An Assessment of the Perceived Effects of Quarry Blasting on a Suburban Residential Area

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Final Report to Commonwealth of Pennsylvania
Department of Environmental Resources
Contract No. 163878

March 1995

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Abstract

Reported were the results and analysis of a community survey based in part on the work of Fidell, Horonjeff, Schultz and Teffeteller (1982), one of the initial field studies of community response to quarry blasting noise and vibration. The present survey was mailed to the owner(s) of record of private residential properties (n=495) in two communities immediately adjacent to a large operating limestone quarry located in Upper Merion Township, about 15 miles north of Philadelphia, Pennsylvania. The site is referred to as the Glasgow Quarry (formerly the McCoy Quarry). Survey items requested information concerning household demographics, residence construction details, residents' perception of various aspects of the community, opinions and reports concerning quarry operations and the impact of quarry operations on the community. A response rate of 48 percent (n=237) was realized, with a single follow-up mailing approximately three weeks after the date of the initial mailing. Also reported were analyses based upon standardized blasting episode diaries maintained by 23 community residents for approximately 18 months, wherein their reactions to various aspects of the experience of a blast event (in total, over 80 actual events) were recorded. The results of analyses examining the relationships among blast characteristics, environmental factors, and human responses to the blast event were presented. A procedure to characterize or describe community response to blast events was suggested.

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Prediction of Annoyance as a Human Response to Noise

In theory, predictions of annoyance as a response to noise (as well as the prediction of complaints, a behavior usually assumed to stem from noise-induced annoyance) should be made by some systematic means, preferably a quantitative model based on the theoretical relationship between noise exposure and annoyance, plus relevant empirical evidence. In reality, we have a most-meager understanding of the mechanism by which noise exposure generates annoyance.

For instance, Fidell (1990), in discussing some of the early research in "noise pollution" mentions that the engineers at Bell Telephone Laboratories initially limited research to "just the noise that people can hear" (p. 14), on the reasonable assumption that if you can't hear it, you can't be affected by it. However, Yeowart (1976) and Bryan (1976) report that, despite the fact that human hearing is supposed to be insensitive to sounds with frequencies below 20 Hz, human reaction to very low frequencies, below 20 Hz, indicates discomfort and "...in some cases, it could be realistically described as being violent" (Yeowart, 1976, p. 37).

The history of the work associated with predicting annoyance due to noise exposure has been summarized by Fidell (1990). A comment by Fidell identifies the major problem with this area of research:

> The fundamental problem (is) to make sense of a large and disorganized literature: to attempt to distill whatever systematic trends might be hidden in a riot of facts and figures. (p. 18)

The problem, although complex, is not insurmountable. An example of the type of integration and synthesis of information that is sorely needed is the work of Schultz (1978), in his development of a model for the dosage-response relationship based on an integration of dozens of research studies.

Part of the complexity is due to the variety of operationalizations of the independent and dependant variables involved in many studies (i.e. lack of a common metric), and part is due to the complex nature of the variable relationships. Rather than strong linear, univariate influences, most variables probably exert their influence in a non-linear, interactive fashion. A sense of the frustration of researchers in this area may be obtained from Shigehisa and Gunn (1979).

> The overall implications of the present results would be that less hope exists for obtaining comparable noise annoyance judgements among different experiments and laboratories employing somewhat different illumination levels using Ss of different personality types (p. 57).

Their results were highly complex, indicating interactions among variables related in a non-linear fashion.[1] Results which are extremely specific to a given research situation do little to build a model of the noise-annoyance relationship, until someone is able to integrate and synthesize seemingly-disparate

[1] Schultz's summary of all survey data points indicates a dosage-response relationship which is a positively accelerating curve (see p.378, p. 383, especially).

or highly-specific results.

Although Schultz's work was thorough and well documented, it has been criticized by some researchers as inaccurate and premature (see, e.g., Kryter, 1982). There are admittedly limitations in Schultz's development. Fidell, Schultz and Green (1988) mention the important issues of:

- the mechanism by which noise exposure produces annoyance;
- the notion that annoyance can be predicted from purely physical measures of noise exposure; and,
- uncertainty about the frequency, duration and level of exposure of individual residents to community noise sources in field studies.

Schultz was well aware of these limitations in his synthesis, pointing out, for example,

> At any given degree of noise exposure, for example, the subject's attitudes toward the source of noise, or toward the neighborhood in general, or toward noise in general, appear to affect whether or not he expresses annoyance and the amount of his annoyance (p. 379).

Green and Fidell (1991) point out that a related problem in synthesizing the results of various studies is the extreme variability in the "...level of noise exposure required to elicit self-reports of consequential degrees of annoyance" (p. 234).

Fidell, Horonjeff, Schultz and Teffeteller (1983) argue that, while the "equal energy model" accounts for the relationship between level of annoyance and transportation noise exposure, a centile-related threshold model is most explanatory of the relationship between impulse noise and level of annoyance. In other words, people do **not** consider the many low-level noise-producing events that produce relatively minor levels of both noise and vibration when judging the annoyance of an activity (such as quarry blasting). Instead, attention is focussed on the relatively small number of events that exceed some level, and create relatively high levels of vibration and noise. A study of the effects of noise in an office environment led Purcell and Thorne (1977) to the same conclusion; it appears the "startle factor" produces more intense or severe effects.

Annoyance Due to Blasting and Related Quarry Activities

Blasting at surface mines produces noise and vibration that might be characterized as impulsive, relatively infrequent, often unpredictable in occurrence and usually variable in intensity. In addition to the direct experience of both air-borne and ground-borne blast energy, indirect exposure to the secondary emissions produced by structures and structural components (both noise and vibration) is common.

A number of studies have concluded that the acoustic signals generated by blasting (or other sources, such as sonic booms) generate more annoyance than vibrations (Kryter, 1970; Schomer, 1978b). Siskind, Stachura, Stagg and Kopp (1980) state that the "...human response and annoyance problem from air-blast is probably caused primarily by wall rattling and the resulting secondary noises" (p.1). Schomer (1978b) also concluded that "...perceived vibration is not normally a factor that contributes significantly to human response to airborne, large amplitude impulse noise. Rather, human response is solely the result of the impulse noise itself and of audible noise due to induced radiation from vibrating surfaces" (p. 328). Schomer's (1978b) synthesis of a number of studies, both field-based and laboratory-based, led him to conclude that "...it appears that only the acoustical stimulus dictates the human response" (p. 330). The "acoustical stimulus" in this review included both the perceived noise of sonic booms and the

secondary noise radiations generated by vibrations.

There has been a marked reluctance to study indoor exposure to secondary noise. There are undoubtedly a number of intervening variables related to the nature of the structure which modify the nature of secondary noises and vibrations experienced by occupants. Fidell, Horonjeff, Schultz and Teffeteller (1982) state that, because of the effects of structural vibration, levels of vibration caused by blasting vary from home to home. Perhaps because of the variation in human response from home to home (and in various locations within a residence), they conclude that "...the only measures of blast noise exposure that are useful in describing and predicting community-wide response are those taken outdoors" (p. 21). To summarize the problems with this conclusion, quoting Schultz (1978), "...anyone who has simultaneously measured the noise just outside and inside a house knows that the exterior and interior exposure bear very little relation to one another" (p. 379). Kamperman, Nicholson and Zak (1976) have documented amplification effects within a structure.

In a synthesis of social surveys on the problem of public annoyance with noise, Schultz (1978) acknowledges the importance of personal traits (e.g. hostility, fear) in predicting an individual's response to noise. However, the question is raised as to whether the **apparent** importance of personal (or non-acoustical) variables is due to their actual importance, or to the possibility that acoustical variables have been poorly handled. Fidell (1984) points out that blasting noises, for example, can be genuinely annoying if only because they remind people of other dislikes, such as early-morning machinery noise, truck traffic, dust, perceived adverse impact on property values or environmental concerns.

Issues Associated with Quarry Activities

There are basically two issues associated with the expression of annoyance with quarry blasting and related activities. The first is apprehension concerning property damage from the airblast or ground vibration resulting from a blast. The second are complaints stemming from anxiety or fear resulting from blast noise or vibration.

In a review of the research literature concerning the effects of blast vibrations on structures, Wiss (1968) summarized extensive work from Sweden, Canada and the United States and concluded that a commonly-used measure of vibration, peak particle velocity, seemed to be the best available criterion for evaluating vibration in terms of its potential for causing structural damage. It was concluded that a peak particle velocity of two inches per second was regarded as safe, i.e. would cause no noticeable damage (p. 46). This standard is set forth in a U.S. Department of Interior, Bureau of Mines Bulletin, number 656, discussed in Kamperman, Nicholson and Zak (1976). They emphasize that, although structural damage will usually not result from peak particle velocities of less than two inches per second, velocities of one inch per second will produce vibrations in a building which will be subjectively regarded as intolerable. Peak particle velocities as low as .2 inches per second can be viewed as unpleasant or annoying by some people. Kamperman, Nicholson and Zak state that the resonance buildup in some structures can increase the amplitude of ground vibrations by a factor of from two to over six (p. 249).

The issues associated with the development of damage to structures by blast vibrations are extremely complex. Certainly, the type and age of structure, geologic considerations, and duration of exposure to all types of vibration (including that due to weather and traffic) are important factors in attributing cause to observed damage.

Annoyance (and resulting complaints) with quarry activities are much more easily documented, and typically show a closer (though imperfect) correlation with actual blast events and related quarry

operations.

The present study was designed to investigate the variables associated with annoyance concerning quarry blasting and related activities in two suburban communities immediately adjacent to a limestone quarry in southeastern Pennsylvania. While issues related to residents' perceptions of blast damage were investigated, there was no attempt to document, investigate or verify the existence of structural (or other) damage reported by study participants.

Part I: The Community Survey

Method

Sample

Based upon a documented history of public annoyance and complaints, the participants in the study were recruited from the area immediately surrounding one of the largest operating limestone quarries in southeastern Pennsylvania. Known as the Glasgow Quarry (formerly the McCoy Quarry), the quarry was originally a source of high quality dolomitic limestone used in the production of steel. Its current principal product is aggregate for highway and similar construction, with a current production level of about 1½ million tons annually. The quarry opening encompasses over 200 surface acres. The communities of Swedesburg and Swedeland lie about one-quarter mile from the quarry, the former to the North, the latter to the South. Both are situated west of the Schuylkill River and would be regarded as suburban communities.

In consultation with Upper Merion Township officials, the real property tax rolls for the communities were examined to identify all private residential properties. Excluded were commercial properties, municipal properties and services, churches, social organizations, and the like. A total of 495 properties were identified, with the owner of record listed and designated as the recipient of the survey questionnaire.

Instrumentation

Based in part upon the work of Fidell, Horonjeff, Schultz and Teffeteller (1982; 1983), a mail survey questionnaire of 52 items was developed. Various sections of the instrument provided for the collection of household information, information concerning structural details of the residence, information concerning the respondents' perceptions of quarry activities and their impact on the community, and respondents' opinions, attitudes and suggestions concerning a wide range of quarry-related activities. The set of open- and closed-end questions was developed during the period May-September 1992, going through seven revisions, with a field test after the fifth. University Institutional Review Board approval was received in late June 1992. (See Appendix A for copy of questionnaire)

Procedure

The instrument was distributed by first-class mail to all 495 property owners of record on October 27, 1992. The mailing included the questionnaire, a cover letter from the principal investigator, a letter of endorsement from the Pennsylvania State Representative for the area including the communities involved, and a stamped, self-addressed return envelope.

A follow-up mailing was made on November 19, 1992. At the time of the second mailing, 150

responses (a response rate of 30.3 per cent) had been received. A final response rate of 237 (as of December 31, 1992) or 48 percent was realized.

