Bingham County
Planning & Zoning Department
Parcel#RP030301 & RP0304400

January 13, 2025

I am in STRONG OBJECTION to SLT LLC's request for a zone change from R/A to A because if the zone were to be changed to A, it allows companies such as SLT LLC to have Special Use Permit that allows industrial or commercial opportunities to come into the area and produce harmful materials that can be harmful to the crops, animals, and pollute the water and air quality and quantity for the nearby residences. Also by changing the zone to A doesn't consider or allow for a sufficient safe buffer between the neighboring residential areas and it does not do what SLT LLC states when they say it will have, "little to no impact on the surrounding environment".

Allowing a zone change to happen opens up the doors for companies, such as SLT LLC, to get a Special Use Permit to use "agriculture" farming that is not actual agricultural. SLT has stated that, "this property will be used for agricultural activities, with little to no impact on the surrounding environment". In the Idaho Statute 22-4502 (a complete quote is attached) it states that agriculture has to do with any and all means of growing or raising for the consumption of food and that nonagricultural activities refers to the commercial and industrial activities that don't produce agricultural products. SLT LLC stated that their intended use is to surface mine the land for gravel. This is not an agricultural activity; it is a commercial or industrial activity that produces a natural resource but not an agricultural resource, which is why a Special Use Permit is needed. If SLT LLC is to continue with their plan to produce a natural resource they will need to go to a zone permitted for that, otherwise it puts the surrounding R/A zones in jeopardy physically and economically. This zone they are proposing to change was already requested to change and was denied years ago to allow for a safety buffer for the health of the existing residences.

A buffer is needed to preserve the water quality of wells for the residences in the area. Residences near a surface mine will not only be exposed to water quality but air quality as well. According to Henry Rauch, who specializes in hydrology and karst geology, he states that:

> Three important aspects of groundwater related to the "hydrologic balance" are the storage capacity of rocks for ground water, the rate of movement of groundwater and chemical quality. Rock units that have relatively high storage capacities and that allow relatively rapid movement of groundwater are termed aquifers. A simple practical definition of an aquifer is a rock unit of other underground layer or zone that yields a sufficient quantity of water to a well or spring being used as a water supply source.

The process of surface mining has a potential to use an absorbent amount of water and removes the very sand and gravel that is used to clean and filter the underground water. Crushing the rock into gravel decreases the capacity to store more water and runs the risk of drying the nearby wells. And by excavating below the water table, in which gravel pits do by removing the protected topsoil, it will expose the aquifer to the atmosphere and make the underground water quality vulnerable to contamination. This leads to increased iron content in the groundwater as well as a change in the water levels and flow of the underground water. If the flow of the groundwater changes direction due to the proposed gravel pit, a) the water may change away from our wells and could possibly dry out or b) could flow towards our well more but contain contaminated materials leaving the well dangerous and useless for us, our crops, and our animals.

Another hazard is the air quality. SLT LLC once stated that by having it closer to the urban areas, it will have "a reduction in the emissions produced in transit", but in comparison to the effects of air quality transit is a minor effect. This is shown with these studies. The NDJHSS animal studies have shown that the polycyclic aromatic hydrocarbons that are released into the air from asphalt plants cause reproductive issues, birth defects and are harmful to the immune system. This hinders the ranchers in the area with their ability to breed and sell. SLT LLC currently states that "protections will be put in place to protect against ***undue*** water and air pollution. The key word here is ***"undue"***. What exactly does that mean? The Cambridge dictionary defines 'undue' as "to a level that is more than necessary, acceptable, or reasonable". Who determines those standards? SLT LLC of course finds the

Exhibit
T-4

amount of pollution that takes place "reasonable and acceptable" to them because they do not live near it. This community/neighborhood has been well established from 40 -50 years. And the EPA states, "exposure to these air toxins may cause cancer, central nervous system problems, liver damage, respiratory problems, and skin irritation". As a **grandfathered** resident of the area (and zone changes), I myself have had cancer issues and am currently dealing with liver issues and am concerned of the higher risk I face with being exposed to these conditions. The mining and crushing of gravel creates and releases fine particulate matter called Crystalline Silica into the air which will be carried by the wind towards our homes. Crystalline Silica, a known carcinogen (cancer causing agent) which has been found to cause lung cancer, silicosis, and other health hazards. Some of the Crystalline Silica can be of the most dangerous variety with a designation as a PM2.5 particle. Those are particles that measure less than 2.5 micrometers in size.Once these tiny particles enter the lung *they stay there*. Once these fine particles enter the lungs, the body has no means to expel them. The body's natural defense encapsulates them *causing permanent lung damage or cancer*. Winds can carry these fine particles over great distances and the closer you are to the source, the higher the concentration and danger it is. Health effects can range from Silicosis, lung cancer, tuberculosis and increased lung irritation. There is no cure for silicosis. Crystalline Silica will infiltrate homes' heating and cooling system and there is no viable way to stop it or mitigate it. The dust is cumulative; each day over the 20 or more years the pit is in operation more and more of this hazardous dust will accumulate inside and around our homes.With family members that have health issues, these can aggravate and/or trigger more health problems.

