, Nova Scotia, Canada (May 1988)

A perfect example of an inadequate/incomplete characterization performed for site vapors is evidenced by the use of the Flux Chamber in evaluating site vapors. The Flux Chamber method is only capable of measuring landfill gases that are moving upward vertically. Studies done in the Dunmore, PA area have determined that landfill like gases do travel laterally through abandoned coal seams. (**Gadinski, Robert (et. al.) Modified Packer Pump for Site Characterization**. Fifth International Conference of Contamination in Eastern Europe. **Prague, Czech Republic (September 2000)**. This entire component of movement has been ignored at the HCP site. Other gases of concern besides, NMOC's, are depleted Oxygen levels, Carbon Dioxide, Carbon Monoxide, Hydrogen Sulfide, Nitrogen and Methane. These gases are a major concern in the coal measures and may and do represent a safety and health concern in many areas in the coal measures. **Dunmore Gas Site,Dunmore Boro, Lakawanna County, Final Background VOA Project Report, John S. Mellow, Regional Project Officer (December 2002); Dunmore Carbon Monoxide Site Background Investigation, Dunmore, Lackawanna County. Weston Solutions, Inc. (October 2002)**

Furthermore, based on field data collected at the Tranguch Gasoline Site-Hazleton City/Hazle Twp./ Luzerne County which is also underlain by a mine pool, indicates that there is no correlation between vapor levels collected in piezometer nests at this site versus groundwater and soils contamination at the same locations. In most cases, seasonal variations of soil gas concentrations were noted with the highest gas levels detected from October to March of a calendar year and the vapor level concentrations did not correspond to the underlying groundwater and soils analyses**. A presentation of this data compiled at the Tranguch Site was made at the EPA Region III States LUST Technical Conference, Nov. 3-5, 2004, Rocky Gap, Maryland by Robert A. Gadinski, P.G.**

(Jarvela, Stephen and Boyd, Kevin, USEPA Region III. And Gadinski, R.A., PADEP. Tranguch Gasoline Site Case History. Freshwater Spills Conference. New Orleans, LA. (April 2004)

Vapor intusion into homes has also been investigated and impacts documented at another local site, the Valmont Superfund Site located in Hazle Twp/West Hazleton Boro/Luzerne Co. At this site a migrating solvent plume of TCE/PCE found beneath this residential area has impacted homes in and adjacent housing development.

It must be further noted that there is not a direct 1 to 1 correlation to what was identified in the sampling of Unit B Solid Media Sampling and Flux Chamber Data, respectively. Only three of the VOC's identified in the solid phase was found in the Vapor Phase which means 15 additional compounds were discovered in the Vapor Phase versus the solid phase. Likewise, in the sampling Results of, Solid Media and Flux Chamber Data of Unit C, respectively, only one compound was identified and 3 new compounds not found in the Solid Media sampling was identified in the Flux Chamber sampling data. **[Baseline Environmental Report-(December 10, 2004**)] This shows a lack of knowledge of the vapor contamination that is migrating both vertically and laterally at this site and supports the data collected at the Tranguch site.

Additionally, sampling results for Unit B 1994-Flux Chamber Results and Unit C 2001 Flux Chamber Results, respectively, list contaminants in the vapor phase that were not found in the trash or soil samples taken from the subsurface in the same area. **Baseline Environmental Report, City of Hazleton, Hazleton, Pennsylvania, Prepared for: Hazleton Redevelopment Authority, Hazleton, Pennsylvania, Prepared by: Groundwater Sciences Corporation. (December 10, 2004)**

This shows that the subsurface has not been adequately characterized or/or suggests that there is a mass of contaminated media that has not been located. Furthermore, contaminants have been listed in these tables that are not included in the TO-14 method, i.e. MEK, Benzyl Chloride and Ethanol.

Additionally, high concentrations of semi-VOC's were detected in solid samples, however their presence in the vapor phase could not be determined because the TO-14 analysis cannot identify or measure their presence. Other methods are required for PAH compounds.

Another consideration ignored by the applicant and their consultants is that landfill gas concentrations can vary over time because of various physical and weather related variables and that is why it is necessary to have a monitoring program to measure concentrations of landfill gases during established intervals and during different seasons of the year to make it technically meaningful. Furthermore, the Flux Chamber Method requires the collection of the vapor samples in 6L Summa® canisters at the rate of 2L./Min. which translates into a 3 minute sample out of a 24 hour day. The sample collected is truly a very small "Snapshot" in time based on this sampling interval. This type of sampling is referred to as Grab Sampling and "is not a useful for evaluating changes of landfill gas over the long term" but is merely a screening tool to determine if gases of concern are present. It may be "useful if additional sampling rounds are conducted at regular intervals according to a detailed plan. **[Landfill Gas Primer-November (2001)]** Longer term Summa® canisters or comparable vessel capable of drawing the sample over a much longer period of time, e.g. 24 hours would be more appropriate and more representative of vapor concentrations over a 24 hour interval.

Furthermore, no consideration has been given to the consequences of capping the site which would effectively eliminate/reduce the upward vertical component of vapor transport. The vapors which previously had been migrating upward would now be directed, in a lateral sense, beneath the cap, following the deep mined coal seams. It would be anticipated that the vapor levels in this direction would therefore increase markedly as a result of site capping. Based on a high degree of scientific certainty the vapors would remain trapped beneath the cap until the vapors reach a point beyond the cap where upward vertical movement of air would be possible. In all likelihood this would be into homes in Hazleton City and or surrounding communities that were located above the groundwater/mine pool or unsaturated mine openings trending under the city. Residences close to the mine workings and/or connected to the mine workings by fractures, mine openings and old borings would be especially jeopardized.