Results

Questions 1 and 2 asked for confidential information from respondents (address and telephone number) in the event that a follow-up interview or telephone call was needed to clarify responses. Question 3, asking whether a respondent owned, rented or made other arrangements for occupancy, was the first question in the survey, per se. Of the 237 respondents, 230 indicated they owned their residence, three indicated rental or other arrangements, and four did not respond.

The next question asked for the approximate year of construction of the home. Responses (n=222) ranged from 1750 to 1989. As might be expected, the dates of 1900, 1910, 1920, 1930, and 1940 showed substantial concentrations of responses. With almost 240 possible dates between 1750 and 1989, 67 homes were reported built in these five years. This undoubtedly represents a "rounding error" in respondents recall or knowledge, but is probably an unimportant source of error. Over 10 percent were reportedly built before 1900, over 40 percent before 1920, and over 75 percent before 1950. One would characterize these communities as comprised of largely older structures (See Table 1).

Table 1
Summary Frequencies for Reported Dates of Construction of Respondents' Homes

Reported Date of Construction	Frequency	Cumulative Percentage
1900 or earlier	25	11.3
1910 or earlier	37	16.7
1920 or earlier	89	40.1
1930 or earlier	130	58.6
1940 or earlier	155	69.8
1950 or earlier	171	77.0
1960 or earlier	180	81.1
1970 or earlier	191	86.0
1980 or earlier	214	96.4
1989 or earlier	222	100.0

The next series of questions were intended to produce a general description of survey respondents' households, in terms of ages, gender, employment status, years residing at the address and pattern of presence at home (mornings, afternoon, evening, or night) on weekdays and on weekends.

The range of age for the 185 persons completing this item was 23 to 85 with the mean for men slightly over 53, for women slightly over 51. The frequencies of respondents reporting ages in several summary categories are reported in Table 2. Almost half the respondents were over age 50, with almost 30 percent older than age 65.

Women completed slightly over half the questionnaires. Of the 226 respondents indicating gender, 54.5 percent indicated female as their gender.

Table 2 Summary Frequencies for Ages Reported by Survey Respondents		
Reported Age Category	Frequency of Response	Cumulative Percentage
35 or younger	33	17.8
50 or younger	95	51.4
65 or younger	133	71.9
80 or younger	181	97.8
85 or younger	185	100.0

The next item respondents completed was employment status. Of the 228 responding to this item, almost (47%) indicated full-time employment, and approximately one-third indicated they were retired. A summary of employment status, by gender, is presented in Table 3.

Table 3 Summary of Employment Status, by Gender, of Respondent[1]					
	Employment Status				
Gender	Full-time	Part-Time	Retired	Homemaker	Unemployed
Male	44	14	40	19	5
Female	63	1	34	-	4

[1]A total of 224 persons provided both gender and employment status information

The next item asked about the number of years respondents had lived in their homes. The range of responses (n=198) was from one to 80 years. A summary of the reported terms of residence is presented in Table 4. It should be noted that almost half the respondents indicated they had resided in their present home for 20 or more years, and almost one-fourth indicated they had resided in their present home for 40 or more years. This is an indication that the majority of the respondents have a long-standing familiarity with the community.

Table 4 Summary of Years of Residence in Respondents' Home		
Number of Years	Frequency	Cumulative Percentage
10 or fewer	70	35.4
20 or fewer	105	53.0
30 or fewer	128	64.6
40 or fewer	149	75.3
50 or fewer	168	84.8
60 or fewer	180	90.9
61 or more	18	100.0

The next series of questions asked respondents when they were usually at home. The pattern of responses indicates a fairly even division between respondents at home in the morning or in the afternoon on weekdays, with the majority at home on the weekends. With the length of residence of most respondents, and the pattern of presence or absence from home, it is reasonable to assume that most, if not all, of the respondents have had repeated first hand experience with quarry blasting noise and vibration. These questions will be directly addressed below.

Additional items asked the same question for each additional resident in the home. The range of number of residents per residence was from one to seven. Of the 237 respondents, 231 reported five or

fewer total household residents. About 150 respondents reported three or fewer residing in their home. Judging from ages and employment status, additional residents in the home tended to be spouse, younger children, older children, and elderly relatives, in descending order of frequency.

Question six asked respondents to indicate whether anyone residing in the household had training or experience in areas related to those involved with quarry activities (blasting, dredging, mining, land clearing, operating heavy equipment or trucks). Of the 237 respondents answering this question, the greatest number indicated training or experience with the operation of heavy equipment or trucks. The responses to this question are summarized in Table 5.

Table 5
Summary of Reported Quarry-related Training or Experience[1]

Activity	Frequency of Positive Response	Percentage
Blasting	11	4.6
Dredging/logging	2	.8
Land clearing/site development	14	5.9
Mining	4	1.7
Heavy equipment	27	11.4
Heavy trucks	32	13.5
Quarry operation	10	4.2

[1]There were 237 responses to each item.

Question seven asked whether the respondent or the family directly benefitted from the work at the Glasgow Quarry. Of the 232 responses to this item, 229 indicated no benefit, two indicated employment by Glasgow and one indicated use of Glasgow products.

The next series of questions asked for information concerning the construction of the respondent's home. Most frequently, respondents (109 of 231) described their homes as detached, single-family dwellings. The next most common configuration was a duplex or twin, with 78 respondents, and rowhouse/townhouse, with 49 respondents. The vast majority of homes (164 of 234 responses) were described as masonry construction or (43 of 234) as wood frame veneered with brick, stone or stucco. Most homes were reported to have a standard masonry foundation. Of the 230 responses to this question, 91 reported poured concrete, 80 reported cement block and 50 reported laid-up stone. When queried as to type of basement, if present, 166 of the 233 (71.2%) responding indicated the house had a full basement. The combination of a crawl space and full basement was the next most popular configuration with 50 (or slightly over 25%) reporting this type of construction. The typical basement had poured or cement block walls with a poured floor, or stone walls with a poured floor. Of the 232 responses, 217 had one of these types of basement.

Question 13 asked for the number of floors (or stories) in the house. Of the 237 respondents, 225 reported a full or partial basement, and 130 reported the presence of an attic. The majority of homes possessed, in addition, one or two floors of living space. The modal response was two floors, with 156 responses.

The next series of questions solicited information about respondents' satisfaction with life in the Swedesburg/Swedeland community. The first question (number 14) asked for the year in which the respondent began living in the Swedesburg/Swedeland community. Responses ranged from 1904 to 1991. Over 30 percent reported 1940 or earlier as the year of first residence, 49.6 percent reported 1960 or earlier, and over 70 percent reported 1980 or earlier, indicating a group of respondents with a relatively

long history of residence in the community.

Questions 15 and 16 are typical neighborhood satisfaction items. Number 15 asks the respondent to indicate what is liked **most** about living in the community; number 16 asks for what is liked **least.** Respondents could volunteer more than one factor for these questions.

The open-ended responses were coded using a system of categories developed and cross-validated on two small random samples of responses from the present study. Coding categories and frequencies of response, in descending order of mention, are listed in Table 6 for characteristics most liked.

Table 6
Summary of Responses Indicating Community Characteristics Most Liked

Characteristic	Frequency	Percentage[1]
Quietness	59	26.1
Friendliness	32	14.2
Size	27	11.9
Location	23	10.2
Small-town atmosphere	20	8.8
Family ties, "roots"	13	5.8
Overall appearance	11	4.9
Sense of continuity	10	4.4
Safety	8	3.5

[1]Percentages are based on 226 responses.

A number of other characteristics were mentioned less frequently: churches (n=2), low taxes (n=4), proximity to job (n=4), park for children (n=3).

Question 16 asked respondents to report what they liked least about living in the community. The factor mentioned in 51 of the total 206 responses (24.8%) was blasting activities. The most-frequently mentioned dislikes are summarized in Table 7, in descending order of mention.

Table 7
Summary of Responses Indicating Community Characteristics Least Liked

Characteristic	Frequency	Percentage[1]
Blasting activities	51	24.8
Effects of industrialization	14	6.8
Volume of traffic	14	6.8
Proximity to turnpike	13	6.3
No dislikes	13	6.3
Quarry activities	12	5.8
Dust and dirt	9	4.4
Damage to home (quarry)	8	3.9
Deficient municipal services	8	3.9
Odors from trash, garbage	8	3.9
Noise level (unspecified)	7	3.0
Community decline	7	3.0

[1]Percentages are based on 206 responses.

A number of other factors were mentioned very infrequently: poor access to stores, (n=5); firehouse siren, (n=6); congestion (too "built-up"), (n=5); poor public transportation, (n=4); insufficient parking, (n=3); vacant, derelict properties, (n=2).

Question 17 asked respondents to evaluate changes in the quality of life in the community since they first began living there. The response frequencies are summarized in Table 8. The most frequent response was that the overall quality of life had remained the same. However, for those respondents reporting change, an opinion of deterioration outnumbered an opinion of improvement by almost four to one. The number indicating deterioration was the same as the number indicating stability.

Table 8
Summary of Respondents' Reactions to Question Concerning Changes in Quality of Life in Community

Status of Quality of Life	Frequency	Percentage[1]
Gotten much worse	28	12.0
Gotten worse	75	32.2
Remained about the same	103	44.2
Gotten better	26	11.2
Gotten much better	1	.4

[1]Percentages are based on 233 responses.

Question 18 asked respondents to rate their level of annoyance with each of a number of common sources of noise in the community. The rating scale used the numbers 1 through seven in a Likert format, with four scale-points offered: not annoyed, somewhat annoyed, very annoyed and extremely annoyed. Considering the set of noise sources provided, it appears sirens, especially firehouse sirens, are a major annoyance, as is the type of noise associated with traffic, especially large trucks. The average annoyance rating for each source, as well as the percentage of respondents reporting "very annoyed" to "extremely annoyed" for each source, are presented in Table 9.

Table 9
Average Annoyance Rating and Percentage of Respondents Reporting High Level of Annoyance with Several Sources of Community Noise

Noise Source	Average Rating[1]	n	Percentage Reporting Very to Extremely Annoyed
Airplanes and/or helicopters	1.72	208	1.9
Automobile and/or motorcycles	2.81	208	9.1
Emergency vehicle sirens	2.40	204	11.8
Firehouse sirens	3.05	215	19.5
Large trucks	3.25	217	15.7
Local street traffic	2.49	212	10.9
Radios, stereos and/or televisions	1.56	202	3.0
Trains	1.65	203	3.4
Small equipment	1.44	200	1.0

[1]Ratings ranged from 1 (not annoyed) to 7 (extremely annoyed)

Respondents were given the opportunity to indicate sources of noise annoyance other than those listed and to rate their annoyance with them. There were 27 responses which indicated quarry blasting, with 24 of the responses indicating very to extremely annoyed (mean=6.22). Several other sources of annoyance were mentioned. These were infrequent and the level of annoyance varied [e.g. buses (n=1), maintenance and construction (n=4), animals, pets (n=1), social clubs (n=1)].

Question 19 began a series of 15 questions specifically dealing with quarry operations and activities and their impact on the Swedesburg/Swedeland community. Question 19 asked respondents to indicate whether, while inside their homes, they had noticed any of a series of types of noises during the past year. More than 80 percent of the 237 persons responding indicated they had heard noise from quarry blasting. A substantial number of respondents reported noticing other noises associated with quarry operations, such as trucks, machinery, or the various alarms and sirens used in the quarry. The frequencies of notice for each source of noise are summarized in Table 10.

Table 10
Frequencies of Reported Awareness of Several Quarry-related Sources of Noise[1]

Source of Noise	Frequency	Percentage
Quarry blasting	194	81.9
Quarry trucks	53	22.4
Quarry machinery	31	13.1
Quarry alarms/sirens	15	6.3

[1]There were 237 responses to Question 19.