Lastly, by changing the zone, this will affect our home values. Gravel pits are known to be noisy and unpleasant to look at. Properties that are adjacent to the pit have lost a value anywhere from 30-56% in value. Because the property of SLT LLC is placed where it is, the majority of the houses in our neighborhood are adjacent to the proposed gravel pit. Having to pay to change the water system or worrying about well issues contributes to the concern of any prospective buyer. Noise is a large contributing factor to the decrease in the property value. Many people come to a R/A zone to get away from the commercial and industrial noises, but the house would be sitting right next to one even though it would be zoned as an A. Another concern is the noise pollution. This may seem like a minor thing to most people, but with someone who has and continues to suffer from severe chronic PTSD, this poses a major concern in being able to function in my daily life. I currently work from home, so this would be my environment 24/7 and can significantly decrease my ability to work and pay my bills. So much so that the Federal ADA would have to get involved. In SLT LLC's Application for Zone Change 10-15-3: E-g, their response states that it "will ensure undue concentration of population and overcrowding of land". The county's Planning and Zoning Commission already has proper controls in place to prevent that from happening such as subdivision requirements of a minimum of 5.01 acres per development. Just as SLT LLC's application pointed out in Bingham County's Comprehensive Plan, the growth of Bingham county has seen a large growth and is projected to grow even more than that. The county would benefit more from the tax revenue of controlled residential growth rather than another gravel pit. Bingham County already has 45 open and running gravel sites, 7 of which already exist within 5 miles of our neighborhood. That doesn't include the abandoned, closed, or "reclaimed" gravel pits in the county. All it takes to be "reclaimed" is to put a layer of topsoil down and it can be abandoned. It will be a waste of good actual agricultural/residential land that can benefit the county regularly and steadily over time instead of just a period of a few years and then becomes desolate.

If the zone were to be changed from R/A to A we have the potential of seeing harmful effects on the land, animals, people, and the county. If it were to be changed and SLT LLC gets the Special Use Permit and continues on with their plan, Industrial/Commercial businesses can misuse and ruin precious agricultural land, it will cause harmful and irreparable damage to the water quality and already endangered water quantity as well as air quality. Lastly, we would not be able to afford to sell nor would we be able to afford the medical burdens it would place on us if these proposed changes were to happen. **The Federal ADA may even have to become involved to protect my rights.** And for these reasons we ask you to deny the proposed zone change from R/A to A.

Chelsey Campbell
550 W. 200 N. Blackfoot, Idaho 83221 (208) 223-6965

I have consolidated the studies I have used please read the blue highlighted sections.

TITLE 22

AGRICULTURE AND HORTICULTURE

CHAPTER 45

RIGHT TO FARM

22-4502. DEFINITIONS. As used in this chapter:

(1) "Agricultural facility" includes, without limitation, any land, building, structure, ditch, drain, pond, impoundment, appurtenance, machinery or equipment that is used in an agricultural operation.

(2) "Agricultural operation" means an activity or condition that occurs in connection with the production of agricultural products for food, fiber, fuel and other lawful uses, and includes, without limitation:

(a) Construction, expansion, use, maintenance and repair of an agricultural facility;

(b) Preparing land for agricultural production;

(c) Applying pesticides, herbicides or other chemicals, compounds or substances labeled for insects, pests, crops, weeds, water or soil;

(d) Planting, irrigating, growing, fertilizing, harvesting or producing agricultural, horticultural, floricultural and viticultural crops, fruits and vegetable products, field grains, seeds, hay, sod and nursery stock, and other plants, plant products, plant byproducts, plant waste and plant compost;

(e) Breeding, hatching, raising, producing, feeding and keeping livestock, dairy animals, swine, fur-bearing animals, poultry, eggs, fish and other aquatic species, and other animals, animal products and animal byproducts, animal waste, animal compost, and bees, bee products and bee byproducts;

(f) Processing and packaging agricultural products, including the processing and packaging of agricultural products into food and other agricultural commodities;

(g) Manufacturing animal feed;

(h) Transporting agricultural products to or from an agricultural facility;

(i) Noise, odors, dust, fumes, light and other conditions associated with an agricultural operation or an agricultural facility;

(j) Selling agricultural products at a farmers or roadside market;

(k) Participating in a government-sponsored agricultural program; and

(l) The ingress and egress of agricultural aircraft to agricultural lands or treatment areas.