Bacterial action is responsible for decomposing organic wastes that are disposed in landfills. “Bacterial activity releases heat, stabilizing the temperature of a landfill between 77º F. and 111º F., although temperatures up to 158º F. have been noted.”(**Landfill Gas Primer- November 200l)** These temperatures generated in landfills can volatize Non-Methane Organic Compounds (NMOC) disposed of in landfills. The only reported temperatures were for the Flux Chamber sampling in which elevated temperatures were recorded in the chamber. Since the Flux Chamber was a surface mounted sampling device, the elevated temperatures nearly 30º F. above normal groundwater/ soil temperatures of 50º-55, clearly indicates a potential heat source at depth relative to these sampling locations. **[Baseline Environmental Report, City of Hazleton, Hazleton, Pennsylvania, Prepared for: Hazleton Redevelopment Authority, Hazleton, Pennsylvania, Prepared by: Groundwater Sciences Corporation. (December 10, 2004)]**

Additionally, at hazardous waste landfills, the possibility of landfill gases containing Non-Methane Organic Compounds (NMOC) has been documented and the possibility of these gases intruding into residential areas must be determined. Since large volumes of hazardous wastes have been dumped at this site, the impacts of (NMOC) and vapors related to chemical contamination to residential areas should be evaluated by indoor sampling and or continuous sampling from established sampling points on site**(Landfill Gas Manual-November 2001).**

Explosions and fires occur at highly regulated and properly designed Municipal Landfills; therefore, it is intuitive based on the large hazardous waste stream reported/documented disposed at the HCP site identified as “toxic, ignitable and flammable” and the fact that a fire did occur in the waste area and since chemical wastes were involved demonstrates that explosion/fire potential is extremely high in the areas where known drums are located in addition to areas where unknown drums may be hidden, as at any hazardous waste landfill.
[Landfill Gas Primer (November 2001)]

Field Investigations Of Uncontrolled Hazardous Waste Sites, Fit Project, Task Report To The Environmental Protection Agency, Contract No. 68-01-6056, A Preliminary Assessment of Hazleton City Landfill, TDD No. F3-8106-28, EPA No. PA-395, Ecology and Environment, Inc.(circa. 1984)

Field Trip Report Of The Hazleton City Landfill Prepared Under, TDD NO. F3-8405-37,EPA NO. PA-395’ Contract NO. 68-01-6699, Hazardous Site Control Division, USEPA, NUS Corporation, Superfund Division. (January 22, 1986)

Therefore, based on a reasonable degree of scientific certainty, because of the failure of the applicant and their consultants to adequately characterize the project area from a groundwater and vapor pathway perspective, it is impossible to assure that the public health and the environment will not be impacted by the proposed project. Without such assurances it would be irresponsible to allow the continuation of a project that could have major health and environmental impacts based merely on assumption and without a valid site characterization and appropriate monitoring safeguards.

3. The flawed Bark Camp Investigation Has Led To A False Sense Of Confidence In The Use Of Wastes at Mine Reclamation Sites In Pennsylvania.

The major justification for using wastes for reclaiming mining sites was based on the supposed success at the Bark Camp Demonstration Site located in the Moshannon State Forest just west of central Pennsylvania in Clearfield County. It is two miles south of the nearest community, Penfield, in Huston Township. Based on the following discussion it will become apparent that this site has been improperly characterized and monitored resulting in erroneous conclusions that made it appear that no environmental damage had occurred as a result of the application of various wastes for reclamation purposes. It is incomprehensible that such a major decision, as the disposal of wastes at mine reclamation sites, was made based on this flawed investigation.

The Bark Camp Report **[The Use of Dredged Materials in Abandoned Mine Reclamation, February (2004)] states in part:**

"The Bark Camp Demonstration Project initiated in 1995 is a public–private partnership among the Pennsylvania Department of Environmental Protection, the New York/New Jersey Clean Ocean and Shore Trust and the Clean Earth Dredging Technologies, Inc. The Project sought to join port economies, the need to dredge navigation channels, and the would-be waste products of coal combustion and dredging with the vast fill requirements of dangerous abandoned mine land features." The Use of Dredged Materials in Abandoned Mine Reclamation. (February 2004)

"This project sought to demonstrate the potential for the combined beneficial use of these wastes, or by-products of US shipping and power generation while leveraging the economies of scale of each of the problems addressed. Along with their ability to form cements, the contaminant binding properties of alkaline activated ashes are well established, making them an appropriate binder for dredged sediments, so as to form a manufactured fill for the replacement of underlying rock of stripped mine lands." The Use of Dredged Materials in Abandoned Mine Reclamation. (February 2004)

As a result of this demonstration project, the authors arrived at the following conclusions (ppg. 48-51), which in my scientific opinion are clearly erroneous:

CONCLUSIONS

1. Appropriately characterized dredged materials with acceptable levels of organic and metal contaminants, properly amended and processed with alkaline activated coal ash, can be used as a manufactured fill for abandoned mine reclamation with exclusively positive environmental benefits.

2. Such materials, including correctly proportioned blends of dredged sediments, coal combustion ash and kiln dusts will not leach contaminants to ground or surface waters due to their inherent physical characteristics and the chemical bonds formed upon their proper blending.

3. Based on the chemical analyses of dredged sediment used at Bark Camp, from nine different project locations in the Hudson – Raritan Estuary, a significant, perhaps predominant percentage of maintenance dredge material available for beneficial upland use will meet required threshold contaminant levels low enough to be used in similar applications with no adverse impacts.

