

**Blasting-Related Citizen Complaints in  
Kentucky, West Virginia, Virginia and  
Tennessee**

**{tc \l1 "Blasting Related Citizen  
Complaints}Mountaintop Mining/Valley Fill  
Environmental Impact Statement  
{tc \l1 "Mountaintop Environmental Impact Statement  
Segment}**

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## **Introduction**

### **{tc \l2 "Introduction}**

Blasting complaints continue to be the most common type of complaint to the Office of Surface Mining Reclamation and Enforcement (OSM) and the state regulatory authorities (RA). Citizens and citizen's groups have expressed concern for many years that the various regulatory authorities do not serve the interests of the citizens on blasting damage complaints. As a result, in FY 1999, the OSM Executive Council formed an OSM blasting team to conduct a national study. The study was designed to identify blasting trends in the regulatory program states. The survey did not assess the technical merits of the investigations.

The study entailed collecting and analyzing readily available data in Federal and State files on citizen's complaints related to surface coal mine blasting. For the purpose of the mountaintop mining environmental impact statement, 708 complaints from West Virginia, Kentucky, Virginia, and Tennessee were extracted from the national study. The national study tabulated 1,317 complaints, with 338 complaints at one surface mine in Pennsylvania.

## **Background**

### **{tc \l2 "Background}**

The Surface Mining Control and Reclamation Act of 1977 (SMCRA) requires the prevention of injury to people and damage to public and private property outside the permit area when blasting at surface coal mines. The regulations specifically address the adverse effects of blasting, which include ground vibrations, air blast and flyrock. In addition to setting limits, the regulations also give the RA the latitude to lower to limits to ensure the prevention of damage on a case-by-case basis.

However, people often feel their house shake and hear rattling caused by blast-induced ground and air vibration levels well below those levels necessary to cause damage to structures. To some people the blasts are annoying. Other citizens "feel" the blasting and are afraid that the blasting is doing or will do damage to their home. Damage is sometimes alleged as blasting events cause citizens to look more closely at their home after they feel it shake. Many times the cracks were preexisting as documented in preblast surveys and are the result of construction methodology, ageing or environmental factors. Furthermore the citizens can rarely identify a *specific* blast that resulted in *specific* damage. In the experience of OSM and the RAs, damage is rarely found where blasting vibrations are kept within the regulatory limits.

The investigation of a blasting complaint requires personnel with technical training in blasting, seismology, acoustics and construction engineering. Any or all of these disciplines may be used depending on the type of complaint. For example, an annoyance complaint would not require specialized training in construction engineering. But the better trained investigators are more capable of discussing the impact of blast induced vibrations on houses in terms the homeowner understands.

The study was limited to data readily available in the complaint files, frequently only the written response back the citizen. No evaluation of the adequacy of the RA complaint review were undertaken. However notes were made on the RA review methodology

**Complaint Study Data**  
**{tc \12 "Complaint Study Data}**

The study gathered data in three general categories: 1) the reason of the complaint; 2) the methods of investigation used in the resolution; and 3) the resolution of the complaint. The following blasting complaint data was distilled from the national study for the mountaintop mining EIS study area for the period 7/98 to 6/99. Table 1 shows the number of complaints by state within the study area. These complaints may have been related to annoyance, damage, fear of damage, well damage, flyrock, dust, noise, blasting schedules, preblast surveys, warning signals, access control to the blast site, record keeping, signs, advertisements, etc. Some complaints may be from the same person numerous times.

Table 1. Summation of all the complaint.

<b>State</b>	<b>Blasting Related Complaints</b>
Kentucky	263
West Virginia	352
Virginia	87
Tennessee	6
<b>Total</b>	<b>708</b>

The following general observations are made from the national data minus the one Pennsylvania mine. Eliminating the one Pennsylvania mine keeps the data from being strongly skewed to one state.

1. The study area accounted for 72% of the complaints. If the one mine in Pennsylvania is considered, the study area accounted for 54% of the complaints.
2. The greatest number of complaints were lodged in West Virginia (40%) and Kentucky (27%). Virginia and Tennessee followed with 9% and 1%, respectively.