(3) "Nonagricultural activities," for the purposes of this chapter, means residential, commercial or industrial property development and use not associated with the production of agricultural products.

(4) "Improper or negligent operation" means that the agricultural operation is not undertaken in conformity with federal, state and local laws and regulations or permits, and adversely affects the public health and safety.

History:

[22-4502, added 1981, ch. 177, sec. 1, p. 311; am. 1997, ch. 341, sec. 1, p. 1025; am. 1999, ch. 377, sec. 1, p. 1035; am. 2011, ch. 229, sec. 1, p. 623; am. 2022, ch. 116, sec. 1, p. 424.]

According to a 2006 study by Auburn University economics professor Diane Hite, there is a statistical correlation between the distance of a property from a gravel pit and its sale price. The study found that properties adjacent to a gravel pit can experience a 30% reduction in value, while properties one mile away can experience a 14.5% reduction, two miles away an 8.9% reduction, and three miles away a 4.9% reduction. The study also found that property values increase by 1% for every 10% increase in distance from the gravel pit.

A residential property located a half mile from the gravel mine would experience an estimated 20 percent reduction in value; one mile from the mine, a 14.5 percent reduction; 2 miles from the mine, an 8.9 percent reduction; and 3 miles from the mine, a 4.9 percent reduction.Aug 15, 200

Property Values Decrease When a Quarry is Built

Property values drop when a quarry is built. Over the past twenty years, the evidence is clear. Scientific methods have been developed to account for other factors such as the size and location of the property, the local environment, age of the house etc., so that the effect of property value changes caused only by the quarry can be calculated. The value of property decreases most within the immediate vicinity but will be felt several miles away. Homes within a quarter mile will drop by about 30%. A mile away the value of homes will decrease by about 13%, Home as far as 3 miles away can expect about a 6% drop in value.

homes, industrial companies seeking fewer regulations for the manufacturing processes they use.

The consulting company C4SE looked at 6 cases where home values were purported to remain the same once a quarry was built. In 5 cases, They found that the methodology used was flawed and did not account for other factors. That is, the comparison was more like comparing apples and oranges. In one, done by the Bureau of Mines, they found that the values actually decreased in 4 of the 5 areas the Bureau claimed remained the same. In the remaining study by the Bureau, the study was in an area that already was heavily industrialized and so a quarry did not affect the overall quality of the area.

Lower Milford Township will lose in a variety of ways:

- *It will lose a small amount in real estate taxes*. The quarry rezoned to industrial will not bring in more tax revenue to offset that lost by the surrounding properties. That is because the equipment and storage facilities are temporary and not subject to real estate tax. Property owners will have to make up the revenue. Of course, the School District will lose even more. This time the School District residents will have to make up for the loss.
- *It will have to provide more municipal services such as Fire, EMT, and Police as well as legal services to have them comply with our ordinances*. It will raise taxes even if Geryville agrees to relocate and support financially the extra services. Other areas, have shown that the training costs for specialized services and the need to recruit often end in non-volunteer services which the Township has to maintain.
- *It will affect the safety of our citizens*. Additional traffic will increase the number of accidents in the Township on Kings Highway and Limeport Pike. When accidents occur due to truck traffic, data has shown the accident is either minor or very serious. There are no accidents that causes non-serious injury or moderate damage. We can expect more residents dying.

Lower Milford Township will change dramatically, none for the better, if a quarry is permitted. How much value in property loss will you encounter? Check the map below to see where you will live if a quarry is built on West Mill Hill. Then as a rough guide use a 19% loss if you live with a mile (*red circle*) of the quarry, and use a 9% loss if you live between 1 and 3 miles(*black circle*) from the quarry. The only winners will be Geryville Materials investors and Haines & Kibblehouse who purportedly will be the quarry operators.

Hot Mix Asphalt Plants: Health Effects and Standards This fact sheet provides information about hot mix asphalt plants, their potential health risks and how they are

On average, property within a mile of the quarry will lose about 19% of its value as soon as a quarry begins. For example, a $350,000 home will lose about $67,000 if it is within a mile of the quarry. For Lower Milford Township, this loss translates to more that $6 million loss in property value with its attendant loss in local taxes, change in the type and mix of new construction, and other effects. These losses do not account for loses in other areas where truck traffic, dust, noise will contribute to further loss in property value.