4. In over five years of surface water and ground water monitoring, there was not a single detection of semi-volatile or volatile organic compounds, pesticides, PCBs, dioxins, or metals other than those attributable to mine drainage. This is due to the well established physical and chemical binding properties of pozzolonic materials, the low permeability of the fill, a relatively low level of commonplace contaminants in the manufactured fill constituents, and the small surface area to volume ratio. Significantly higher levels of contaminants have been successfully sequestered using this technology.

The Use of Dredged Materials in Abandoned Mine Reclamation (February 2004)

These conclusions are flawed for the following reason. The people who performed the Bark Camp Demonstration Project failed to follow accepted site characterization and monitoring protocols generally accepted by the technical/regulatory community. Many of these same protocols were developed by the Pennsylvania Department of Environmental Protection (PADEP) to assist the regulated community in conducting technically sound field investigations,[**Groundwater Monitoring Guidance Manual (December 1, 2001)**]. It is incomprehensible that a regulatory agency could or would ignore policies/recommendations on a project as visible and important as the Bark Camp Demonstration Project, since the justification for using these wastes, statewide, were based on the questionable conclusions/results derived at this site.

Additionally, the National Academy of Sciences (NAS) has recently released a report, [**Managing Coal Combustion Residues in Mines (March 1, 2006**)] on the management of Combustion Waste Ash which recommends the proper characterization and monitoring of this waste. These recommendations further bring to question the appropriateness and validity of the Bark Camp Demonstration project's characterization approach, results and conclusions.

Bark Camp Site

The Bark Camp site is located in the Moshannon State Forest just west of central Pennsylvania in Clearfield County. It is two miles south of the nearest community, Penfield, in Huston Township. The area's watershed and underlying coal beds dip downward to the north and the northwest. Bark Camp Run follows this drainage pattern and empties into the Bennett Branch to the west. The site contains two layers of coal beds (Lower and Middle Kittanning) which, are now above the stream and outcropping the hillsides, one 40 feet above the other. It is noteworthy that in the, Use of Dredged Materials (2004) pg. 30, it is stated that:

> The underlying coal seams, being relicts of geological time, differ in contour from the surface. The former coal processing facility (and now the dredge processing facility) was located in the curve of Bark Camp Run because that is the point where the tilted plane of the seams, descending from within the hills above the valley to the southeast, intersect the valley floor, and continue downward below the stream bed. The upper end of the coal seams lie at about the 1700 foot contour near the head of the valley and fall to an elevation of 1120 feet at its mouth, dipping almost 600 feet to the stream's 300 feet over the same linear distance.

It is apparent from this narrative and the geologic maps of the area that the coal seams dip beneath the invert elevation of the stream bed at site affording a preferential pathway to the northwest in the direction of bedrock/coal seam dip.

The Use of Dredged Materials in Abandoned Mine Reclamation. ppg. 29-30 (February 2004); Geologic Map of the Sabula and Penfield Quadrangles, Clearfield, Elk and Jefferson Counties (Berg and Glover). Geology and Mineral Resources of the Sabula and Penfield Quadrangles, Clearfield, Elk and Jefferson Counties, Pennsylvania (1976)

Groundwater Gradient

The PADEP website lists two downgradient wells at the Bark Camp site but doesn't distinguish or provide data to demonstrate that the wells are hydrogeologically downgradient of the area of disposal. An upgradient well capable of monitoring or establishing background water quality was never identified or is not existent. As a matter of fact, it is my opinion, to a reasonable degree of scientific certainty that the groundwater monitoring system appears to be totally defective and incapable of effectively monitoring groundwater at the site. The website identifies both monitoring wells 4 and 5 (MW-4 and MW-5) as downgradient wells **[Sample Point Descriptions (10/3/2005)** but the obvious question is, has this determination been made based on topography or hydrogeology? It is convention that a groundwater monitoring system is comprised of at least 1 upgradient and at least 3 downgradient wells located in the dominant direction of groundwater flow. This determination is based on head differentials of the wells in the monitoring system. At this site not one conceptual model or potentiometric surface map, which includes the relationship with surface water (a map depicting groundwater flow) was available or produced in discovery to establish conditions that establish wells as being upgradient or downgradient hydraulically as accepted as a conventional practice or as recommended in the, **[Groundwater Monitoring Guidance Manual (December 2001)].**

The Middle and Lower Kittanning Coals have been extensively deep and surface mined at the site. Prior to mining, it is more than likely that groundwater gradient was controlled by surface topography. However, the normal gradient has been adulterated by the mining activities. It is common knowledge that the bottom rock of a mined coal can act as a preferential pathway for mine water movement depending on bedrock/coal dip. In the case of the Bark Camp site it is the abandoned deep mine workings of the Middle Kittanning and the Lower Kittanning Coals in conjunction with the regional strike and dip of bedrock (N 47º E. 5% NW) that would control mine water/groundwater movement. It has been reported that the regional dip of bedrock is to the northwest and, consequently, this would be the direction of mine water/groundwater gradient.

Waste was backfilled in the outcrops of the exposed Middle and Lower Kittanning coal seams on site but no monitoring wells, lysimeters or piezometers were installed in the waste backfill to measure static water levels, water mounding in the waste that could affect contaminated groundwater movement nor were samples taken to determine if the waste was leaching at unacceptable levels. The NAS has made this recommendation as part of their recommendations on proper site monitoring plan at Coal Combustion Residue (CCR) sites.

> transport. At least one well or lysimeter, and preferably two, should be placed directly in the CCR to assess the field leaching behavior and confirm predicted contaminant flux. As part of the monitoring plan, quality assurance and control plans should be developed prior to CCR placement with clearly defined protocols for sampling and analysis, for data validation, and for managing systematic errors in analytical procedures.