**Reasons for the Complaints**

**{tc \13 "Reason for the complaint.}**

The reason for a complaint or type of complaint determines the level of investigation necessary to resolve the complaint. For example, a damage claim warrants a review of the structure where the damage is alleged and an annoyance complaint does not. Table 2 shows the complaints by type. Consolidated in Table 2 are the other types of complaints not pertinent to the issues of damage or injury such as record keeping, advertisements, schedules, warning signals, signs, access control, pre-blast survey offerings. These were not issues identified during scoping of the EIS. Some complaints listed multiple types, i.e. annoyance and damage and resulted in counting one complaint in more than one category, thus the total complaint types (960) will exceed the number of complaints filed (708).

Table 2. Distribution of the complaints by type (Appendix A).

<b>Complaint Type</b>	<b>WV</b>	<b>KY</b>	<b>VA</b>	<b>TN</b>	<b>Total</b>
Dust and Fumes	11	9	9	0	29
Flyrock	5	7	3	0	15
Annoyance/noise	278	177	75	4	534
Water Quantity/Quality	38	44	8	6	96
Structure Damage	85	110	38	3	236
Other	10	31	8	1	50
<b>Total</b>	<b>427</b>	<b>378</b>	<b>141</b>	<b>14</b>	<b>960</b>

The following general observations are made from the study area data. Since some complaints cited more than one area of concern, the reported percentages are based on the number of individual complaints (708). Therefore the percentages will add to more than 100%.

1. Annoyance/noise, which relate to concerns for excessive vibration (house shaking), fear of damage, startle, irritation, etc. accounted for 75% of the complaints in the four state area. This percentage is high, because anyone alleging damage or water problems was generally annoyed.
2. Alleged damage to structures (residential dwellings) accounted for 33% of the complaints. Damage allegations include interior cracks, foundation cracks, concrete floor cracks, brick veneer cracks, roof leaks, door misalignments, windows, personal property, etc.
3. Alleged complaints of damage to domestic water well systems accounted for 14 percent of the complaints. Most of the concerns focused on changes in the quantity or quality of well water.
4. Complaints of excessive dust and fumes accounted for 4 percent of the complaints. Dust from blasting travels off site to cover cars, houses, laundry, etc. If fumes drift off site they may cause respiratory problems.

5. Complaints of flyrock accounted for 2 percent of the blast related citizen complaints. Flyrock is any material that leaves the permit area either through the air or along the ground. Flyrock has the greatest potential for causing damage to property and injury or death to persons who reside near the mining areas.

6. Other types of complaints accounted for 7%. Mostly these are administrative type complaints pertaining to preblast surveys, blasting schedules, record keeping, advertisements, warning signals, etc.

### **Methods Of Investigation Used In The Resolution of Complaints**

#### **{tc \13 "Methods of investigation used in the resolution}**

When a complaint is received, the RA locates the house relative to the mine and decides if a violation has been committed. Often, the investigator is the mine inspector who is intimately familiar with the mine and surrounding areas. Sometimes a blasting specialist is involved. The investigation can be a simple compliance check of records and vibration levels for annoyance complaints or a more detailed investigation for damage complaints.

The RA can use some or all of the following investigative procedures to help resolve the complaint.

1. Document the location of the complainant relative to the mine,
2. Review blast records for the period relative to the complaint,
3. Observe and document the alleged damage,
4. Compare alleged damage to the condition of the structure as documented in a pre-blast survey,
5. Document the location of flyrock,
6. Estimate the maximum ground vibrations at the complainant's house for the claim period,
7. Conduct monitoring with blasting seismographs,
8. Require the mine operator to conduct monitoring with a blasting seismograph,
9. Perform regression analysis techniques on the blast vibration data,
10. Conduct structural response monitoring,
11. Conduct hydrologic review.

For compliance checks, the investigator does not always document the exact location of the house relative to the mining. For administrative type complaints, locations may not be needed either. Thus in review of responses back to the citizen, conclusive data on the number of houses within ½ - mile of the permit area were not always available. Based on the survey, Table 3 is a summary of houses within ½-mile.

Table 3. Houses within ½-mile of the permit area.

	W/in ½-mile	Outside ½-mile	Unknown	Total
Kentucky	83	43	137	263
Tennessee	0	6	0	6
Virginia	45	15	27	87
West Virginia	18	91	243	352
Total	146	155	407	708

Likewise, for preblast survey documentation, the investigator reviews the survey if a damage claim was filed. No review of the preblast survey is required for an annoyance complaint. Therefore the true number of surveys conducted at residences within ½-mile of the permit is unknown. Table 4 is a summary of the available data for preblast surveys.

Table 4. Availability of preblast surveys.