Respondents were allowed to specify other quarry-related sources of noise. Relatively few voluntary responses were obtained, with several persons mentioning the quarry telephone bell (n=1), noise from loading operations (n=3), and "dirt and rocks falling", apparently from loading and excavation operations (n=2).

Question 20 asked respondents to rate their level of annoyance with each of the four sources of quarry-related noise listed, plus any other sources volunteered. The mean level of expressed annoyance, and the percentage of endorsements for the three most extreme scale points (very to extremely annoyed), are given for each source of annoyance in Table 11.

Table 11 Mean Level of Expressed Annoyance and Percentage Responses to Three Most-Extreme Scale Points for Four Sources of Quarry-related Noise[1]		
Source of Noise	Mean Level of Annoyance	Percentage of Extreme Responses
Quarry blasting	4.87	63.1
Quarry trucks	2.28	17.4
Quarry machinery	1.77	10.5
Quarry alarms/sirens	1.48	7.0

[1]The number of responses to each source of annoyance varied, and were, respectively 217, 161, 153, and 142. Ratings ranged from 1 (not annoyed) to 7 (extremely annoyed).

Quarry blasting was rated as the most annoying of all sources of quarry-related noise, both listed and volunteered. Over 60 percent of the 217 persons rating this source of noise found it very or extremely annoying. No other source of quarry-related noise was rated as annoying; in fact, the vast majority found other sources not annoying.

Question 21 asked respondents to report the frequency with which they heard household items rattling during the past year. The frequencies and percentages of respondent reports are summarized in Table 12.

Table 12 Summary of Reported Frequency of Household Items Rattling During Past Year[1]		
Frequency of Experience	Number Reporting	Percentage Reporting
Never	19	8.5
Almost daily	50	22.4
Once or twice a week	72	32.3
Once or twice a month	57	25.6
Once or twice the year	24	10.8

[1]There were 223 responses to Question 21.

The modal response was "once or twice a week", with over 20 percent reporting an almost daily experience and about the same number reporting once or twice a month.

Question 22 asked respondents to identify the items which were rattling, by selecting from a list or volunteering items unlisted. The most commonly reported items were structural components: windows (n=170), doors (n=91), and walls (n=100). Light fixtures (n=47), dishes/curios (n=70) and pictures (n=56) were the most common furnishings identified as rattling. The frequency with which each listed item was identified is listed in Table 13. Relatively few items were volunteered, but 31 respondents reported the whole house was rattling and seven listed the floor.

Table 13 Summary of Respondents' Reports as to Identification of Items Rattling[1]		
Item Identified	Frequency	Percentage Reporting
Nothing identified	18	7.6
Don't know	17	7.2
Dishes/curios	70	29.5
Pictures/painting	56	23.6
Furniture	14	5.9
Lamps/light fixtures	47	19.8
Windows	170	71.7
Doors	91	38.4
Walls	100	42.2
Plumbing	24	10.1
Other	41	17.3

[1]There were 237 responses to Question 22.

Question 23 asked respondents to indicate all perceived causes of the rattling that was experienced and reported above. Of the 237 persons responding to this question, seven indicated they didn't know the cause (3%). The most common perceived cause was quarry blasting (n=207), with all other sources receiving relatively little mention (See Table 14).

Table 14 Perceived Causes of Reported Rattling[1]		
Reported Cause	Frequency	Percentage
Don't know	7	3.0
Airplanes and/or helicopters	3	1.3
Large trucks	24	10.1
Quarry blasting	207	87.3
Trains	9	3.8
Turnpike traffic	7	3.0

[1]There were 237 responses to Question 23.

An additional cause, construction equipment, was volunteered by two respondents (.8%).

Questions 24, 25 and 26 asked a series of questions similar to numbers 21, 22 and 23, except the phenomenon was now vibration rather than rattling noises.

Question 24 asked respondents to report the frequency with which they felt anything in their house vibrating during the past year. The pattern of responses for the experiencing of vibrations is very similar to that reported for hearing rattling noises. The most frequent reported frequency of experience was "once, twice a week". The next most frequently reported frequencies of experience were both "almost daily", and "once, twice a month" (See Table 15).

Table 15 Reported Frequency of Experiencing Household Vibrations During Past Year[1]		
Frequency of Experience	Number Reporting	Percentage Reporting
Never	19	8.7
Almost daily	48	22.0
Once or twice a week	71	32.6
Once or twice a month	54	24.8
Once or twice the year	26	11.9

[1]There were 218 responses to Question 24.

Question 25 contained a list of items that may have been reported as vibrating in the previous questions. Respondents were asked to identify all vibrating items, as well as to supply any items not listed. The frequencies with which various items were reported are summarized in Table 16. Although 17 persons indicated nothing was vibrating (7.2%), or they didn't know what was vibrating (n=7, 3%), the most commonly endorsed item was "whole house" (n=146), followed by "windows" (n=117). Walls and floors were reported as vibrating by 68 and 71 persons, respectively. "Household contents" was a response volunteered by four respondents and one individual reported the plumbing was vibrating.

Table 16 Summary of Frequencies with Which Items Were Reported as Vibrating[1]		
Item Vibrating	Frequency Reported	Percentage
Porch or deck	10	4.2
Floors	71	30.0
Walls	68	28.7
Whole house	146	61.6
Windows	117	49.4

[1]There were 237 responses to Question 25.

Question 26 asked respondents to identify the perceived cause of the vibration. The most-commonly identified cause was "quarry blasting", followed by "large trucks". All other sources were infrequently identified. The responses are summarized in Table 17.

Table 17 Perceived Causes of Reported Vibration[1]		
Reported Cause	Frequency	Percentage
Don't know	11	4.6
Airplane/helicopter	7	3.0
Large trucks	26	11.0
Quarry blasting	199	84.0
Trains	8	3.4
Turnpike traffic	7	3.0

[1]There were 237 responses to Question 26.

Question 27 asked respondents to indicate and identify other noises or "types of annoyance" from quarry operations. Of the 237 respondents, fifty indicated other noises or types of annoyance (22.5%). These are listed, in order of mention, in Table 18. The sources listed in Table 18 are those mentioned first, if two or more items were mentioned. Few persons volunteered more than one; the most frequently mentioned second item was dust and dirt (n=3).

Table 18
Summary of Frequencies With Which Other Noises and Types of Annoyance Were Identified by Respondents[1]

Other Noise/Type of Annoyance	Frequency	Percentage
Dust and dirt	14	28.0
Blast noises	13	26.0
Damage to home	12	24.0
Machinery noise	8	16.0
Ground tremors	1	2.0
Quarry phone alarm	1	2.0
Dishes shaking	1	2.0

[1]There were 50 responses to Question 27.

Question 28 asked respondents to estimate, for the past year, the number of days on which the Quarry blasted, whether the respondent experienced the blast or not. Respondents selected a category from those listed which contained the approximate frequency. The frequencies with which the categories were selected are summarized in Table 19. The range was from fewer than 10 days (n=15) to more than 150 days (n=41), with a fairly even distribution across most of the categories (see Table 19).

Table 19
Reported Estimated Frequency of Days of Blasting Activities by Glasgow Quarry in Past Year[1]

Number of Days of Blasting	Frequency	Percentage
Less than 10 days	15	7.4
10-25 days	27	13.3
26-50 days	47	23.2
51-100 days	38	18.7
101-150 days	35	17.2
More than 150 days	41	20.2

[1]There were 203 responses to Question 28.

Question 29 asked respondents to estimate, for the number of days of blasting they estimated in Question 28, the percent of the time that they were at home. Almost half those responding (45.3%) reported that they felt they were home most of the time (75% or more) when the quarry blasted (See Table 20).

Table 20 Estimated Percent of Time Respondent Was Home When Blasting Occurred[1]		
Percent of Time	Frequency	Percentage
None of the time	14	6.3
About 25% of the time	61	27.6
About 50% of the time	46	20.8
About 75% of the time	36	16.3
Almost all of the time	64	29.0

[1]There were 221 responses to Question 29.

A cross-tabulation of estimated presence at home during blasting and estimated frequency of blasting was carried out. Glasgow Quarry reported approximately 70 blasts occurred between October 1, 1991 and November 1, 1992. On only one day did two blast events occur. Considering 70 blasts over 13 months as an approximate baseline figure, it appears fewer than 20% of the respondents can accurately estimate the frequency of blast events. One might expect an association between the estimated number of days upon which blasts occurred and the estimated percent of time the respondent was home. An inspection of Table 21 indicates this is not the case. It can be seen that even for respondents who reported they were home almost all of the time, there is a tendency to both over- and under- report the actual frequency. If one assumes the category "50-100 days" contains the actual number of events, the accuracy of this group (9 of 56 or 16%) is actually worse than the group reporting they were **never** at home when blasting occurred (2 of 11 or 18%)

Table 21 Cross-tabulation of Reported Presence at Home During Blasting and Estimated Annual Number of Days of Blasting							
Reported Presence at Home During Blasting	Estimated Number of Days of Blasting						
	<10	10-25	26-50	51-100	101-150	>150	**Row Total**
None of the time	5	2	1	2	-	1	**11**
About 25% of the time	4	9	20	8	8	10	**59**
About 50% of the time	-	5	10	10	12	5	**42**
About 75% of the time	-	3	5	9	8	9	**34**
Almost all the time	5	8	11	9	7	16	**56**
Column Total	**14**	**27**	**47**	**38**	**35**	**41**	**202**

Question 30 asked respondents to estimate the number of blasts actually experienced during the past year. The range of responses was from one to 365. About 28 percent reported 10 or fewer, almost half reported 25 or fewer, over 65 percent reported 50 or fewer and over 80 percent reported 100 or fewer. The mean number reported was 58.2, remarkably close to the total number of blasting events but indicative of over-estimation considering that less than 30% of the respondents were usually home when blasting occurred, according to their self-report. There were obvious "rounding errors" with reported numbers clustering at the numbers ten, (n=15), 20 (n=11), 25 (n=16), 50 (n=11), 100 (n=16) and 200 (n=6). The responses to this question are summarized in Table 22.

Table 22
Summary of Frequencies Reported for Actual Blasts Experienced During the Past Year[1]

Blast Experiences Reported	Frequency	Percent	Cumulative Percentage
0	8	4.3	4.3
1	2	1.1	5.4
2	6	3.2	8.6
3	5	2.7	11.4
4	4	2.2	13.5
5	8	4.3	17.8
7	3	1.6	19.5
8	1	.5	20.0
10	15	8.1	28.1
12	4	2.2	30.3
15	6	3.2	33.5
16	1	.5	34.1
18	1	.5	34.6
20	11	5.9	40.5
21	1	.5	41.1
25	16	8.6	49.7
26	1	.5	50.3
29	1	.5	50.8
30	6	3.2	54.1
35	2	1.1	55.1
40	4	2.2	57.3
45	4	2.2	59.5
50	11	5.9	65.4
52	4	2.2	67.6
53	1	.5	68.1
60	1	.5	68.6
65	2	1.1	69.7
70	2	1.1	70.8
75	5	2.7	73.5
80	1	.5	74.1
90	1	.5	74.6
100	16	8.6	83.2
104	2	1.1	84.3
120	3	1.6	85.9
125	1	.5	86.5
130	1	.5	87.0
150	5	2.7	89.7
170	2	1.1	90.8
175	2	1.1	91.9
190	1	.5	92.4
195	1	.5	93.0
196	1	.5	93.5
200	6	3.2	96.8
235	1	.5	97.3
240	1	.5	97.8
285	1	.5	98.4
300	2	1.1	99.5
365	1	.5	100.0

[1]There were 185 responses to Question 29.