Managing Coal Combustion Residues in Mines (2006), pg 8

Therefore, it is impossible to construct and fine tune a conceptual model (see figure below) from the National Academy of Sciences'(NAS) report, Managing Coal Combustion Residues in Mines (2006), of the site without basic site information, such as, as a potentiometric surface map, as described above. This document further lists the basic recommended requirements in characterizing a site for the disposal of Coal Combustion Ash. It should be noted that the Bark Camp report, The Use of Dredged Bark Materials in Abandoned Mine Reclamation (2004) , falls far short of the requirements listed in the recommendations of the National Academy of Sciences' report.

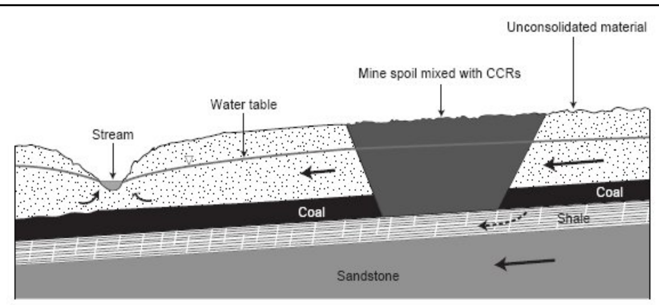

FIGURE 6.1 Example conceptual model, showing contaminant transport and water flow in the unsaturated and saturated zones.

It is noteworthy that contrary to the suggested groundwater direction not one monitoring well was installed downgradient (northwest) of the waste (dredge, flyash etc.) in the direction of bedrock and coal seam dip. This direction of groundwater flow was even noted in, **Coal Ash Beneficial Use in Mine Reclamation and Mine Drainage Remediation in Pennsylvania, PADEP (2006)Pg. 39**

> flow system may reveal structurally-induced flow pattern controls. The uplands may still be the principal recharge areas with the lowlands as the principal discharge areas, but groundwater flow may follow preferred avenues, such as along bedding planes and selected lithologic units of contrasting permeability, to down-dip discharge sites.

Consequently, it is impossible to determine if contamination is being transported to the northwest in the direction of bedrock/dip. Therefore, it is my opinion, to a reasonable degree of scientific certainty, that conclusions 1-4, as contained in the Bark Camp Report" <u>The Use of Dredged Materials in Abandoned Mine Reclamation",</u> are totally invalid and flawed since downgradient wells were never installed at site to investigate the most probable direction of mine water/groundwater flow.

<u>Final Groundwater Monitoring Plan,</u> Consolidated Technologies Inc., (5-12-98); <u>The Use of Dredged Materials in Abandoned Mine Reclamation</u> (February 2004): Surface Water Sampling Locations, Sample Point Locations, Location Map showing locations of waste disposal, site process areas and proposed grouting locations. From DEP website:
<u>www.state.pa.us/dep/deputate/minres/bamr/bark_camp/surfacewater/swmap.htm 10/3/2005.www.state.pa.us/dep/deputate/minres/bamr/bark_camp/WaterQdata/locations.htm 10/3/2005; www.state.pa.us/dep/deputate/minres/bamr/bark_camp/Alternative/gen sitemap.html10/3/2005; www. state.pa.us/dep/deputate/minres/bamr/bark_camp/WaterQ Data/descriptions.htm 10/3/2005.</u>

<u>Groundwater/Surface Water Relationship</u>

In the Anthracite and Bituminous Coal Regions of Pennsylvania it is not uncommon for mining operations to extend beneath or adjacent to rivers, streams and other water bodies. In many cases surface water can lose to the subsurface into the mining operations as a stream can lose to the subsurface in a limestone area. Additionally, there are situations were water bearing zones above deep mining operations have been drained into mining operations destroying the groundwater resource. At the Bark Camp site, the relationship between surface and groundwater has not been investigated or ascertained.

Streams can be either Losing or Gaining streams. In the case of a Gaining Stream groundwater elevations are higher than the receiving stream allowing groundwater to discharge into the stream channel. This groundwater discharge is referred to as baseflow. The base flow contribution increases stream flow downgradient of the groundwater discharge, hence a stream becomes a Gaining Stream. In contrast, a Losing Stream is one in which a stream loses flow to groundwater because the stream channel is higher than groundwater and stream flow diminishes in a downgradient direction of stream flow because of this loss.

No attempt was ever made to establish the type of system Bark Camp Run represents either Losing or Gaining. Based on conjecture, although it is not explicitly stated in the Bark Camp report, **[The Use of Dredged Materials in Abandoned Mine Reclamation (2004)]**, Bark Camp Run was determined to be a Gaining System; otherwise, monitoring wells would have been located to the west of the waste disposal areas. I do not know how this determination could have been made without establishing vertical control on Bark Camp Run at surface water monitoring points or measuring flow rates at the surface water monitoring points to ascertain the elevation differential between surface water and adjacent groundwater wells and changes in discharge along the stream channel, respectively.

Please note that MW-4 is plotted, based on the PADEP Map**. Sampling Point Locations 10/03/2005**, above the undermined portion of the Bark Camp Run Watershed which would make it prone to stream loss into the abandoned deep mine workings and result in Losing Stream conditions.