There have been several studies that have confirmed this data unequivocally. Quarry operators, including witnesses for Geryville Materials, try to refute that fact. They claim there is not effect when quarries are built. This certainly goes against common sense -- would you pay the same amount for a house with a quarry in the neighborhood and the same house without a quarry? But it also goes against the actual data. Quarry operators compare property values in one of two ways:

- It compares values in two locations but do not account for differences in the type of environment. They compare homes in an industrial area or a lower income housing area with homes in the quarry area which were more rural or residential thus commanding a higher price. They then claim homes are comparable in value, not taking into account the loss when the quarry came into existence.
- They look at the property appreciation over time pointing out that the value of the properties grow at about the same rate as homes further away from the quarry. They also point out that there is development that occurs in the area. Both are true. The loss in value occurs when a quarry first comes to the area. This loss persits essentially forever. However, the property after the initial loss will grow at about the same as other, more desirable areas. Development also occurs in that area but it is of less value, e.g., strip malls, small subdivision

Health Issues with an Asphalt Plant Nearby

Here are some short quotes and abstracts from articles referencing the health problems that occur with working, and/or living near an Asphalt Plant.

Asphalt and Diesel Exhaust Fumes

> " Over a half-million workers are exposed to fumes from asphalt, a petroleum product used extensively in road paving, roofing, siding, and concrete work. Health effects from exposure to asphalt fumes include headache, skin rash, sensitization, fatigue, reduced appetite, throat and eye irritation, cough, and skin cancer. "

Reference: Asphalt Fumes - United States Department of Labor, Occupational Safety and Health Administration

Reference: Hot Mix Asphalt Plants - Truck Loading and Unloading

> " The primary emission sources associated with Hot Mix Asphalt(HMA) production are the dryers, hot bins, and mixers, which emit particulate matter (PM) and a variety of gaseous pollutants. Other emission sources found at HMA plants include storage silos, which temporarily hold the HMA; truck load-out operations, in which the HMA is loaded into trucks for hauling to the job site; liquid asphalt storage tanks; hot oil heaters, which are used to heat the asphalt storage tanks; and yard emissions, which consist of fugitive emissions from the HMA in truck beds. Emissions also result from vehicular traffic on paved and unpaved roads, aggregate storage and handling operations, and vehicle exhaust. "

> " The PM emissions associated with HMA production include the criteria pollutants PM-10 (PM less than 10 micrometers in aerodynamic diameter) and PM-2.5, hazardous air pollutant (HAP) metals, and HAP organic compounds. The gaseous emissions associated with HMA production include the criteria pollutants sulfur dioxide (SO 2), nitrogen oxides (NO x), carbon monoxide (CO), and volatile organic compounds (VOC), as well as volatile HAP organic compounds. "

Reference: EPA - Hot Mix Asphalt Plant Emission Assessment

Summary of Research on Diesel and Asphalt Hazards

Toxic Smell

> "It smells."

"While a state study indicates the air quality in a neighborhood next to a controversial paving plant meets safety standards, neighbors say their problems with the plant are as much about quality of life as quality of air.

The odor of asphalt coming from the R.C. & Sons paving plant has been a prime complaint of several residents of the nearby Grandview neighborhood."

Bangor Daily News - It smells, but Maine Asphalt Plant meets standards

" Dr. Mitchell said that tiny particles in asphalt production plant emissions can cause lung damage, exacerbate breathing conditions and ultimately cause more severe problems. "

New York Times Article - Who Wants to Live Near an Asphalt Plant

Noise

Here are typical noise emissions from a Hot-Mix Asphalt Plant.

Noise Level	Distance from Center of Plant
85 dBA	50 feet (measured reference level)
78 dBA	100 feet
70 dBA	200 feet
63 dBA	400 feet
55 dBA	800 feet
46 dBA	1,600 feet
36 dBA	3,200 feet
24 dBA	6,400 feet

We do not know the assumptions that went into the measurements in this noise summary table.

Looking at the California study, we do not know the age or size/capacity of the plant(s) measured.

Remember that newer plants are quieter, and older plants make more noise.

Reference: Full Document - Caltrans - State of California

Overall Health Effects

" The complex chemical composition of asphalt makes it difficult to identify the specific component(s) responsible for adverse health effects observed in exposed workers. Known carcinogens have been found in asphalt fumes generated at worksites. Observations of acute irritation in workers from airborne and dermal exposures to asphalt fumes and aerosols and the potential for chronic health effects, including cancer, warrant continued diligence in the control of exposures. "

Reference: CDC - Hazard Review - Health Effects of Occupational Exposure to Asphalt

What the Federal Government Regulates on Asphalt Plants and Air Quality

What federal rules apply to asphalt plants?

- Asphalt plant emissions of particulate matter (PM2.5 and PM10, carbon monoxide, sulfur dioxide nitrogen dioxide, and lead must not exceed National Ambient Air Quality Standards (NAAQS) at the property boundary.
- Asphalt plants manufactured after June 11, 1973, are subject to 40 CFR 60 Subpart I-New Source Performance Standards for Hot Mix Asphalt Plants. NSPS, Subpart I limits only the emissions of particulate matter from material handling systems.
- On November 8, 2002 , USEPA removed Asphalt Hot Mix Production from the Source Category List for which development of National Emission Standards for Hazardous Air Pollutants Standar is required.