	Preblast Survey	No Preblast Survey	Unknown	Total
Kentucky	15	95	153	263
Tennessee	0	6	0	6
Virginia	9	22	56	87
West Virginia	9	58	285	352
Total	33	181	494	708

Appendix B shows the items reviewed for each complaint by the RA as outlined in the response back to the homeowner. The following general observations are made from the data.

1. Blast logs at the mine were reviewed in response to almost all the complaints within each state.
2. The average number of investigative procedures used to resolve annoyance or damage complaints were in 4.3 in Tennessee, 1.6 in Kentucky, 1.1 in Virginia and 0.9 in West Virginia.
3. Dust or fumes investigations only resulted in a review of the blast records relative to the complaint period.
4. 54 out of 96 water complaints resulted in hydrology investigations.
5. Flyrock resulted in review of the blast logs and observation of the alleged damages in almost all 15 occurrences.

These data reflect information contained in the response letter sent to the citizen. The RA may have looked at more information than reported. But it does indicate that the citizens may feel they are not getting a thorough review based on the RA's response.

**Resolution of the complaint**

**{tc \13 "Resolution of the complaint}**

Each complaint warrants a written response that outlines the finding of the investigation. Depending on the type of complaint, the letter can be simple (for a annoyance complaint that discusses compliance with the rules) or complex (if all of the items discussed in methods of investigations are used). Ultimately, either action or inaction must be substantiated. When action is taken, the types of violations to be issued and the mitigative measure to be taken should be discussed.

The following general observations are made from the data on violations written as a result of the complaint investigation (Appendix C). Often more than one violation was written as a result of an investigation.

1. 36 violations were issued in Kentucky in response to 23 of 263 complaints (9%).
2. 17 violations were issued in Virginia in response to 12 of 87 complaints (14%).
3. 44 violations were issued in West Virginia in response to 30 of 352 complaints (9%).
4. Zero violations were issued in Tennessee in response to 6 complaints.
5. Flyrock was the only substantiated cause of damage to homes (2 – Kentucky, 1 - Virginia).
6. West Virginia found 1 case of damage to a water supply.
7. Most of the violations were for exceeding vibration limits or inadequate records.
8. West Virginia issued one violation for dust off the permit.

Almost all the violations issued were unrelated to the original complaint allegation. Data were scarce or non-existent for cases of damage, whether the complainant was compensated or whether the insurance company was involved.

Lastly the date of the written response back to the citizen was compared to the date the complaint was received. Timely responses are generally viewed as a positive factor when providing a public service but may not necessarily be the most thorough. Each RA had the following average response time for each complaint:

1. Kentucky ..... 46 days
2. Tennessee ..... 109 days
3. Virginia ..... 25 days
4. West Virginia ..... 16 days

West Virginia had the quickest response time and Tennessee had the slowest. From the number of investigative procedures used to resolve a complaint as discussed above, the time to resolve the complaint is inversely proportional to the number of procedures used to resolve the complaint. In other words, the response time was quickest for the RAs who used the least investigative procedures to resolve a complaint and lowest for the RA that used the most procedures to resolve the complaint. This suggests a trade off exists between timeliness and quality.

## **Discussion of the Data{tc \l2 "Discussion}**

### **Dust and Fumes**

#### **{tc \l3 "Dust and Fumes}**

The data do not indicate that excessive dust and fumes are a significant problem with a complaint percentage of only 4 percent. One violation was written during the study period on this issue.

Fumes are either nitrogen dioxide or carbon monoxide. Nitrogen dioxide is visible as an orange/brown cloud that moves away from a blast area and can cause health problems at low concentrations (2 ppm). Any visible cloud may be dangerous. Carbon monoxide is colorless and is dangerous at concentrations of 500 ppm in confined spaces. Generally, coal mine blasts do not occur in confined places.

Dust from blasting is more of a nuisance than a health risk at coal mines. To date, no study has identified dust from mining to be in quantities large enough to be a health concern. However, the dust can soil houses, laundry, cars, swimming pools, etc. While no OSM rules on dust exist, the RAs sometimes use their state rules on air quality. The one violation written for dust was for depositing spoil off the permit area.

### **Flyrock**

Complaints of flyrock, material traveling through the air or along the ground outside the permit area, makes up 2 percent of the blasting complaints. Flyrock has the greatest potential for causing death and injury to persons as well as damage to private property. No allegations of injury occurred during the study period. Three violations were written during the study period for damage from flyrock. However, since flyrock is such a dangerous occurrence, the regulatory authorities frequently find and take action even before a complaint is lodged. Therefore, the actual number of events are probably higher than found during this complaint review.