Question 31 asked respondents to indicate, for those blasts actually experienced during the past year, the percentage of cases where they were startled by the blast noise. Most respondents indicated they were startled at least some of the time. Over 30 percent indicated they were startled almost all of the time, and an almost-equal percentage indicated "none of the time" (See Table 23).

Table 23
Percentage of Time Respondents Report Being Startled by Blast Noise[1]

Percentage of Time Startled	Frequency	Percentage
None of the time	71	31.7
About 25% of the time	35	15.6
About 50% of the time	28	12.5
About 75% of the time	17	7.6
Almost all of the time	73	32.6

[1]There were 224 responses to Question 31.

Question 32 asked respondents to report, for the same events considered in Question 31, the incidence of startle reactions to blast vibration. Comparing Table 23 and Table 24, fewer respondents reported **not** being startled by vibration than by noise, and more reported being startled at least some of the time by vibration. Almost 25 percent more respondents reported being startled almost all of the time by vibration, as compared to noise.

Table 24
Percentage of Time Respondents Report Being Startled by Blast Vibration[1]

Percentage of Time Startled	Frequency	Percentage
None of the time	42	18.8
About 25% of the time	42	18.8
About 50% of the time	27	12.1
About 75% of the time	22	9.9
Almost all of the time	90	40.4

[1]There were 223 responses to Question 32.

To obtain an estimate of the degree to which there was some agreement between reported startle response to noise and to vibration, a cross-tabulation of the responses to Questions 31 and 32 was done. As may be seen in Table 25, there is a tendency for respondents to report about the same frequency of startle response to both factors (note the concentration of frequencies on the diagonal of the table).

Table 25
Cross-tabulation of Reported Startle Response Frequencies to Blast Noise and Blast Vibration

Reported Frequency of Startle Response to Blast Noise	Reported Frequency of Startle Response to Blast Vibration				
	None of the time	About 25% of the time	About 50% of the time	About 75% of the time	Almost all of the time
None of the time	41	9	3	3	14
About 25% of the time		25	3	2	5
About 50% of the time	1	6	16	1	4
About 75% of the time	-	1	3	12	1
Almost all of the time	-	1	1	4	66

Question 33 asked respondents to rank-order six factors associated with quarry activities in terms of their annoyance, with a 1 assigned to the **most** annoying and a **6** assigned the **least** annoying. Although respondents were asked to **rank** all six sources of annoyance, some respondents **rated** them, which resulted in the ranks 1-6 being used in an incomplete fashion, or being used so that a given rank was used more than once. The **average** of the ranks **or** ratings assigned are reported in Table 26, and are termed weights.

Table 26
Average Weights Assigned to Six Factors Associated with Quarry Activities as Sources of Annoyance

Source of Annoyance	Average Rank	Number of Ranks
Dust and dirt	3.0	198
Machinery noise	2.5	179
Blasting noise	2.7	200
Heavy truck traffic	3.6	185
Vibration (equipment & trucks)	4.3	177
Vibration from blasting	2.2	207

Vibration from blasting is ranked as the most annoying of the six factors and vibrations due to equipment and trucks, as well as heavy truck traffic, are regarded as less annoying.

Question 34 through 44, inclusive, are intended to document perceived quarry influences and impacts on the Swedesburg/Swedeland community.

Question 34 asks whether the respondent knew about the quarry when he/she first began living in the community. Slightly more respondents indicated they knew of the quarry (n=116) than denied knowledge of the quarry (n=97) and 16 people indicated there was no quarry.[2]

Question 35 asks respondents to indicate whether they would choose to move to Swedesburg/Swedeland today, knowing about the quarry operation. Of the 221 responses to the question, over 60 percent indicated they would not, almost 40 percent indicated they would.

[2]Quarry activities have existed on the present site since the 1800s.

Question 36 asked respondents whether they have become used to quarry operations. Almost half (46.3%) indicated they had not, and slightly over half of the 229 responses (53.7%) indicated they had.

Question 37 asked respondents to report on the length of time it had taken for them to become used to quarry operations, by selecting one of several options presented. The frequencies with which various periods were selected are summarized in Table 27.

Table 27
Reported Amounts of Time Required for Respondent to Become Used to Quarry Operations[1]

Period of Time Required	Frequency of Selection	Percentage
Not used to the quarry's operations	110	50.7
One week	9	4.1
One month	13	6.0
Six months	21	9.7
One year	18	8.3
More than one year	46	21.2

[1]There were 217 responses to Question 37.

Over half the respondents indicated they had not become used to quarry operations. For those indicating they had become used to quarry operations, it appears the process requires considerable time, with almost 40 percent of the respondents reporting it required six months or more.

Question 38 asked respondents to report the type of change, if any, in the annoyance associated with quarry operations over the respondent's length of residence in the community. Of the 229 responses to this question, over half (52.0%) reported quarry operations had become more annoying. Quarry operations were described as less annoying by 35 respondents (15.7%), or unchanged as to annoyance by 74 respondents (32.3%).

Question 39 asked respondents to consider the changes in the overall quality of life in the Swedesburg/Swedeland community (reported above in Question 17), and to report the amount of the change that was perceived to be due to quarry operations. Respondents tended to report no change in the quality of life (although only about 30 percent of the respondents to Question 39 indicated they had reported no change in Question 17), or attribute little of the change to the effect of quarry operations (see Table 28).

Table 28
Reported Perceived Changes in Respondent's Quality of Life Attributed to Quarry Operations[1]

Degree of Change due to Quarry	Frequency	Percentage
None of the change	40	18.0
Some of the change	57	25.8
Most of the change	32	14.5
Almost all of the change	21	9.5
Previously reported quality of life unchanged	71	32.1

[1]There were 222 responses to Question 39.

Question 40 asked respondents to report the perceived effect of quarry operations and activities on the market value of their home. Of the 203 responses to this question, 95 reported no influence. An almost identical number reported a decrease in value (n=102), with few reporting an increase in value (n=6). The frequencies of endorsement for each response are summarized in Table 29.

Table 29
Summary of Respondents' Reports of Quarry's Influence on Value of House[1]

Nature of Influence	Frequency	Percentage
Value greatly increased	2	1.0
Value increased	4	2.0
No influence on value	95	46.8
Value decreased	77	37.9
Value greatly decreased	25	12.3

[1]There were 203 responses to Question 40.

Question 41 was an open-ended question which asked respondents to report and describe the effects of quarry operations on their house. Responses were coded and characterized as first-mentioned or later-mentioned. The most common responses to this question were cracks and surface damage in interior walls and ceilings. Cracks in basement walls and damage to windows were other frequently mentioned effects. The frequencies with which specific problems received first, second and third mention are summarized in Table 30.

Table 30
Frequency of First, Second and Third Mention of Specific Effects of Quarry Operations[1]

Effect	Frequency of		
	First Mention	Second Mention	Third Mention
Cracks, patio/porch	4	2	4
Cracks, interior walls	69	23	3
Cracks, ceilings	16	23	5
Gas leaks	1	-	-
Cracks, basement walls	20	14	10
Cracks, exterior walls	16	9	8
Damage, ceramic tile	2	-	1
Structural damage	4	1	1
Cracks, basement floor	2	1	3
Damage, driveway - sidewalks	6	11	12
Damage, windows	15	10	5
Dust, dirt	3	8	3
Surface falling off walls, ceilings	25	13	7
Cracks, walls and ceiling	4	1	-
Chimney damage	1	2	-
Water in basement	2	1	1
House settling	-	1	-
Roof leaks	-	1	1

[1]There were 202 responses which mentioned only one effect, 123 mentioned two or more, 66 mentioned three or more.

Question 42 asked respondents to report whether they thought the effects reported were due to a single blast or by continued blasting at the quarry. There were 205 responses to this question, with 169 respondents (82.4%) expressing the opinion that the effects were due to continued blasting. Only one person felt the damage was due to a single blast, and 35 (17.1%) reported they were unsure.

Question 43 asked respondents to describe the effects of quarry operations on anyone in the household who may have had a chronic health problem. There were 51 responses to this question, with most reporting an aggravation of respiratory problems (n=10), allergies (n=19), or the experience of fright, stress, or anxiety (n=17). The remaining responses mentioned fear of dust and pollution, or eye irritation (n=5).

Question 44 asked respondents to describe other ways in which quarry activities effected their house or life. The responses were coded and are listed in Table 31 as first-mentioned or second-mentioned. A total of five responses were obtained as third-mentioned effects -- all alluded to property damage.

Table 31
Summary of Other Ways in Which Quarry Effects House or Respondent's Life[1]

Factor	Frequency of First Mention	Frequency of Second Mention
Dust, dirt	25	10
Property damage	25	10
Fear, anxiety	23	2
Decreased property values	5	1
Heavy truck traffic	9	1
Fear of gas explosion	4	2
Eyesore	1	-
Blasting noise, vibration	13	2
Bothers pets	3	2
Quality of life	3	-
Effects on health	4	-
Positive economic factor	1	-
Danger from quarry activities	1	-

[1]There were 118 responses to Question 44, with 30 respondents offering two or more effects and five offering three or more.

Question 45 is the first of a series intended to directly assess respondents' attitudes, opinions and suggestions concerning Glasgow Quarry operations. Question 45 directly asks respondents whether they feel Glasgow Quarry is operating in a responsible manner. Of the 184 responses to this question, 114 (62%) felt they were not. Question 46 asked respondents to explain their answer to Question 45. The most common responses by those persons indicating the quarry was **not** operating responsibly concerned the strength of blasts (54 responses) or a perceived lack of concern for the community (39 responses). Property damage was mentioned by 16 respondents. Unfortunately, there were few explanations for positive opinions concerning Glasgow operations. The few responses mentioned friendliness of employees (1 response), "doing its best" (6 responses), neat appearance, legally operating, or economically important (each with 1 response).

Question 47 asked residents to report on ways they felt the presence and activities of the quarry had harmed the community. Responses were coded as to content and as to first, second or third mentioned, and are summarized in Table 32. A total of four persons reported four ways; two of the four responses concerned property damage. Heavy truck traffic and dust/dirt were mentioned by the remaining two respondents.

Table 32
Frequency of Reported Mentions of How Quarry Presence and Activities Harm the Swedesburg/Swedeland Community

Effect	Frequency of		
	First Mention (n=184)	Second Mention (n=79)	Third Mention (n=28)
Damage to homes	62	17	5
Decreased property value	17	8	1
Heavy truck traffic	12	7	7
Dust, dirt	17	21	3
Effect on newcomers	8	-	-
Eyesore	3	-	-
Load spillage	1	2	-
Road damage	4	3	-
Quality of life	7	-	1
Noise, vibration	29	9	7
Damage to gas, water lines	3	4	1
Concern about future	2	-	-
People leaving	1	-	-
Health threat	-	8	3
No harm	16	-	-
Other	2	-	-

Perception of damage to one's home is the principal perceived harm, followed by various adverse effects on community life or environment.

Question 48 asked respondents to report ways in which the quarry's presence and activities have helped the community. Of the 178 persons providing at least one codable response, 116 (over 65%) stated they felt the quarry hadn't done anything to help. The responses to Question 48 are summarized in Table 33.

Table 33
Frequency of Reported Mention of How Quarry Presence and Activities Help the Swedesburg/Swedeland Community[1]

Effect	Frequency of First Mention (n=178)	Frequency of Second Mention (n=16)
Haven't helped	116	-
Provides employment	45	2
Effect on area economy	3	5
Pays taxes	10	8
Appearance of quarry	-	1
Other	4	-

Question 49 asked respondents to report on their perceptions of things the quarry had done during the past year to make its operations less objectionable to the community. Of the 166 responses to this question, 96 (57.8%) felt the quarry had done nothing, while 70 responses (42.2%) alluded to positive actions or activities. The frequencies with which various efforts were mentioned are summarized in Table 34.