Reference: North Carolina Division of Air Quality - Air Toxics and Asphalt Plants

Web Sites With More Information

Here are addition web sites that have information on Asphalt Plants and health effects.

- Hot Mix Asphalt Plants - Stakeholders Opinions Report - US EPA
- Fact Sheet - Hot Mix Asphalt Plants - Oregon Department of Environmental Quality
- Preventing Pollution at Hot Mix Plants - A Guide to Environmental Compliance and Pollution Prevention for Asphalt Plants in Missouri - State of Missouri
- Asphalt Plant Pollution - Blue Ridge Environmental Report
- Road Paving Asphalt - State of New Hampshire - Fact Sheet
- Asphalt - Hazardous Fact Sheet - State of New Jersey
- North Carolina Division of Air Quality - Air Toxics and Asphalt Plants

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We are PARC - Protectors of the Ammonoosuc River Corridor in Lisbon, New Hampshire.

You can contact PARC at

PARC
P.O. Box 515
Sugar Hill, New Hampshire.
03586

Fiscal Agent: Peter Nightingale
Phone #: (603) 616-9292

ASPHALT PLANT POLLUTION

Asphalt plants mix gravel and sand with crude oil derivatives to make the asphalt used to pave roads, highways, and parking lots across the U.S. These plants release millions of pounds of chemicals to the air during production each year, including many cancer-causing toxic air pollutants such as arsenic, benzene, formaldehyde, and cadmium. Other toxic chemicals are released into the air as the asphalt is loaded into trucks and hauled from the plant site, including volatile organic compounds, polycyclic aromatic hydrocarbons (PAHs), and very fine condensed particulates.[EPA]

Asphalt Fumes are Known Toxins. The federal Environmental Protection Agency (EPA) states "Asphalt processing and asphalt roofing manufacturing facilities are major sources of hazardous air pollutants such as formaldehyde, hexane, phenol, polycyclic organic matter, and toluene. Exposure to these air toxics may cause cancer, central nervous system problems, liver damage, respiratory problems and skin irritation." [EPA]. According to one health agency, asphalt fumes contain substances known to cause cancer, can cause coughing, wheezing or shortness of breath, severe irritation of the skin, headaches, dizziness, and nausea. [NJDHSS] Animal studies show PAHs affect reproduction, cause birth defects and are harmful to the immune system. [NJDHSS] The US Department of Health and Human Services has determined that PAHs may be carcinogenic to humans. [DHHS]

Health Impacts & Loss of Property Value. The Blue Ridge Environmental Defense League (BREDL), a regional environmental organization, has done two studies on the adverse impacts on property values and health for residents living near asphalt plants. A property value study documented losses of up to 56% because of the presence of a nearby asphalt plant. In another study, nearly half of the residents reported negative impacts on their health from a new asphalt plant. The door-to-door health survey found 45% of residents living within a half mile of the plant reported a deterioration of their health, which began after the plant opened. The most frequent health problems cited were high blood pressure (18% of people surveyed), sinus problems (18%), headaches (14%), and shortness of breath (9%). [BREDL]

Flawed Tests Underestimate Health Risks. In addition to smokestack emissions, large amounts of harmful "fugitive emissions" are released as the asphalt is moved around in trucks and conveyor belts, and is stored in stockpiles. A small asphalt plant producing 100 thousand tons of asphalt a year may release up to 50 tons of toxic fugitive emissions into the air. [Dr. R. Nadkarni] Stagnant air and local weather patterns often increase the level of exposure to local communities. In fact, most asphalt plants are not even tested for toxic emissions. The amounts of these pollutants that are released from a facility are estimated by computers and mathematical formulas rather than by actual stack testing, estimates that experts agree do not accurately predict the amount of toxic fugitive emissions released and the risks they pose. According to Dr. Luanne Williams, a North Carolina state toxicologist, 40% of the toxins from asphalt plant smokestacks even meet air quality standards—and for the other 60% of these emissions, the state lacks sufficient data to determine safe levels.

BE SAFE: Take Precautionary Action to Protect Our Communities from Asphalt Plant Air Pollution

Effects of Surface Mining on Ground Water Quality

by Henry Rauch

Nature of Ground-water pollution by surface mining

Ground water is becoming a major concern with respect to surface mining of coal in both West Virginia and the nation's other coal fields. Two major concerns are ground-water quality and ground-water quantity, but only the quality aspects are addressed in this paper. Despite the new emphasis placed on ground water by regulatory authorities, the effects of coal mining on ground water are still poorly understood. It is my intention to elaborate on general aspects of ground water, and to share with you some results of research done in Monongalia and Preston counties in conjunction with colleagues and graduate students in geology at West Virginia University and the West Virginia Geological and Economic Survey.