An observation gleaned from the Bark Camp report**, The Use of Dredged Materials in Abandoned Mine Reclamation (2004) pg. 45**, further questions if Bark Camp Run is a Gaining Stream. It was stated that during a pump test that, **"Drilling logs showed that Well 4 was the only one to be drilled deeply enough to hit the next layer of coal, from immediately above which layer it was recharging. Recall that all coal seems in the region dip northwestward away from the stream. Well 4 was collecting water from above an impermeable barrier and which was not heading to the stream."** If Bark Camp Run was truly a Gaining Stream, the hillsides on either side of this waterway would be recharge zones, or zones where water is infiltrating downward and laterally through the ridges and would subsequently discharge into the stream channel which would be the point of discharge. Wells located in the recharge zone would have water elevations higher than the receiving stream which would provide the potential energy for the water to discharge into the receiving stream. The fact that water proximal to Well-4 was moving away from the stream suggests that Bark Camp Run was losing flow into the formation and groundwater movement was away from the stream and to the northwest in the direction of regional dip of bedrock.

Based on all available data this is the only statement regarding the relationship between groundwater and surface water and suggests that stream loss is occurring in the vicinity of this well and that there is potential flow to the northwest which is consistent with the regional dip of bedrock and direction of the deep mined coal units. Theoretically if all the monitoring wells were drilled to the same coal seam encountered at depth, as MW-4, similar hydraulic characteristics would be evidenced in those wells, further supporting stream loss in this area. It is for this reason the NAS recommends in Managing Coal Combustion Residues in Mines (2006) pg.142 that:

> An ideal groundwater monitoring system should include wells installed at multiple depths and multiple locations, concentrated primarily in the probable directions of groundwater flow with additional wells to characterize upgradient water quality. Overall, well screens should be placed in a range of materials, including coal spoils, CCRs, blended materials, and undisturbed geologic materials, to provide information that is representative of variations present at the site. Downgradient wells should be sited with an understanding of the travel times for contaminants to reach these monitoring points. Several monitoring points should be established along predicted flow paths at distances downgradient from CCR emplacement that will yield early (i.e., during the established bonding period) confirmatory information regarding predicted CCR leachate transport (e.g., advection, dispersion, dilution, attenuation). If uncertainty exists regarding the directions of groundwater flow or if ongoing mining and associated groundwater pumping could disrupt groundwater flow, additional wells may be necessary to capture the movement of any contaminant plume. As discussed above, if wells are placed only at the permit boundary, water quality monitoring for the length of the bonding period may not detect a contamination problem, even if one exists. If downgradient contamination is detected, additional wells may have to be installed to assess the impact of CCR on groundwater resources. At least one well (or a suction or pan lysimeter for unsaturated conditions), and preferably two wells, should be placed directly in the CCR to monitor local porewater chemistry and assess the field leaching behavior. These data should then be compared to the predicted flux rates in the site conceptual model.

Nested wells are needed to detect stratification of groundwater contamination and determine the potential field laterally and vertically because groundwater contamination will be driven by the hydraulic gradient in both of these directions, laterally and vertically. Additionally, a review of static water differentials in nested wells at different depths will determine if recharging or discharging conditions exist at the site.

This same well (MW-4) was also described in, **The Use of Dredged Materials in Abandoned Mine Reclamation (2004) pg.44** as **"exceptional, in that even though pumped dry, it recovered extremely quickly, regaining 13 feet of water in 10 minutes."** Monitoring well recovery in fractured bedrock is dependent upon the size or the spatial distribution of the fractures intercepted or proximity to recharge boundaries.

Normally, the source of the recharging groundwater can be identified while reviewing drill logs and pumping test data because "Delayed Yield" bumps would be visible on drawdown curves of observation wells employed during the pumping test. A "Delayed Yield" is an aberration identified during a pumping test on drawdown curves from observation wells that indicates an inflow of water into the borehole. This aberration is indicative of the interception of either water bearing zone (i.e. fracture(s)) or recharge boundary proximal to the observation well.

Since observation wells were not used in this project to evaluate aquifer characteristics during the performed pumping test, it is impossible to determine if "Delayed Yield" bounces were present. Likewise the presence of the "fracture" in MW-7 would also be highly speculative without either drawdown curves, indicating the presence of a "Delayed Yield" or drill logs that have identified the presence of this fracture; neither, have been provided for evaluation.

However, in this case the well was advanced to the mine pool and is next to Bark Camp Run in a northwest direction; therefore, based on a reasonable degree of scientific certainty, it is more than likely, that Bark Camp Run is losing to the formation and/or deep mine workings at least in the vicinity of MW-4. **<u>The Use of Dredged</u> <u>Materials in Abandoned Mine Reclamation</u> (2004) pg. 44; Drill Log MW-7, L.G. Hetager Drilling, Inc. (11-25-97)**

The investigation of the coal seams (deep mines) is an intricate part of any investigation in the coal measures of Pennsylvania. The PADEP emphasizes the role coal seams play in transmitting water as outlined below:

> tend to be confining beds. The coal seams, which often occur in a highly-jointed condition between the underclays and thick sequences of overlying shale, may readily transmit groundwater accumulated by vertical leakage from the overlying beds. The prevalence of springs and seeps at the outcrop line of coal seams in some topographic settings reflects the role
>
> of these beds in the transmission and discharge of infiltrating groundwater as part of shallow and intermediate flow systems.

Coal Ash Beneficial Use in Mine Reclamation and Mine Drainage Remediation in Pennsylvania, PADEP (2006)Pg. 39

Once again the PADEP noted a major groundwater pathway but totally dismissed it in the report, **<u>The Use of Dredged</u> <u>Materials in Abandoned Mine Reclamation</u> (2004)** because not one monitoring well was emplaced in the coal seams downdip of the waste which may serve as a preferential pathway. As the old adage goes, "If you don't look for it you won't find it'; apparently, no one wanted to find anything in the downdip coal seams to the west of the emplaced waste.