Table 34
Frequency of Mention of Various Reported Efforts by Quarry to be Less Objectionable to Community

Effect	Frequency of First Mention (n=158)	Frequency of Second Mention (n=8)
Done nothing	96	-
Reduced level of operation	26	-
Lighter blasts	13	6
Wetting roads	12	-
Cleaning up area	2	2
Courteous employees	1	-
Economic importance	1	-
Operating legally	1	-
Trying to improve situation	4	-
Other	2	-

Question 50 asked respondents to indicate things the quarry had done to make its operations more objectionable to the community. The most frequent coded response was that the quarry hadn't become more objectionable. The next-most-frequent response, however, mentioned continued blasting activities. The frequencies of first and second mentions of various quarry actions and effects are summarized in Table 35.

Table 35
Frequency of Mention of Various Reported Actions by Quarry to Have Made its Operations More Objectionable to Community

Effect	Frequency of First Mention (n=150)	Frequency of Second Mention (n=13
Continued blasting	34	1
Continuing damage	3	2
Haven't changed	3	-
Ignored complaints	7	1
Truck traffic	2	2
Wetting roads	3	-
Denied responsibility	3	-
Blasting worse	16	2
Haven't become more objectionable	74	1
Level of dust	2	2
Deception of community	2	1
Noise level worse	-	1
Other	1	-

Question 51 was intended to elicit suggestions from respondents as to actions the quarry could take to make its operations and activities more acceptable to the community. The greatest number of responses alluded to blasting activities, suggesting that blasting be either reduced in strength, frequency or eliminated, (i.e. "cease operations"). Most respondents offered only one codable suggestion, with all but two respondents offering three or fewer. The suggestions offered, and their frequencies, are summarized in Table 36.

Table 36 Suggestions Offered to Make Quarry More Acceptable to Community			
Effect	Frequency of		
	First Mention (n=166)	Second Mention (n=57)	Third Mention (n=15)
Reduce blast strength	43	9	-
Cease operations	32	3	-
Reduce blast frequency	29	4	1
Repair property damage	9	7	1
Regulate truck traffic	9	11	6
Warn of blasts	5	1	2
Control dust better	9	13	1
Improve road repairs	2	2	3
Public blast records	2	3	-
More public involvement	14	2	1
More concern for community	-	1	-
More local employment	1	-	-
Install child-proof fences	2	-	-
Other	2	-	-

Question 52 asked respondents to indicate any factor (such as time of day, weather conditions, season) which seemed to affect their perceptions of noise and/or vibrations from quarry operations. It appears the only fairly consistent response is that blasts in the summer months seem worse. Opinion seemed divided as to the effect of time of day, with 18 respondents indicating morning blasts were worse and 21 reporting afternoon blasts were worse. Weather was mentioned by twelve respondents; ten respondents felt cloudy or wet days were worse and two felt clear days were worse. The frequencies with which factors received first or second mention are summarized in Table 37.

Table 37 Factors Which Were Reported as Effecting the Amount of Quarry Noise and Vibration Experienced		
Factor	Frequency of First Mention (n=98)	Frequency of Second Mention (n=15)
Morning blasts worse	12	6
Summer blasts worse	26	3
Fall, winter blasts worse	9	2
Clear days worse	2	2
Cloudy days worse	8	-
Afternoon blasts worse	20	1
Wind direction effects	3	-
State investigators present	3	-
Wet weather better	2	-
Market conditions	1	-
Other	12	

Part I: Discussion of Results

It is obvious from the results obtained that the noise and vibration associated with quarry blasting are a significant and continuing source of annoyance to Swedesburg and Swedeland residents. These factors are viewed as more annoying than any other quarry activity (such as alarms and truck traffic) or any other source of annoyance in the communities (such as aircraft and street traffic). It appears that these factors (especially vibration) derive their annoyance value from the startling effects of blast events -- the fact that they occur on an irregular and unexpected basis. Public reactions to blast noise are probably often reactions to secondary noise generated by vibrations of structural components (e.g. windows, ceiling, walls and floor) or furnishings, rather than actual blast noise. It appears that these data support

the centile-related threshold model interpretation of annoyance due to quarry blasting. Most of the other low-level sources of noise in the community are regarded as minimally annoying. Again, the "startle factor" may be part of the reason, as well as the public fear of blasting activities. In a sense, it may be similar to fearing thunder more than the lightning which created the noise.

The demographic data concerning survey respondents indicate a relatively stable community of older persons, many of whom are either retired, are homemakers or are otherwise at home during quarry operating hours. Relatively few respondents indicated anyone in the household with quarry-related training or work experience. This probably accentuates negative reactions to blast events, which are poorly understood and regarded as dangerous or, at best, extremely annoying.

The age of many community residences, coupled with the age of the quarry, makes the attribution of damage extremely complex. The quarry has operated for well over a century. With the ignorance and disregard for the physical effects of blasting, reflected in an almost total lack of regulation, in the quarry's early years, and considering the effects of weather, turnpike and street traffic, construction activities and other phenomena, the precise cause of observed damage is difficult or impossible to identify. Most of these effects, however, lack the distinctiveness or "startle effect" of a blast event and are, therefore, probably regarded by residents as contributing little to the problem.

While there is some community sentiment that the quality of life has deteriorated, relatively few respondents feel it has been due to quarry activities.

There seems an extremely strong tendency to overestimate the level of quarry blasting. This tendency does not appear to be related to the relative frequency that respondents reported being at home when blasts occurred. This may reflect a strong negative perception of the quarry's blasting activities, rather than an accurate reporting of actual experiences.

Although the most common response given when respondents were asked to report the frequency of household items rattling or vibrating appears to roughly correspond to the frequency of blasting (on the average, about one blast per week), the variability in perceptions and reported frequencies is startling. Lower estimates are understandable if they come from people who are rarely or infrequently at home during the day. Significant over-estimates from persons who report being usually at home are difficult to understand. If their reported presence at home and perceptions of rattling and vibration are accurate, then a substantial number of annoying events are being erroneously attributed to quarry blasts. Considering, however, that over half the respondents reported being home 50 percent of the time **or less** when blasting occurred, and that the mean number of reported blasts **experienced** was over 58 (which is close to the actual number of total blast events) there appears to be an extremely strong tendency to over-report or to exaggerate the frequency of blast events actually experienced.

There is a substantial level of negative feeling concerning the quarry's presence and activities, revealed in respondents' reactions to questions concerning the quarry's effects on property values, their decision to locate in the community and the litany of negative factors associated with quarry operations. Despite this feeling (which may be largely attributed to blasting activities, which are a necessary aspect of quarry operations), it should be noted that over a third of the respondents indicated that a perceived lack of concern for the community by the quarry was a problem.

This latter factor can and should be addressed. Although over half the respondents identified blast strength and frequency as a problem, little can be done concerning these factors. Blast "strength" is already lower than permitted by the Commonwealth and blast frequency is dictated by the operating needs

of the quarry. It may be possible to initiate a community relations plan which will reduce the negative reactions to blast events. Part of the problem appears to be the "startle factor". For example, blasting schedule (appearing in a local paper or on cable television channels) may reduce the fear or apprehension associated with an unexpected rumble, noise or other blast effect.

There seems to be no clear-cut environmental factor associated with perceived blast severity, as reported by respondents. Summertime blasts are regarded as more severe, but this may be due to windows being open, greater frequency of blasting and similar factors. While the research literature indicated a number of factors related to perceptions of blast severity, no consistent factors were reported by respondents.

Part II: The Blasting Episode Diary

Concurrent with the development of the community survey methodology, a blasting episode diary was designed. While the community survey was intended to provide an index of current community attitudes, sentiments and beliefs concerning quarry activities, it was felt there was a need to assess residents' reactions to specific blast events, at the time of the event, to enable the study of the relationship between human response to a blast (in terms of noise and vibration and their effects) and both characteristics of the blast (direction of initiation, face, quarry level, etc.) and intervening variables (wind speed, wind direction, temperature, etc.)

Method

Sample

Persons to maintain blasting episode diaries were primarily recruited through telephone calls and letters to individuals appearing on the real property tax rolls of the community of Swedesburg. Appeals were made through television announcements, arranged by township administrators, and through direct appeals at several community meetings designed to acquaint residents with the study. A total of 25 persons were initially recruited, through telephone contacts, two community meetings and informal networking, to maintain diaries. The criteria for recruitment and participation were: a) an interest in reporting one's reactions to blasts as they occurred and as they were experienced, and; (b) a personal situation that allowed the respondent to be at home most of the time during normal quarry operating hours.

The latter requirement prevented the vast majority of residents from participation in diary maintenance. Operationally excluded were younger persons employed full-time and favored for inclusion were older, retired individuals, as well as mothers with young children, and other persons with characteristics that would enable their remaining at home during the day. This undoubtedly biased the nature of the sample in one sense, but it must also be acknowledged that these are the persons who frequently and routinely experience the effects of blasting.

Instrumentation

A one-page diary form was developed over the course of the summer months of 1992 by the Villanova University study group and representatives of the Pennsylvania Department of Environmental Resources. Diary designed drew upon the work of Horonjeff and Teffeteller (1980) and Fidell, Horonjeff, Schultz and Teffeteller (1982). The diary was a one page form which allowed a respondent to enter the date and time of a blast experience, indicate their location at the time of the blast, and then evaluate their

experience with reference to vibration, level of rattling, intensity of blast noise, other effects, and finally, an overall rating of blast severity, compared to all other blasts the respondent had experienced (See Appendix B).

A self-contained binder of materials was prepared for the use of respondents. The binder contained a cover letter from the principal investigator, a Demographic Data form, an Owner's Manual for the Blasting Episode Diary data collection form, coded copies of the Diary form, an Informed Consent form and stamped, self-addressed return envelopes for the return of completed diary forms.

Procedure

Data collection continued until late Fall 1993 when quarry blasting activities virtually ceased.[3] Additional community meetings were held in Swedesburg to provide a summary of work to date to residents, especially to those maintaining diaries. Several meetings were held in Upper Merion Township Offices and in the Swedesburg Fire House Meeting Hall to report progress on the overall study and to provide an opportunity for all persons involved to interact.

Results

Demographic Data Form

Although confidentiality of information was repeatedly stressed, as was the need for demographic information concerning persons maintaining diaries, Demographic Data Forms were provided by only 21 of the original 25 persons. The average age of these 21 persons is slightly over 61 years. Almost every type of common family configuration is represented; four persons report living alone (average age 65 plus) and ten persons report two residents at the address, with the data indicating both married couples as well as parent and child. Family size for the remaining seven diary keepers ranged from three to five, with four families apparently parents with younger children and three families apparently older children with aged parent(s).

Of the 21 residents volunteering to maintain diaries and providing Demographic Data Forms, 16 indicated they were usually at home between the hours of 8:00 a.m. and 6:00 p.m. The remaining five indicated they were usually **not** at home an average of 2.6 hours per day; absences were about evenly divided between mid-day hours (n=3) and late afternoon (n=2).

All but four of the 21 residents reported having complained to someone "in authority" about noise, vibration or other sources of annoyance associated with quarry operations. Complaints were most frequently directed to Township Administrative personnel (e.g. supervisor), with eight persons mentioning those offices. The office of the area State legislator, Ms. Ellen Harley, was mentioned four times, the study principal investigator two times, and three persons failed to indicate to whom they complained.

Persons completing the Form were then asked to report their typical reaction to quarry blasts. Virtually all responses alluded to shaking, vibration and rattling, with most responses describing the rattling of bric-a-brac and dishes and the rattling of windows. A number of respondents equate the sensation with an earthquake.