Ground water occurs in a variety of ways, depending upon depth below land surface, rock type, and topography. Three important aspects of ground water related to the "hydrologic balance" are the storage capacity of rocks for ground water, the rate of movement of ground water and chemical quality. Rock units that have relatively high storage capacities and that allow relatively rapid movement of ground water are termed aquifers. A simple practical definition of an aquifer is a rock unit of other underground layer or zone that yields a sufficient quantity of water to a well or spring being used as a water supply source. This is generally at least one gallon per minute for domestic supplies for single families. Rock types that are usually considered aquifers, where they occur in thick enough units, are sandstone, limestone, and coal. Thick coal seams sometimes are the best yielding aquifers in certain localities, because of the coal cleats or fractures. Shales, mudstones, and clays are usually not aquifer units. Ground water can be classified by depth. Shallow ground water usually supplies springs and dug wells, whereas deeper ground water supplies mostly drilled wells. Shallow ground water is intersected beneath the water table, and deeper ground water (in drilled wells) commonly is artesian water under significant pressure. Deeper ground water is usually at least 30 feet deep, and has typically been in the ground longer and is flowing slower than shallow ground water. Ground water typically moves at rates ranging from a few feet per year to a few feet per day, which is much slower than stream flow.

Ground-water pollution can occur both directly and indirectly as a result of surface mining. Direct degradation can occur to ground water situated downhill or down gradient from a surface mine, by flow of contaminated drainage from the mine. This mine drainage can come from pits, ponds, or from rainfall infiltration and ground-water flow during mining and after reclamation. Ground-water pollution would result from the same toxic overburden and coal materials that cause surface water contamination.

Indirect degradation of ground water could result from blasting, which causes a temporary shaking of the rock and results in new rock fractures near working areas of the mine. Blasting can also cause old preexisting rock fractures to become more open or permeable, by loosening mineral debris or cement in these fractures; this could affect nearlyvertical fractures located up to several hundred feet away from the surface mine, causing vertical leakage of ponded mine drainage from nearby abandoned deep mines to underlying aquifers. These deep mines could be situated in the same coal seam being surface mined or in a lower coal seam.

Acid mine drainage originates by geochemical reactions described by Harold Lovell in a companion paper of this symposium proceedings. Pyrite from exposed coal or associated rocks reacts with oxygen gas and water to yield dissolved iron and sulfuric acid. The iron then further oxidizes to yield more acid and precipitated iron mineral solids. Further, dissolved oxidized iron can react with more pyrite generating more sulfuric acid. Mine drainage may then be artificially or naturally neutralized. Most mine drainage becomes at least partially neutralized by natural exposure to alkaline rocks and minerals even without any treatment by the coal mine operator. The strong acid may become partially neutralized primarily by solution of carbonate minerals (such as calcite and dolomite). This happens in the reclaimed mine site as well as in rock strata underlying the mined coal seam.

Ground water contaminated by mine drainage often is different in chemistry from polluted surface water before chemical treatment. Polluted ground water typically has undergone a higher degree of natural neutralization than has polluted surface water, because of its greater contact with carbonate minerals and slower rates of movement. Typically, ground water contaminated by mine drainage in northern West Virginia has higher pH and total hardness, and lower acidity, total iron, manganese, aluminum, and suspended solids than untreated surface mine drainage. Ground water polluted by mine drainage is better in overall chemical quality. However, even after complete neutralization of acidity in mine drainage waters, residual pollution still exists in the form of dissolved sulfate. Sulfate is not normally precipitated, and mostly remains in solution following natural or artificial acid treatment. This sulfate is a good tracer or indicator of present and past mine drainage pollution.

Several factors affect the severity of mine drainage contamination of ground water. The acid-producing potentials of coal and overburden rock are a prime factor. In northern West Virginia my colleagues, students, and I have investigated the Pittsburgh, Sewickley, Upper Freeport, Bakerstown, and Waynesburg coals as mine drainage sources. With respect to ground water, we have found that the Pittsburgh coal is the worst mine drainage source (with poorest quality water), followed in order by the Upper Freeport, Waynesburg, Bakerstown, and Sewickley coals. Surface mines in the Sewickley coal usually do not significantly affect ground-water quality. Further, the quality of acid mine drainage appears to vary somewhat geographically within the same coal seam, for reasons not yet fully understood.