It was imperative at the Bark Camp site for nested wells to be developed to the west of the emplaced waste material because of bedrock dip and deep mining of the coal seams. Each well location should have consisted of at least 3 nested wells. The first well should have been advanced to the first mined coal and into the bottom rock to at least a depth of 10' and screened above the bottom rock elevation to capture sheet flow on the bottom rock of the coal; the second well should have been advanced to the bottom rock of the second coal and constructed with the same screen configuration; the last well should have been advanced to the deepest coal or to an elevation 10' below the invert elevation of Bark Camp Run adjacent to the well nest. By this construction all possible groundwater movement to the northwest, either along the bottom rock of the mined coal seam or along bedding planes could have been intercepted and adequately monitored. Furthermore, it would be possible to ascertain the surface water/groundwater relationship at this site.

This position is reinforced by PADEP's own publication, **Coal Ash Beneficial Use in Mine Reclamation and Mine Drainage Remediation in Pennsylvania, PADEP (2006) Pg. 39**

> As the bedrock structure is often closely related to the present topography, the structural configuration may be related to the groundwater flow system as with topography above. For example, the crests of anticlines or other structural highs may be groundwater recharge areas, with the discharge areas located in the synclinal lows coincident with the topographic lows. However, numerous interacting geologic and hydrologic factors produce flow-system behavior which deviates considerably from the ideal case where the groundwater is flowing through isotropic, homogeneous media. In a typical geologic setting for Pottsville and Allegheny Groups strata in western Pennsylvania where a cyclical sequence of varying rock types outcrops in a gently dipping or folded configuration, a three-dimensional representation of the groundwater flow system may reveal structurally-induced flow pattern controls. The uplands may still be the principal recharge areas with the lowlands as the principal discharge areas, but groundwater flow may follow preferred avenues, such as along bedding planes and selected lithologic units of contrasting permeability, to down-dip discharge sites.

Another basic observation which suggests a flawed site characterization is the fact that all monitoring wells at site were located to the west of Bark Camp Run but to the east of the disposed waste making it impossible to evaluate the hydrogeology to either the east of the waterway or to the west of the waste. Based on an inspection of the Geologic Map as per Berg and Glover (1976), the east side of Bark Camp Run may provide recharge to the waterway based on bedrock dip and mining operations. This side of the stream as the area to the west of the emplaced waste was totally ignored in any investigative work or the Bark Camp report, **Use of Dredged Materials in Abandoned Mine Reclamation (2004).** This is contrary to PADEP's own recommendations regarding downdip movement of groundwater mentioned above.

It is quite possible that groundwater is recharging Bark Camp Run from the east but Bark Camp Run may be losing flow to the deep mines to the west of its flow path. In any investigation of impacts to a watershed all contributing groundwater sources to a waterway should be investigated and evaluated in order to construct hydrographs, potentiometric surface maps and establish background water quality all of which are necessary in developing an accurate Conceptual Model and conducting an adequate site characterization of the site. This has not been done at this site and further suggests that all results and conclusions are scientifically questionable and highly disputable.

Further, supporting evidence for a conceptual model of a northwestward migration of contamination is found in the results for MW-10. The results from this well which is to the north and somewhat sidegradient to the regional dip of bedrock exhibits contaminant levels and analytes that would be indicative of the waste disposed at site. **PADEP CD Bark Camp Sample Data (3-2-2006)**

From the above discussion it is apparent that the basic relationship between groundwater and surface water has not been established at the Bark Camp Site. This is a basic requirement of any site characterization. The NAS report, Managing Coal Combustion Residues in Mines (2006) pg. 114 recommends:

> *Surface water flow.* Large amounts of surface water flow data are typically collected in the standard mine permit application. However, the addition of CCR placement at a mine site necessitates that there be a clear understanding of the interconnections between groundwater and surface water flow under pre-mining, mining, and post-reclamation conditions. Due to concerns about flooding and erosion at the CCR placement site, the configuration of the site with respect to the 100-year floodplain should also be verified.

The ramifications of improperly characterizing groundwater flow near a boundary condition are paramount. In this case, if Bark Camp Run is losing flow in a Losing Stream condition and if groundwater/mine water movement is to the northwest in the direction of regional bedrock dip, all wells drilled at site, to the west of Bark Camp Run but to the east of the waste, are up gradient wells, hydraulically, relative to the disposal areas and no wells are situated in a down gradient direction relative to the waste /fill disposal. (**Reportedly, the PADEP and or its agents drilled additional wells to the northwest of the waste, in the suggested northwest direction of dip and groundwater mine water movement. However, neither the location of these wells, drill logs or any results of these wells have been provided for inspection or review.)**

Consequently, it is my opinion, to a reasonable degree of scientific certainty that groundwater contamination is being transported to the northwest and is not being effectively monitored. The shortcomings of the monitoring of groundwater and surface water and the failure to determine the connectivity between these water systems at the Bark Camp site becomes apparent in Chapters 6 and 7 of Managing Coal Combustion Residues in Mines (2006). Because of these failures, I am of the opinion, with a reasonable degree of scientific certainty, that the full magnitude and extent of groundwater/surface water contamination relative to this site are unknown.