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[3] Data collection was interrupted during the Winter of 1992 (during the quarry's winter shut-down of activities) and began again in the Spring of 1993 with a letter of information and encouragement to respondents.

When asked to describe the types of damage, to personal items or property, which were attributed to quarry operations, virtually all respondents mentioned cracks appearing in interior walls and ceilings, damage to various masonry structures and surfaces, such as chimneys, porches, steps, foundations, walkways, driveways and stucco surfaces, window damage, and very infrequently, damage to household furnishings.

These data, concerning the experience of a blast event and the perceived consequences of quarry activities (primarily blasting) are consistent with the results obtained from the Community Survey, based upon a larger number of respondents from both the Swedesburg and Swedeland communities.

Blasting Episode Diary

As mentioned above, the Blasting Episode Diary form (see Appendix B for copy of Diary form) is adapted from a "post card diary" reporting form developed by Horonjeff and Teffeteller (1980), as part of a study of public reaction to sonic booms created by aircraft operating over a residential area. While the procedure apparently produced satisfactory data in the study cited, Fidell, Horonjeff, Schultz and Teffeteller (1982), employing a similar reporting form to gauge self-reported annoyance due to quarry blasting activities reported the *...procedure produced little useful information in the current context* (p.B-3).

Specifically cited were a low response rate and apparently little variation in reported annoyance from blast to blast. Response rates were extremely low at three different sites, ranging from 0 to 29 percent, with an overall average of about 16 percent. Only about half of those who agreed to participate completed one or more report forms. Other than a report of problems with the procedure and a cursory summary of response rates, virtually no data were reported and, to quote the authors, *...no further use of the procedure is anticipated...* (p. B-3)

Despite the problems noted, it was decided to attempt to employ the basic methodology to directly assess human response to a blast event as it occurred. The community meetings and continued contact between the community and all other persons responsible for the research were intended to maintain an acceptable level of participation and response. The design of the rating scale would allow for the recording of variations in human response, if such existed and if they were perceived accurately.

A total of 394 Blasting Episode Diary forms were received from 23 respondents who participated over the entire course of the study. Individuals could report their reactions only to blasts actually experienced. There were undoubtedly occasional failures to report an event actually experienced. The range in number of responses per "diary keeper" was from a low of one form to a high of 58, with a mean of about 17 per respondent. There were seven respondents who completed 20 or more forms; two were single persons, four reported two persons in residence, and one was a family of three. All reported someone normally at home between the hours of 8:00 a.m. and 6:00 p.m.

A persistent problem with Diary report forms was the tendency to fail to complete one or more items on an occasional report. This resulted in a fluctuation of the number of responses to any given item, with the maximum number of completed Diary forms, across all respondents and events, equal to 394.

Recorded times and dates of blast events on Diary forms were matched with official Commonwealth records. With respect to dates, it was found that 358 reports (over 90%) matched actual blast events. There were 12 blast events for which no Diary reports were completed, and there were a total of 36 reports submitted detailing reactions on dates and at times for which there were no Glasgow Quarry blast

events.

An analysis of the accuracy with which the time of an actual blast event was recorded revealed that for the 320 Diary forms which contained blast time data, 304 (95%) were accurate within plus or minus 15 minutes. Of the remaining 16 records, 12 were in error by approximately one hour; negative errors ranged from -57 to -64 minutes, positive errors from 51 to 68 minutes. One record was in error by -114 minutes and the three remaining were in error by +16, +18 and +21 minutes, respectively. It is assumed that the minor errors were due to either inaccurate time-pieces or a failure to note the time exactly at the time of a blast event. The larger errors are assumed to be the result of misreading a time piece (e.g. transposing hour and minute hands). In summary, it appears that the recording of blast events as to time of occurrence was accomplished with acceptable accuracy.

The vast majority of reported blast experiences were reported by residents who were indoors at the time, on the residence's first floor (n=309) or on the second floor (n=42). A summary of all reported locations is provided in Table 1 for the 381 forms reporting location at time of blast.

Table 1
Summary of Reported Respondent Location at Time of Blast

Location		Frequency	Cumulative Percent
Indoors:	Basement	17	4.5
	1st floor	309	85.6
	2nd floor	42	96.6
	3rd floor	0	96.6
Outdoors:	Front yard	4	97.6
	Side yard	2	98.2
	Back yard	7	100.0
Total		**381**	

The next series of questions (number five through ten) on the Blasting Episode Diary reporting form asked for evaluations by respondents of several aspects of the blast experience. Questions 5, 6 9 and 10 provided a five point rating scale, to be used in the evaluation of each aspect. Questions 7 and 8 were open-ended questions, calling for description of specific aspects of the experience.

The responses to Questions 5, 6 9 and 10 are summarized in Table 2, for all events reported, for actual blast events, and for reported events which were not actual blasts. The scale values are in terms of increasing severity; a value of 1 indicating least, 5 indicating greatest values of the respective aspects.

Table 2
Means and Standard Deviations of Reported Human Responses to Actual Blast and Non-blast Events Reported

		All Reports			Actual Blasts			Non-Blast Events		
Question	Variable	n	$\bar{x}$	s.d.	n	$\bar{x}$	s.d.	n	$\bar{x}$	s.d.
5	vibration	385	3.26	1.33	349	3.27	1.32	36	3.17	1.46
6	rattling	380	3.13	1.42	344	3.14	1.41	36	3.06	1.51
9	noise	389	3.11	1.36	353	3.13	1.35	36	2.97	1.50
10	severity	380	3.12	1.42	344	3.14	1.41	36	2.92	1.54

Considering all diary records, categorized as to whether the report was for an actual blast event or not, it may be seen that the responses to the four items dealing with human reactions to perceived events were more negative for actual events in every instance, with responses to non-blast events more variable in intensity, though somewhat less on the average. Unfortunately, there is no way to identify the event which precipitated a report when no blast took place.

Considering that Questions 5, 6 9 and 10 all dealt with aspects of the human response to a given blast event, the intercorrelations among responses should be determined. If the intercorrelations are high, the responses to the four items could be summed or averaged to provide an overall index of response. The intercorrelations among the responses to these four questions were determined for those diary records which were responses to actual blast events, and are summarized in Table 3.

Table 3
Intercorrelations Among Responses to Questions 5, 6, 9, and 10

Question	5	6	9
6	.95 (344)		
9	.86 (344)	.86 (339)	
10	.93 (336)	.92 (332)	.90 (344)

Note: Sample size in brackets

The intercorrelations are very high among all four items, indicating a summated or average score across Questions 5, 6 9 and 10 can be used to characterize an individual's response to a given blast event. This score will "capture" virtually all the information present in individual question responses, and, since it is based on four highly-intercorrelated items measuring various aspects of the same construct, will be considerably more reliable than information based on any single item.

Question 7 asked respondents to list those items which were "rattling" at the time of the blast. A number of respondents mentioned as many as three items or classes of items. The responses to Question 7 are summarized in Table 4.

Table 4
Sources of Rattling Noises at the Time of a Quarry Blast Most Frequently Cited

	Frequency of		
Source	First Mention	Second Mention	Third Mention
Dishes, curios	34	27	9
Windows	119	44	8
Doors	45	28	3
Floor	39	23	11
Whole house	26	2	-

Note: Only those sources receiving 20 or more first mentions are listed. These are, across all mentions, those sources most frequently mentioned.

These results agree very closely with those summarized in Table 13, which were based upon the Community Survey data, collected from a greater number of respondents in two adjoining communities.

Question 8 asked respondents to list any other effects on their property at the time of the blast. Only

about one-third of the Diary report forms contained codable responses to this question. The most common responses concerned the experience of the floor or whole house shaking; 88 responses were so coded. The remaining responses alluded to a variety of household effects or furnishings (e.g. furniture) or indicated that the respondent was unsure of the source of the rattling noise.

The Prediction of Human Response to Blast Events

Environmental Factors

A weather station was erected by the Commonwealth on Township property immediately south of the approximate center of Quarry operations and the weather data records for the period October 2, 1992 to the end of the project were made available to the principal investigator. The records included windspeed, wind direction, temperature at 8 and at 50 feet, precipitation, and solar radiation. The Commonwealth also provided data concerning blast location or origin for the same time period. These data included quarry level at which an event took place, face orientation, and direction of initiation. The above data were regarded as predictor variables in a series of four stepwise multiple regression analyses, with the average of the responses to Diary questions 5, 6, 9 and 10 for a given blast event regarded as criteria. In addition to the above variables, two derived variables were developed. The first, the difference between temperature at 8 and at 50 feet, is an index of the presence of an atmospheric inversion. The second was a composite variable, the product of wind speed and a series of azimuth values which reflected wind direction toward or away from the community at the time of the blast event.

In the first stepwise regression, with the average of responses to Question 5 as the criterion or "dependant" variable, (using the criterion of "significance at the .05 level" for inclusion in the regression equation), only one variable was selected as a predictor. This variable was the temperature at eight feet at the time of the blast event. The multiple r (or simple correlation in the one variable case) between this variable and the average responses to Question 5 is -.28. An ANOVA summary table for the regression analysis is presented in Table 5.

Table 5
ANOVA Summary Table for Stepwise Regression Analysis, All Predictors with Question 5 Responses as Criterion

Source	df	Sum of Squares	Mean Square	F
Regression	1	8.200	8.199	18.57*
Residual	227	100.210	.441	

* $p < .001$

In view of the high correlations among the responses to Questions 5, 6, 9 and 10, one might expect the results of similar stepwise regression analyses to be similar. However, the intercorrelations indicate that there is some specific variance accounted for by each question, and the stepwise regression analysis will shed light on whether that variance can be predicted or accounted for by some variable or combination of variables in the set of predictors.

The second stepwise regression analysis utilized the same set of predictors listed above and utilized the average responses to Question 6. In this analysis, using the same criterion for inclusion, three predictors entered the equation. They were, in order: temperature at eight feet (simple correlation: -.24), the derived composite variable which was the product of wind direction and wind speed (simple correlation .20, multiple correlation .30), and wind direction (simple correlation -.06, multiple correlation .342). An ANOVA summary table for this regression analysis is presented in Table 6.

Table 6
ANOVA Summary Table for Stepwise Regression Analysis, All Predictors with Question 6 Responses as Criterion

Source	df	Sum of Squares	Mean Square	F
Regression	3	13.581	4.527	9.96*
Residual	225	102.246	.454	

* $p < .001$

The analysis was repeated, utilizing all predictors with the average responses to Question 9 as criterion. In this analysis, only one predictor, temperature at the eight foot level, was significant. The simple correlation between this variable and the dependant (criterion) variable was -.19. An ANOVA summary table for this analysis is presented in Table 7.

Table 7
ANOVA Summary Table for Stepwise Regression Analysis, All Predictors with Question 9 Responses as Criterion

Source	df	Sum of Squares	Mean Square	F
Regression	1	4.468	4.468	8.37*
Residual	228	121.672	.534	

* $p < .005$

The fourth stepwise regression analysis utilized all predictors with the average of responses to Question 10 as criterion. The best predictor was again temperature at eight feet (simple correlation: -.26). A second predictor, simple wind direction, also entered the equation (simple correlation: -.12; multiple correlation: .29). The third predictor to be entered in the equation was the derived composite variable, the product of wind direction and wind speed (simple correlation: .14; multiple correlation: .34). An ANOVA summary table for this analysis is presented in Table 8.