The primary cause of flyrock is inadequate blast design, failure to pay attention to detail when loading blast holes or changing geology. Proper supervisory controls, training of blasters (both certified blasters and the blasting crew) and the establishment of set procedures are the best methods to eliminate flyrock. To protect the public, the blaster is responsible for clearing the blast area (any place flyrock might be expected) prior to the detonation. RAs have the authority to suspend or revoke the license of any certified blaster who causes flyrock off the permit area.

### **Water Well Quantity and Quality**

Fourteen percent of the complaints in the study area were related to domestic water wells. One violation was written during the study period on this issue.

Scientific studies have determined that there is an extremely low probability of causing damage

to a domestic water well by blasting activities associated with mining, quarrying or road construction. When a water well is damaged by mining activity, quarrying or road construction, it is almost always caused by an interruption of the aquifer--either by draining the aquifer, or cutting off the recharge to the aquifer as a result of the mining excavation. Problems with the quality of well water are almost always the result of an increase in dissolved solids at the well from groundwater percolating through the rubble zone of the backfill area.

### **Annoyance**

Complaints of annoyance accounts for a over 75 percent of the complaints in the study area. No violations were written during the study period on this issue.

Annoyance includes, startle, noise, fear of damage, “blasting too hard”, objects moving on shelves, windows rattle, “frightens the children”, etc. SMCRA does not allow OSM to regulate or prevent annoyance. Peoples’ homes may be shaken by the blasting, which is annoying to most people. However, while blast-induces vibrations do shake houses, vibrations may not lead to property damage.

Both ground vibrations and air vibrations cause homes to shake. Ground vibrations enter a house through the ground and airblast through the roof or building side. As a result, the house will respond or shake. A typical house will respond 1 to 3 times the ground vibration level. The higher shaking is caused when the vibration frequency of the ground matches the natural frequency of the house, causing it to resonate. The natural frequency of typical homes is 4 to 12 Hertz. In other words, when the frequency of the incoming vibrations match the natural frequency of the house, the house will “ring,” much like an opera singer can vibrate a glass with her voice. The greater the difference in frequencies between the vibration of the ground and the house, the less the house responds. This significantly impacts people’s perception of a blast. It also explains why the same vibration will cause a complaint at one house but not the neighbors (i.e. the neighbor’s house has a different natural frequency).

Complaints of annoyance can stem from the lack of communication between the coal operators and the citizens in the community. A well-implemented public relations program sometimes significantly reduces complaints. OSM’s experience is that the coalfield citizens typically desire more information from the regulatory authority and the mine operator. The regulations require, at a minimum, information notices to citizens such as blasting warning signs and warning signals, pre-blasting surveys, pre-permit public involvement and a comment period for the citizen to express their concerns.

Some operators and regulatory authorities hold public meetings in order to involve the public and inform them on what they can expect to experience when living near a mining operation. This includes a dialog on blasting and the possible effects on the community. Exchanges of information prior to mining and blasting may reduce the number of annoyance complaints.

## **Structure Damage**

Allegations of blast damage to property were lodged in 33% of the complaints. No violations were written during the survey period on damage other than flyrock.

Property damage could be broken windows, cracked walls, broken bricks, wall separations, doors sticking, chimney cracks, foundation cracks, driveway cracks, roof leaks, etc. When damage is alleged, the regulatory authority is required to evaluate the damage potential.

Scientific investigations by various investigative groups, including the U. S. Bureau of Mines, has related the occurrence of damage at typical structures to the intensity and frequency of blast-induced vibrations. The data collected by the Bureau of Mines shows that no damage<sup>1</sup> (threshold, minor or major) is expected at ground vibration levels at or below 0.5 in/s. Within a 95-percent confidence interval, major damage is not expected below about 2.34 in/s; nor is minor damage below about 1.80 in/s. Airblast damage below 134 dB has never been documented. These observations pertain to typical residential structures of 1-2 stories.

While the regulations specify various methods to show compliance, they also allow the RAs to reduce the ground vibration and airblast levels when blasting activity may impact structures. This permits the RA to protect homes regardless of their age, construction methodology or quality of materials. For example, the regulatory limits at a typical home may not be appropriate for a historic structure where the walls and ceiling are made of plaster. Since no violations of damage were found, none of the RAs established a lower ground vibration or airblast level in response to a complaint.