Groundwater Monitoring

Impacts to groundwater as noted by the NAS may not occur over a short temporal period; rather it may take decades for groundwater contamination to manifest itself. Therefore, it was recommended that the monitoring period for coal combustion residue (CCR) sites be increased, to at least a decade. The NAS noted that to address temporal concerns, "**An increased monitoring period will likely be needed in some situations in recognition of the fact that subsurface migration of potential contaminants can occur over time periods in excess of a decade**." (2006) pg.142

At the Bark Camp site sampling was sporadic and coupled with the faulty monitoring system in place would not have identified groundwater/surface water contamination for temporal and technical reasons, as discussed above in **Site Characterization and Groundwater Surface Water Relationship.**

The NAS report states in **Managing Coal Combustion Residues in Mines (2006) on page 7**, that:

> **Monitoring**
>
> Monitoring is an essential tool to confirm predictions of contaminant behavior and detect if and to what extent contaminants are moving into the surrounding environment. Because SMCRA monitoring regulations are not very prescriptive, states have a great degree of flexibility and control, and monitoring programs required at CCR mine placement sites vary widely by state. *Based on its reviews of CCR post-placement monitoring at many sites visited during the course of this study, the committee concludes that the number of monitoring wells, the spatial coverage of wells, and the duration of monitoring at CCR minefills are generally insufficient to accurately assess the migration of contaminants.* Additionally, the committee found quality assurance and control and information management procedures for water quality data at CCR mine placement sites to be inadequate.
>
> The committee believes that a more robust and consistent monitoring program is needed in situations involving CCR mine placement. **The committee recommends that the number and location of monitoring wells, the frequency and duration of sampling, and the water quality parameters selected for analysis be carefully determined for each site, in order to accurately assess the present and potential movement of CCR-associated contaminants.** Such an approach would also allow the specifics of the monitoring plan to be tailored to accommodate the unique combination of CCR characteristics, emplacement techniques, and overall site characteristics, while considering estimates of ecological and human health risks and the uncertainties in the site conceptual model.

The Bark Camp report, Use of Dredged Materials in Abandoned Mine Reclamation (2004) emphasizes the contaminant bonding **"ability of pozzolons to form cementitious bonds" and attributes this quality to the apparent lack of detections, of semi-volatile or volatile organic compounds, pesticides, PCB's, Dioxins or metals other than those attributable to mine drainage."** This contaminant bonding ability is brought into question considering the naming of a new Superfund Site, **Little Traverse Bay CKD Superfund Site, Emmett County, Michigan.** At this site a combination of Cement Kiln Dust (CKD) and Combustion Coal Residue (CCR) was disposed of in quarries along Lake Michigan until 1980. At this site the dumping of CKD dust occurred from 1921 to 1980. This area was, subsequently, developed; however, seeps of high pH groundwater (pH 13.5) were discovered along the beach entering Lake Michigan with associated metals (Arsenic, Copper, Mercury, Nickel, Selenium, Vanadium and Zinc) contamination.

It is ironic that the state of Michigan provided a Covenant Not to Sue (Release from Liability) to the responsible party. It is, noteworthy, that the cement operation closed in 1980 but it took 25 years for the plume to reach Lake Michigan. Apparently, **"the pozzolons ability to form cementitious bonds"** did not work in this situation or possibly provided only a temporary buffer; however, the buffer may have been depleted and this may have led to the development of the contaminant plume that is now impacting the site. Therefore, it is my opinion, to a reasonable degree of scientific certainty, that without an adequate monitoring system with an extended monitoring period, at the Bark Camp site, similar impacts may not be identified until it is too late to minimize or mitigate impacts to the public health and the environment.

Professional Certifications

Act 367. Engineer, Land Surveyor and Geologist Registration Law, prohibits the practice of any of these disciplines without a license issued by the State of Pennsylvania. The law requires that any document containing geologic interpretation be stamped and certified by a geologist licensed in the Commonwealth.

Furthermore, it is stated in, **Title 25. Environmental Protection. Department of Environmental Protection. Chapter 250. Administration of Land Recycling Program, § 250.204. Final report. "Interpretations of geologic and hydrogeologic data shall be prepared by a professional geologist licensed in this commonwealth."** It is this statute and accompanying regulation that establish clean up standards and site characterization requirements for investigating and remediating environmental contamination in the Commonwealth of Pennsylvania. Since the clean up standards and requirements for environmental remediations have been established by regulation and policy the Commonwealth of Pennsylvania and its agents should be held to the same standard as any other potential responsible party. Considering the above this has not been done at this site.

The Bark Camp report, The Use of Materials in Abandoned Mine Reclamation Dredged (February 2004) does not include the name of a licensed Professional Geologist (P.G.)/responsible person who certified the accuracy of the geologic/hydrogeologic interpretations, documents, drill logs, etc. contained in the report. Furthermore, the report is not stamped and certified by a geologist licensed in the Commonwealth. Without this certification it is unknown if any of the data or interpretations were prepared or approved by a licensed geologist from the state of Pennsylvania or is certifiable as technically valid.

As a sidebar, the Bark Camp report**, The Use of Dredged Materials in Abandoned Mine Reclamation (February 2004)** claims that the results of this report supports the utilization of these wastes statewide for mine reclamation purposes. It is ironic that a document of this stature has not been Peer Reviewed, as the expression is properly used in the scientific community, for technical credibility. Comments provided by the academic community should be made available to demonstrate the scientific soundness of this report based on anonymous scrutiny which is normally the accepted mode in the evaluation of any academic production. It would be interesting to note that this report would not meet the basic requirements as proposed by the NAS in the publication listed below in the next section.

Managing Coal Combustion Residues in Mines (2006)

Based on the NAS report, Managing of Coal Combustion Residues in Mines, Committee of Mine Placement of Coal Combustion Wastes, Board on Earth Sciences and Resources, Division on Earth and Life Studies, National Research Council of the

National Academies, The National Academies Press, Washington, D.C. (March 1, 2006), it becomes apparent that the Bark Camp demonstration into the use of wastes for mine reclamation can have very questionable consequences. This NAS document prepared by an illustrious panel of scientists from various academic disciplines makes recommendations involving the use of Coal Combustion Ash in mine reclamation and brings into question the approach and conclusions used at the Bark Camp site as found in the, The Use of Dredged Materials in Abandoned Mine Reclamation. Final Report on the Bark Camp Demonstration Project. New York/New Jersey Clean Ocean and Shore Trust-PADEP-Bureau of Abandoned Mine Reclamation. (February 2004).