Table 8
ANOVA Summary Table for Stepwise Regression Analysis, All Predictors with Question 10 Responses as Criterion

Source	df	Sum of Squares	Mean Square	F
Regression	3	16.051	5.351	9.98*
Residual	226	121.141	.536	

* $p < .001$

In light of the substantial intercorrelations obtained among the four criteria, it was decided to create a composite variable by summing the average responses to Questions 5, 6, 9 and 10, to obtain an overall index of intensity for a given blast, based upon human perceptions. These indices were employed in a stepwise regression analysis, with the weather and blast location data as predictors. Only one predictor, temperature at the eight foot level, was significantly related to the composite variable. The simple correlation was -.28, supporting the results of previous analysis. An analysis of variance summary table for this analysis appears in Table 9.

It should be pointed out that the variables of wind direction and the composite of wind direction and speed both failed to enter the regression equation because of significance values exceeding .05 but in the third decimal place.

Table 9
ANOVA Summary Table for Stepwise Regression Analysis, All Weather and Blast Location Predictors with Composite Criterion

Source	df	Sum of Squares	Mean Square	F
Regression	1	123.568	123.568	17.34*
Residual	211	1503.848	7.127	

* $p < .001$

Measured Blast Characteristics

Also made available to the principal investigator were measurements of ground vibration, airblast, and blast data associated with data collected at McCoy compliance stations numbers 1, 2 and 4. These compliance stations are situated on the Swedesburg side of the Pennsylvania Turnpike, along the southeast boundary of the community, and are arrayed in a southwest-northeast line over a distance of slightly over a quarter of a mile. Data were available from only one of the above stations for most blasts. Data from two other stations (one approximately northeast of the quarry and one south of the quarry) were not utilized. It was hoped that the non-systematic (if not random) selection of a data source (i.e. compliance station) situated between a blast event and the community would provide an index of the impact of selected measured blast characteristics on human perceptions of a given blast event. For each event considered, the following measured characteristics were treated as predictors of the human response:

- charge weight per delay, in pounds
- square root of scaled distance
- cube root of scaled distance
- airblast intensity, in decibels
- three seismic indices:
  - H1 (peak particle velocity radial to blast);
  - H2 (peak particle velocity horizontal and perpendicular to blast); and,
  - V (peak particle velocity vertical to blast).

A single stepwise regression analysis was carried out using the composite variable based upon responses to Questions 5, 6, 9 and 10, described above, as the criterion, and the measured or monitored blast characteristics as predictors. Using the $\propto$ level of .05 as the criterion for inclusion, three predictor variables entered the equation: these were H2 (simple correlation .16), then charge weight per delay (simple correlation .10, multiple correlation .21), then blast intensity in decibels (simple correlation -.07, multiple correlation .24). An analysis of variance summary table for this analysis appears in Table 10.

Table 10
ANOVA Summary Table for Stepwise Regression Analysis, Monitored Blast Characteristic Predictors with Composite Criterion

Source	df	Sum of Squares	Mean Square	F
Regression	3	161.504	53.835	**6.82***
Residual	334	2636.986	7.895	

* $p < .001$

Both analyses employing the composite criterion indicate a relatively small portion of the variance in human responses to blast events can be predicted from weather and blast environmental data or from monitored, measured blast characteristics. It appears weather data have the greatest potential, in terms of statistical relationships.

To obtain some insight into the relative importance of all predictor information, a stepwise regression analysis was carried out utilizing all classes of predictors (weather data, blast location or environment, and measured blast characteristics) with the composite variable described above as criterion. This analysis indicated that the same set of weather variables identified earlier (temperature at eight feet (simple correlation -.27), wind direction (simple correlation 0.14, multiple correlation .31), and the composite variable reflecting both wind direction and wind speed (simple correlation .16, multiple correlation .37) were the only variables entering the regression equation. Minor differences in the simple and multiple correlations obtained are due to the fact that this analysis (as well as all analyses) were based upon specific sets of data with no missing values. The precise number of observations varied slightly from one analysis to another. This had no discernible influence on the analyses. The results of this analysis are summarized in Table 11.

Table 11
ANOVA Summary Table for Stepwise Regression Analysis, All Weather, Blast Location and Measured Blast Characteristics as Predictors with Composite Criterion

Source	df	Sum of Squares	Mean Square	F
Regression	3	214.994	71.665	**10.62***
Residual	206	1389.853	6.747	

* $p < .001$

Characterization of Blast Events by Respondents

One of the principal problems with the analysis and interpretation of Blasting Episode Diary data is the extreme variation in both the number of responses to any given blast event, and in the number of events reported by any given respondent. The combination of these two factors created an enormous missing data problem. In an attempt to develop a means by which blast events could be characterized, it was decided by representatives of the Pennsylvania Department of Environmental Resources and the principal investigator to focus upon the seven respondents who submitted the greatest number of diary reports.

An overall severity rating for each blast (for which two or more of the seven principal respondents provided data) was obtained as follows:

The average of each respondent's ratings of all reported blast events was determined, for Diary questions number 5, 6, 9 and 10. For each reported blast, the signed (plus or minus) difference between that respondent's average and that respondent's response (rating) for that blast was obtained for each of the four questions, 5, 6, 9 and 10.

These signed deviations (which represent respondent reactions above or below each respondent's average response) were then averaged across all respondents providing data for a given blast, to obtain an overall average for each question for each blast.

In view of the substantial intercorrelations among questions 5, 6 9 and 10, these averages were then summed across the four questions, to create an overall index of perceived severity for each of the 84 possible actual blast events. The overall blast ratings are presented graphically in Figure 1.

The intermediate and overall averages are presented in Table 12. As may be noted, there are a number of apparently severe blast events (e.g., #12, 21, 68, 70, 71) and a number of milder events (e.g., #10, 30, 46, 51, 52). Further analyses may reveal factors which are associated with these very different perceptions of blast events.

Conclusions

Data from the Diary clearly indicate that residents are able to accurately perceive the occurrence of blasts and that such blasts are intrusive and annoying. However, the effects of quarry operations seem to extend beyond that which is clearly and unequivocally attributable to operations, per se. Some of the public annoyance and antagonism that is directed at Glasgow Quarry appears to be either inherited from earlier operations, prior to contemporary regulation and oversight by the Commonwealth, or due to a generalized dislike of quarry operations stemming from real sources of annoyance, such as dust and dirt, possible property damage and the periodic startling experience of blast noise and/or vibration.

A persistent problem and source of tension between quarry and community may be the widespread public impression that the quarry is disinterested, at best, concerning its effects on surrounding communities (see especially Tables 34, 35 and 36). A more concerted attempt at building a positive relationship by both residents and quarry personnel could reduce some of that tension. There seems a very limited level of knowledge and familiarity with quarry operations on the part of most residents, and certainly very little by way of positive identification with the operation. These, it is felt, are factors which can and should be addressed through community relations and educational programs.

The "startle" aspect of the experience of a blast event is a major source of annoyance. Disseminating a schedule of blast events and/or initiating a warning system may reduce the effects associated with this factor.

The intercorrelations of the ratings of the experience of a blast event, and the consistent results from the regression analyses, suggests that weather (specifically temperature) is significantly related to the experience of a blast event. While responses to the Community Survey indicate that residents perceived summertime blasts to be more severe, other data indicate a consistent **negative** relationship between temperature at eight feet and the typical rating of a blast event. The latter indicate that warmer

Figure 1
Averaged Overall Blast Ratings of Seven Principal Respondents

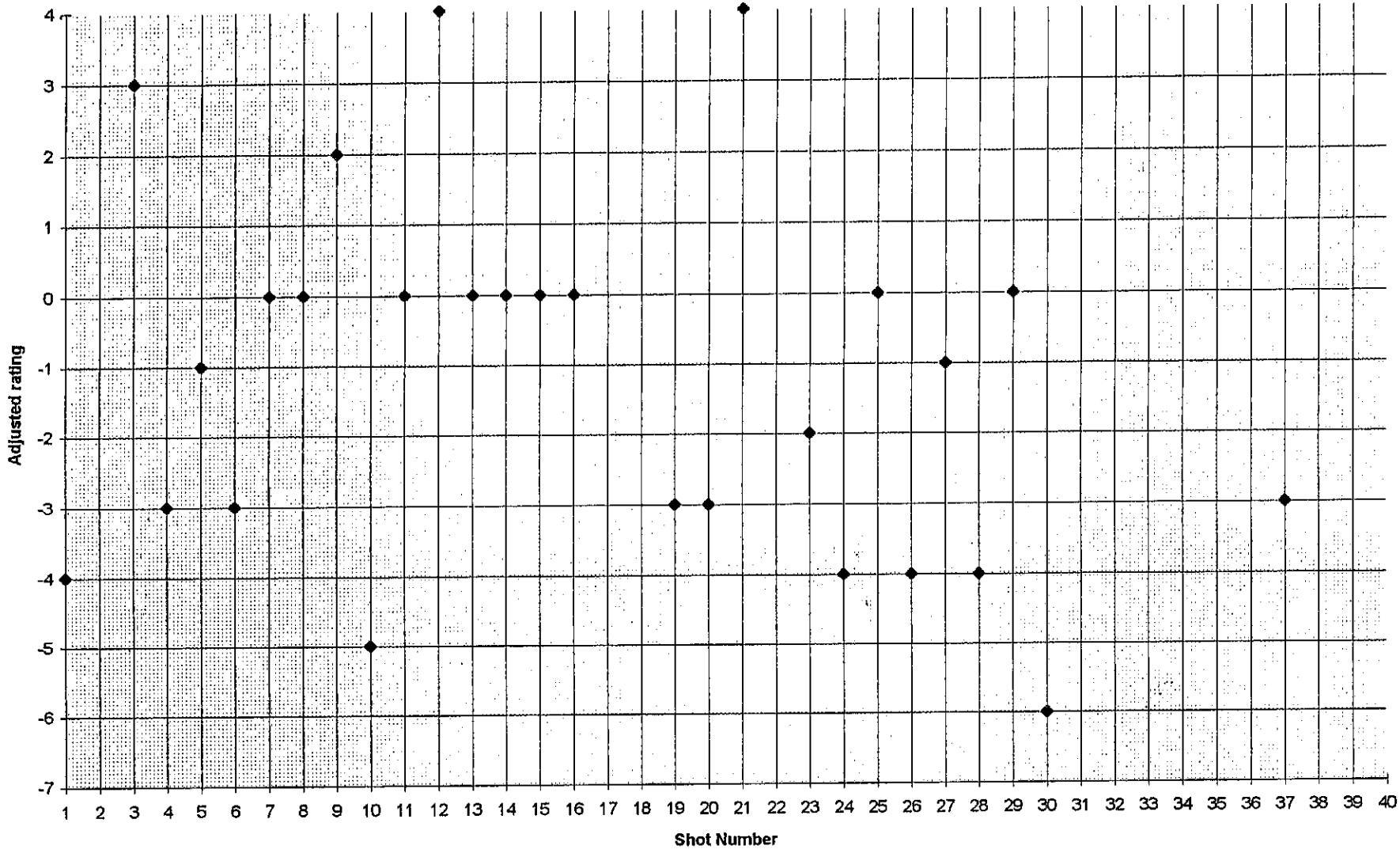
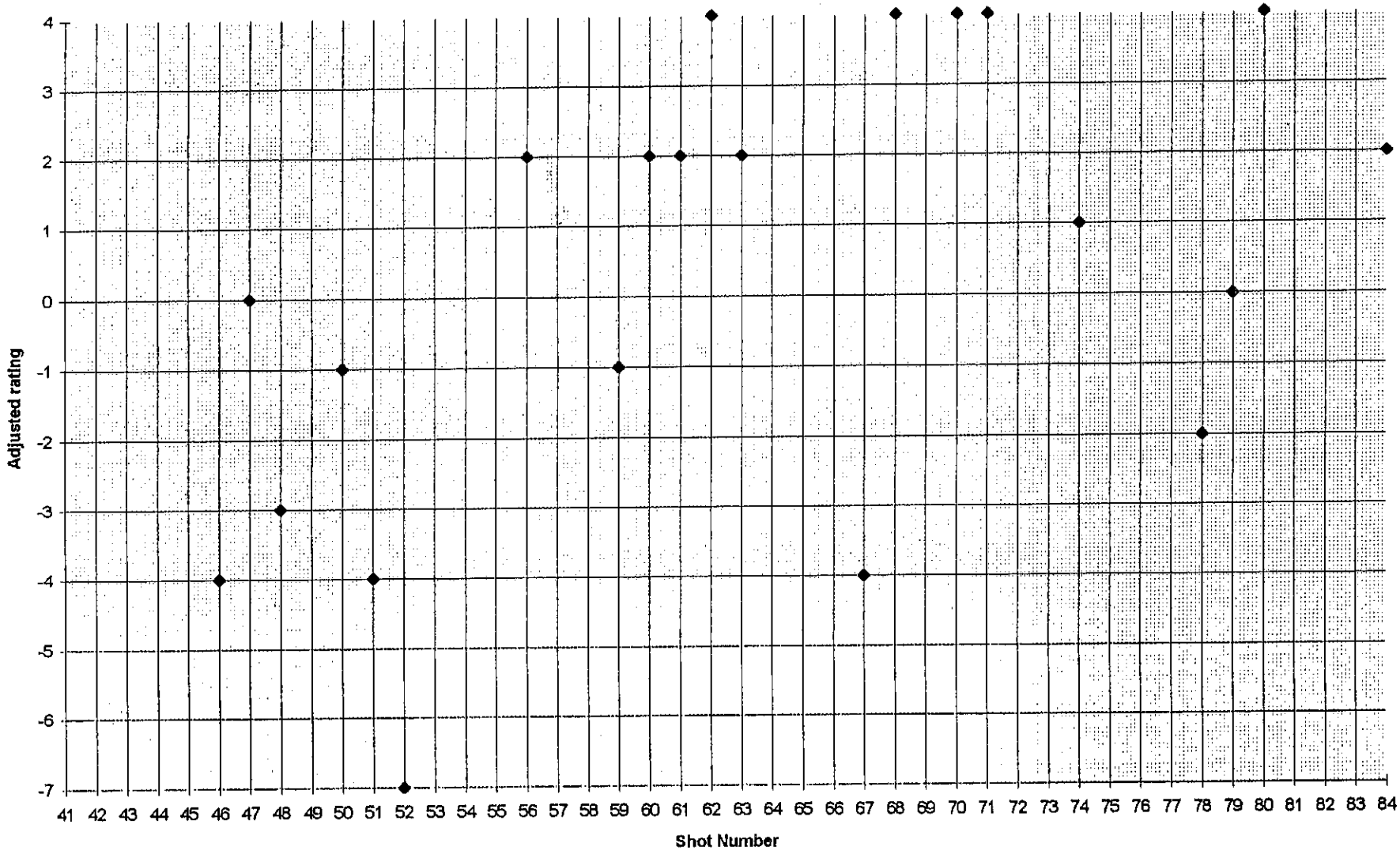