The type and degree of surface-mine reclamation also probably affect the severity of subsequent ground-water pollution, since it affects the degree of stream-water pollution. Although less pollution should occur with better reclamation, we have not yet evaluated this factor in our research.

The hydrogeologic setting can also influence the mine-drainage contamination of ground water. In northern West Virginia, shallow ground water (such as that in springs and dug wells) is more susceptible to pollution than deeper ground water. Springs near surface mines typically have lower pH, higher acidity and higher sulfate content than drilled wells near surface mines. In fact, almost all tested drilled wells exhibiting mine drainage pollution in northern West Virginia had pH values over 6.0, reflecting largely completed neutralization by natural solution of carbonate minerals. Furthermore, properly constructed drilled wells with casings over 30 feet deep usually have little or no problem with mine drainage pollution, even near surface mines; such wells tap deeper aquifers that are less likely to be contaminated by mine drainage.

The distance of a ground-water supply source from a surface mine is also critical in determining the severity of any pollution. In northern West Virginia, severe contamination appears to be mostly restricted to ground water located within about 200 feet horizontally of a mine drainage source. The eight most severely contaminated wells surveyed in Monongalia and Preston counties are near mines in the Pittsburgh, Waynesburg, Upper Freeport, or Bakerstown coal. These wells had sulfate contents of over 250 mg/l, iron contents of lip to 11.0 mg/l, and manganese contents of up to 2.75 mg/l. A rule of thumb is that most wells and springs with more than 100 mg/1 of sulfate are probably being

supplies. However, wells and springs with less than 100 mg/1 sulfate are either not affected or are not significantly contaminated by mine drainage. Wells appear to be especially susceptible to contamination with mine drainage if they are located near an apparent rock fracture zone that also extends to a nearby mine. Such fracture zones would allow ground water to move more rapidly away from a mine, to create more severe mine-drainage pollution in their paths.

Some legal aspects of ground-water pollution by surface mining

Surface mine operators and companies are concerned about ground water with respect to their legal obligations for protection of groundwater quality and quantity. I interpret three types of legal obligations regarding ground-water quality. First, there are requirements for certain data and plans in the surface mining permit application. Second, there will be monitoring requirements during surface mining, and third, there are water quality standards which must not be violated. Only water quality standards will be reviewed in detail.

Concerning information needed for the mining permit, it is my judgment of Federal and State regulations that the following quality information is required or will soon probably be required of surface miners in West Virginia: (1) pre-mining surveys of ground water, including sampling of all water supply wells and springs within 1000 feet of the mine site, and chemical analyses of these waters for at least pH, total suspended solids, iron, and manganese; (2) characterization of water quality for each aquifer between land surface and the lowest mined coal (including the aquifer just beneath this coal), for pH, suspended solids, iron, and manganese. If wells or springs are not available for sampling and analysis to represent some aquifers, then new wells must be drilled; (3) description of how the potential for ground-water pollution will be minimized, and what pollution is likely to occur; (4) a plan for treatment of pond, pit, or stream waters before they infiltrate, to correct future ground-water pollution should it occur; (5) identification of alternate water-supply sources for ground-water users whose present supplies may become polluted; and (6) a plan for ground-water quality monitoring, involving wells, to be implemented where future pollution is judged probable for areas within 1000 feet of the mine site. It is likely that easily-pollutable ground water at springs and wells will have to be monitored at least once every three months, for at least pH, total suspended solids, iron, and manganese. Probably at least one new well will have to be drilled downhill from the mine site, if no other nearby wells are present.

Water quality standards that will likely soon be required in West Virginia fall under two major categories. First, we have chemical quality standards of the West Virginia Department of Natural Resources, U.S. Office of Surface Mining, and U.S. Environmental Protection Agency - NPDES program, which pertain to mine discharges. Such discharges also include ground water that is likely to be affected by infiltrating pit, pond, or stream waters at the mine. Monitored well and spring waters should not violate the following long-term water quality standards: pH - not less than 6.0 nor greater than 9.0; total suspended solids - not greater than 35 milligrams per liter (the same as 35 parts per million); iron - not greater than 3.5 milligrams per liter as total iron; manganese - not greater than 2.0 milligrams per liter as total manganese. Violations of these standards may result in criminal or civil prosecution, resulting in fines and additional required water treatment. However, most ground water polluted by mine drainage, especially deeper ground water, should be of acceptable quality according to the above standards. Research in northern West Virginia indicates the pH is usually above 6.0, and iron and manganese usually are less than 3.5 and 2.0 milligrams per liter respectively, at least for well waters. Total suspended solids would never be above 35 milligrams per liter in ground water, except perhaps in some underground mines. Shallow ground water that discharges at springs near surface mines will be especially susceptible to contamination by mining.