Because of problems identified at sites where Coal Combustion Residues (CCR) have been exposed to surface water, the NAS Committee recommends that precautions be taken to minimize the exposure of the CCR waste to infiltrating water (Managing of Coal Combustion Residues in Mines (2006), pg. 7).

> Given the known impacts that can occur when CCRs react with water in surface impoundments and landfills, special attention should be paid in reclamation operations to the interactions of water with CCRs. **Specifically, the committee recommends that CCR placement in mines be designed to minimize reactions with water and the flow of water through CCRs.** Several methods are described for reducing the interaction of CCRs with water, including placement well above the water table, compaction and cementation, and the use of liners and low-permeability covers. In all cases, proper covers should be placed over CCRs to prevent erosion as well as root penetration by plants and subsequent upward mobilization of CCR constituents. However, the committee recognizes that none of these methods will totally prevent CCRs from coming into contact with infiltrating water.

No precautions to minimize exposure to infiltrating surface water have been taken at either the Bark Camp Demonstration site or any mine reclamation site despite overwhelming evidence that problems are associated with this exposure. It is my opinion, to a reasonable degree of scientific certainty, that it is reprehensible that wastes of these types are being arbitrarily utilized without site controls capable of minimizing potential damage to the public health and the environment.

Although various wastes have been employed at the Bark Camp site (dredge, amended dredge with flyash, flyash, coal combustion ash, incinerator ash etc.) in attempts at reclaiming this site, the conclusions regarding the innocuous qualities of the waste and impacts to the environment are very questionable considering the shortcomings employed in characterizing and monitoring the site. Because of these shortcomings, it can be said with a reasonable degree of scientific certainty that the provided justification that these wastes can be used safely across the state for mine reclamation purposes is totally fallacious and requires much further scrutiny, including reconsideration.

Conclusions

The Bark Camp Demonstration Project has been touted in the Executive Summary of the Bark Camp report, The Use of Dredged Materials in Abandoned Mine Reclamation pg. 6:

> EXECUTIVE SUMMARY
>
> This report documents the successful demonstration of the safe beneficial use of nearly half a million cubic yards of dredged materials to reclaim an abandoned coal mine in central Pennsylvania. The project was undertaken to evaluate whether sediments from standard navigational maintenance dredging operations, containing metals and organic contaminants within regulatory limits, can be processed with alkaline activated coal ash to form a low permeability cementitious fill for mine reclamation with exclusively positive environmental benefits. It also demonstrates the feasibility of this application on a practical basis; the material can be handled, processed, treated, transported and emplaced while keeping up with the production capacity of dredging operations.

Based upon all of the above, it is my opinion, with a reasonable degree of scientific certainty, that since the site has not been properly characterized and monitored it is impossible to deem this site and demonstration project as a **"successful demonstration of safe beneficial use of nearly half a million cubic yards of dredged materials to reclaim an abandoned coal mine in central Pennsylvania."** It is unverifiable claims of this type that exude confidence in an unproven project which can have numerous adverse health and environmental implications if not properly managed, as indicated by the NAS in Managing Coal Combustion Residues in Mines (2006) pg. 3

> **POTENTIAL IMPACTS FROM COAL COMBUSTION RESIDUE PLACEMENT IN MINES**
>
> Coal combustion residues may be effective in neutralizing acid mine drainage and therefore reducing the overall transport of contaminants from acid-generating mine sites. However, CCRs often contain a mixture of metals and other constituents in sufficient quantities that they may pose public health and environmental concerns if improperly managed. In a mine setting, subsurface water flow is the primary mechanism for transporting contaminants from CCRs to potential human and ecological receptors. Risks to human health and ecosystems may occur when CCR-derived contaminants enter drinking water supplies, surface water bodies, or biota. Impacts on downgradient water quality will depend on the concentration of the contaminant, the flow rate and volume of contaminated water entering the flow system, and the ability of the aquifer or receiving water body to dilute or attenuate the contamination. The concentration, volume, and flow rate of contaminated water, in turn, depend on the leachable mass of toxic constituents in the CCR, the emplacement design, and the local hydrogeologic setting.

Furthermore, the NAS Report cautions regulatory agencies ***"that although potential advantage should not be ignored, the full characterization of possible risks should not be cut short in the name of beneficial use."***

> Furthermore, while SMCRA and its implementing regulations indirectly establish performance standards that could be used to regulate the manner in which CCRs may be placed in coal mines, neither the statute nor those rules explicitly address regulation of the use or placement of CCRs. The committee also believes that the use of CCRs in minefilling operations has advantages, but that it should not result in the circumvention of appropriate characterization and permitting processes. With regard to beneficial use of CCRs in minefills, *the committee concludes that although potential advantages should not be ignored, the full characterization of possible risks should not be cut short in the name of beneficial use.*

It is the arbitrary use of the expression **"beneficial use"** that exudes a false sense of confidence in wastes that are potentially detrimental to the human health and the environment and are not as innocuous as suggested.

Therefore, based on the data and the lack of meaningful data provided in conjunction with the Bark Camp report, The Use of Dredged Materials in Abandoned Mine Reclamation (2004), I can say, with a reasonable degree of scientific certainty, that the Bark Camp Demonstration Project study is highly flawed from a technical perspective and the results of the project cannot be used to predict human and environmental safety of using a mixture of fly ash and river dredge material in mine reclamation, as outlined above.

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Robert A. Gadinski, PG-000007-G
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(date)

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