The level of documented effort in addressing the complaint is reflected in the number of investigative procedures used by the RA. Some RAs simply respond back to citizens that the mine was in compliance and that damage was not caused by the blasting. While, the study did not entail appropriateness of the responses, the review team felt that more of the RA responses could have expounded on the level of investigation. This would serve the citizens better and bolster their confidence in the RA.

## **Conclusions**

Both SMCRA and the OSM regulations make it clear that people must be protected from injury and private property must be protected from damage when blasting at surface coal mines. Furthermore, the rules provide for citizens to be part of the regulatory process by requiring RAs

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<sup>1</sup>There are three classifications of damage-*Threshold* -Loosening of paint, small plaster cracking at joints, lengthening of old cracks. *Minor*-Loosening and falling of plaster, fall of loose mortar, hairline to 3-mm wide cracks. *Major*-Cracks of several mm in walls, structural weakening, fall of masonry. (U.S. Bureau of Mines RI 8507)

to respond to allegations of improper activities or complaints. This survey identified trends in blasting-related citizen complaints based on readily available data.

Based upon the results of the survey, annoyance is the most common citizen complaint about blasting, followed by damage and water concerns. Dust, fumes and flyrock were of much lesser concern. None of the complaints concerned injury to a person. The survey did not attempt to discern if allegations were legitimate or appropriately investigated by the RAs.

Usually, a citizen complaint can be resolved in a short time. However there are cases where a complainant may file repeated complaints and the investigation may remain open for an extended period. The survey did reveal that the RAs conducting the most in-depth investigation took the longest to respond on their findings and resolve the complaint. While quality of the investigation is important, the response timeliness is essential too.

Most of the violations found during the complaint investigations were related to record keeping and exceeding vibration limits. The only substantiated occurrences of damage to homes were from flyrock.

Ultimately the gauge of success in resolving citizen complaints is in the response back to the citizen. Complaints need to be addressed in a timely and sound manner. If the blasting data is verified and adequately compiled, a conclusive, defensible decision on the disposition of the complaint can be made. A good report that clearly describes the findings will show the complainant the level of effort expended in the investigation, boost their confidence in the reviewer and provide adequate information by which the complainant can go for a "second opinion" if they are uncertain of the findings. While the RAs may look at the appropriate technical items, this survey found that blasting complaint report improvements could be made in describing the effort expended and justifying the conclusions made as a result of an investigation.

## **APPENDIX A**

### **COMPLAINT TYPE BY REGULATORY AUTHORITY**

#### **Appendix Headings:**

RA – Regulatory Authority

Rec ID – Record identification number

Annoy/Noise/Vib/Fear - Complaint of Annoyance, noise, vibrations or fear of damage from blasting

Damage – Complaint alleging damage from blasting

Dust/Fumes – Complaint of either dust or fumes

Flyrock – Complaint of flyrock off the permit area

Water Quality/Quantity – Complaint of change in domestic water supply

Other – Blasting related complaints not in one of the above categories

## **APPENDIX B**

### **INVESTIGATIVE EFFORT BY REGULATORY AUTHORITY**

#### **Appendix Headings:**

RA – Regulatory authority

ID – Record identification number

Blast Record – Blast records reviewed

Docum. Dam. – Documented the alleged damage

Comp. To PBS – compared alleged damage to the preblast survey

Est. PPV – estimated the peak particle velocity at the residence

Est. PPV to BOM – Compared the estimated PPV to damage criteria of the US Bureau of Mines

Cond. Seis. Mon. – RA conducted seismic monitoring in response to the complaint

Req. Seis. Mon. – Required the mine operator to conducted seismic monitoring in response to the complaint

Regress. Analysis – RA conducted regression analysis of the blast log and seismic data

Structure Response – Structure vibrations were measured in response to the complaint.

Hydro. Rev. – Hydrology review of water complaint

## **APPENDIX C**

### **MTR BLASTING COMPLAINTS, VIOLATIONS ONLY**

#### **Appendix Headings:**

RA – Regulatory Authority

ID – Record identification number

Violation Description – Description of the violations issued in response to the complaint

Annoy/Noise/Vib/Fear - Complaint of Annoyance, noise, vibrations or fear of damage from blasting

Damage – Complaint alleging damage from blasting

Dust/Fumes – Complaint of either dust or fumes

Flyrock – Complaint of flyrock off the permit area

Water – Complaint of change in domestic water supply

Other – Blasting related complaints not in one of the above categories

Blast Cause – Blasting caused the alleged damage