The second set of chemical quality standards apply only indirectly, but are much more significant and

comprehensive for ground water. If a spring or well owner can reasonably show that his water supply as significantly worsened in quality and that a nearby surface mine is probably to blame, then the ıine owner is obligated to replace the contaminated supply with another potable one. What water uality parameters are considered are not indicated in detail by any regulations pertaining directly to ıining. Regulations of the West Virginia Department of Natural Resources (chapture 20, article 5A, ection 3) may be interpreted to include ground-water supplies affected by pollution sources. Pollution ources, including mines, should not cause or significantly worsen objectionable taste, odor, or color of ater supplies, and should not require an unreasonable degree of treatment for potable water.

urthermore, if a water-supply owner can show from quantitative measurements that significant dverse changes have occurred in chemical concentrations for his water, he will probably have a tronger legal case. Adverse changes probably indicate pollution and pollution may be aesthetic or hysiologic in character. Aesthetic pollution causes bad tastes, smells or appearance, whereas hysiologic pollution is more serious and commonly causes a disease or illness following water onsumption. Fortunately, physiologic pollution of ground water by coal mining is not likely to occur, ut research on toxic trace elements in polluted ground water has not yet been done to prove this ssumption. However, aesthetic ground-water pollution is likely to occur because of mine drainage, at east with respect to iron, manganese, and sulfate. According to standards of the U.S. Environmental rotection Agency -Safe Drinking Water Act of 1974, iron and manganese become objectionable in ater if their total concentrations exceed 0.3 and 0.05 milligrams per liter respectively. When this ccurs, they cause brown or black mineral stains on laundry, cooking utensils, and bathroom fixtures, nd the water also commonly looks and tastes bad. Most tested ground waters of northern West irginia exceeded these standards, where mine drainage pollution was apparent. Note that these tandards are much more stringent than those Office of Surface Mining Standards mentioned above for ıine discharges. Some ground-water supplies are naturally high in iron and manganese and even xceed the Environmental Protection Agency standards without mine drainage pollution, but these lements become even higher in concentration if mine drainage pollution results.

ust as serious as iron and manganese is sulfate. Water with sulfate over 250 milligrams per liter is onsidered to be unfit to drink by guidelines issued by the U.S. Environmental Protection Agency -Safe rinking Water Act. High sulfate contents cause diarrhea and poor-tasting water. Water supplies erving 200 or more customers should not exceed 250 milligrams per liter, by U.S. Environmental rotection Agency and West Virginia State Board of Health standards. However, if a well or spring wner can show that his water's sulfate content has significantly increased because of coal mining, he ıay institute a civil suit for polluted water. Such a person would have an especially strong case, if he an demonstrate that sulfate was previously less than 100 milligrams per liter, but then increased to reater than 250 milligrams per liter during nearby surface mining. All wells and springs tested to date ı northern West Virginia, with sulfate contents of over 250 milligrams per liter are located near ources of mine drainage.

reventive and corrective measures for mine drainage pollution

everal actions can be taken to lessen the chances of ground-water pollution occurring because of urface mining. Ground water should be directed away from the mine site both during and after ıining, where possible. This objective should be easier to achieve for contour mines than for area ıines. In contour mines, drainage pipes can be installed in ditches dug at the foot of the high walls ust prior to reclamation. This will result in lower water tables after reclamation, and less ground-vater contact with fill material. Ground-water drainage could then be directed in pipes towards a ıearby stream channel. Another approach would be to install an impermeable barrier in the backfill ıaterial, a few feet below the surface. This would have the effect of directing infiltrating rainfall lownslope away from the mine and buried toxic overburden. Where possible, surface mining should be ept at least 200 feet away from any well or spring water supply, especially those supplies located

should be filled with concrete grout at the mine site during mining. Otherwise, polluted mine drainage may recharge aquifers underlying the mine. Likewise, wells drilled near the mine to monitor ground water should be grouted following mine reclamation.

Certain corrective measures can be taken after ground-water pollution is detected. One should first locate and stop discharges from specific pollution sources on the surface mine site, if possible, before reclamation is completed. This could include channeling mine surface water into treatment ponds that are lined with impermeable bottoms. Second, new water supplies should be located for persons whose wells or springs have become polluted. The most dependable water supply would be piped water from a water service district. If piped water is too far away to be economically feasible, then the choices would be a new well, a cistern or a nearby spring. Of these, a new well is definitely preferable. It should be located as far away from the mine as possible and away from other potential pollution sources such as septic tanks, acid streams and other mines; it should also be properly constructed and sealed, and have enough casing to seal off the upper shallow ground-water zone. If possible, a deeper aquifer with potable ground water should be tapped for a water supply. New well drilling and construction should be handled by an experienced water-well driller.