Figure 1 (continued)
Averaged Overall Blast Ratings of Seven Principal Respondents



temperatures are associated with lower average ratings for blast events, and that events occurring in cooler weather receive higher (i.e. more severe) ratings. These data are completely inconsistent with survey results. For several reasons, however, the Diary results (which reflect immediate experience and temperature, rather than the retrospective summary of blast event intensity and context) may be more valid.

Interestingly, a blast event experienced by many residents was not detected by either the principal investigator or a representative of PADER (as to noise or vibration) who were at an outdoor location in Swedesburg within 1500 feet of the actual blast. This blast generated considerable comment and annoyance among residents, and was reported at a community meeting later that same day. The amplification effects of residential dwellings were undoubtedly responsible for this. Also, it will be recalled that a major source of secondary noise from blast events are residence windows (e.g. see Table 13, Table 16 and Table 4, Part II). Cooler weather results in windows closed within sash frames. The stiffened units may accentuate the vibrations of window panes, generating more rattling and secondary noises. It is disappointing that the several measured or monitored variables associated with blast events and available for analysis were not more strongly predictive of public perceptions and reactions.

The present study suffered from the combination of a lower-than-desired and uneven rate of response to blast events. This was due largely to two factors. The first consideration was the need for respondents to incorporate respondent duties into an ongoing lifestyle (including unavoidable absences from home, leading to "missed" blast events). The second was a severely diminished number and rate of blast events during normal operating months. This latter situation was often and erroneously attributed to the influence of the ongoing research. Residents often commented on their belief that, when the study ended, things would return to their usual unbearable state, that both the frequency and severity of blasting would increase. The quarry did, in fact, experience a prolonged period of reduced activity, immediately before and during the study. Activity has not returned to a normal level (approximately 2 million tons annual production). The principal causes of the reduction, however, are the completion of several major local construction projects (e.g. the "Blue Route" and the Northeast Extension Interchange on the Pennsylvania Turnpike), and the generally sluggish state of the economy. Lessened quarry activity undoubtedly had an adverse impact on Community Survey response rate, as well as the rate of participation in the Blasting Episode Diary study.

The basic methodologies employed in the present study appear adequate, if enough blast events occur to maintain respondent concern, interest and involvement.

An alternative procedure may be to allow respondents to call a dedicated toll-free number, to complete a brief computer-administered "Diary Form", using touch-tone telephone buttons to respond to various questions and to rate aspects of their experience of a blast event. This may increase response rates, since it seems more efficient than completing and returning hard-copy forms. Also, non-response can be immediately determined and followed up, to determine its basis. A totally telephone-based system would also allow for more frequent interaction between respondents and research personnel.

Table 12: Averaged Overall Blast Ratings of Seven Principal Respondents

Shot #	Loudness	Rattling	Vibration	Severity	Sum Rating	Shot #	Loudness	Rattling	Vibration	Severity	Sum Rating
1	-1	-1	-1	-1	-4	43					
2						44					
3	1	1	0	1	3	45					
4	-1	-1		-1	-3	46	-1	-1	-1	-1	-4
5	0	0	-1	0	-1	47	0	0	0	0	0
6	-1	-1		-1	-3	48	-1	0	-1	-1	-3
7	0	0	0	0	0	49					
8	0	0	0	0	0	50	-1	1	-1	0	-1
9	1	0	0	1	2	51	-1	-1	-1	-1	-4
10		-1	-1	-3	-5	52	-2	-1	-2	-2	-7
11	0	0	0	0	0	53					
12	1	1	1	1	4	54					
13	0	0	0	0	0	55					
14	0	0	0	0	0	56	1	0	0	1	2
15	0	0	0	0	0	57					
16	0	0	0	0	0	58					
17						59	0		-1	0	-1
18						60	1		0	1	2
19	0	-1	-1	-1	-3	61	0	0	1	1	2
20	-1	-1	-1		-3	62	1	1	1	1	1
21	1	1	1	1	4	63	-1	1	1	1	2
22	0					64					
23	0	0	-1	-1	-2	65					
24	-1	-1	-1	-1	-4	66					
25	0	-1	0	1	0	67	-1	-1	-1	-1	-4
26	-1	-1	-1	-1	-4	68	1	1	1	1	4
27	0	0	-1	0	-1	69					
28	-1	-1	-1	-1	-4	70	1	1	1	1	4
29	0			0	0	71	1	1	1	1	4
30	-1	-2	-2	-1	-6	72					
31						73					
32	-2					74	0	1	0	0	1
33						75					
34						76					
35						77					
36						78	-1			-1	-2
37	-1	-1	-1	0	-3	79	0	0	0	0	0
38						80	1	1	1	1	4
39						81					
40						82					
41						83					
42		0				84	1		0	1	2

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APPENDIX A

Community Survey Questionnaire

ELLEN A. HARLEY, MEMBER
HOUSE POST OFFICE BOX 178
MAIN CAPITOL BUILDING
HARRISBURG, PA 17120-0028
PHONE: (717) 787-6572

COURTSIDE SQUARE
570 W. DEKALB PIKE, SUITE 116
KING OF PRUSSIA, PA 19406
PHONE: (215) 962-8179

House of Representatives
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG

COMMITTEES

LOCAL GOVERNMENT
HEALTH & WELFARE
URBAN AFFAIRS
PENNSYLVANIA COUNCIL ON THE ARTS
PENNSYLVANIA PUBLIC TELEVISION
NETWORK COMMISSION

Dear Neighbor,

Enclosed is a survey developed by Villanova University as part of a research project concerning Glasgow Quarry activities. As you know, after 20 years of citizen concern, a major study is underway on the effects of the blasting at Glasgow Quarry. This study, funded by the Commonwealth of Pennsylvania and administered by the Department of Environmental Resources, through Villanova University, is an extremely thorough examination of the factors related to your experiences with Quarry blasting, noise, traffic and other potential sources of annoyance.

Your response to this survey is very important to the creation of an accurate picture of residents' reactions to Quarry activities. It will provide a true opportunity for your voice, and those of your neighbors, to be heard. I strongly endorse this bipartisan effort by the Commonwealth and urge you to complete the Villanova University survey at your earliest convenience.

Very truly yours,

Ellen A. Harley
State Representative
149th District

EAH/mep

VILLANOVA
SESQUICENTENNIAL

150TH ANNIVERSARY

HUMAN ORGANIZATION SCIENCE INSTITUTE

Dear Resident:

The following survey, developed by the Human Organization Science Institute of Villanova University, is being distributed to every household in the communities of Swedesburg and Swedeland. It is part of a comprehensive study of the effects of Glasgow Quarry activities on your community. The Pennsylvania Department of Environmental Resources, the United States Bureau of Mines and Villanova University are working together on this study - one of the most comprehensive investigations of blasting effects ever to be carried out in Pennsylvania.

We think it is important for every family in Swedesburg and Swedeland to have the chance to be heard. This survey asks for a lot of information. It will take more than just a few minutes to complete. However, we are attempting to understand a very complex problem. We want you to be fully represented. We don't think your knowledge, experience and opinions can be adequately expressed with just a few questions. We hope you will take the time to answer each of the survey questions.

Please be assured that your responses to this survey are completely confidential. Your answers will be coded and your name will not be linked to your responses. Only summaries of all responses will be used in our reports.

Please complete and return this survey within the next ten (10) days. We have enclosed a self-addressed, postage-paid envelope for your convenience. If you have any questions about this survey or the confidentiality of your responses, please feel free to call me at 215-645-4558.

Sincerely,

Stanley S. Jacobs

Stanley S. Jacobs, Ph.D.
Project Manager

P.S. If you would like a copy of our final report, summarizing the results of this survey, please answer Question 53 on page 10 of the survey.

VILLANOVA UNIVERSITY VILLANOVA, PENNSYLVANIA 19085-1699 215-645-4558 FAX 215-645-7162

Swedesburg/Swedeland Public Reaction Survey

Human Organization Science Institute
Villanova University

This survey is being conducted by the Human Organization Science Institute of Villanova University. It is one part of a comprehensive study of the operations of the Glasgow Quarry being supported by the Pennsylvania Department of Environmental Resources. This study will combine the results of this survey with seismic, meteorologic, geologic and blast information in an attempt to better understand the effects of blasting on your community.

Your responses to this survey are completely confidential. The surveys will be summarized by the Human Organization Science Institute and presented in summary form. Only the key research personnel at Villanova University will know your identity. Your name, address or other identifying information will not be included in any reports issued as a result of this survey. Further, once summarized, no know will know your specific responses to the survey questions.

We recognize that this is a lengthy survey. We need to gather a variety of information from you in order to determine those factors most important to understanding the connection between quarry operations and community reaction. We ask you to take the time to seriously consider each of the following questions. Without your honest responses, it will not be possible to take appropriate action to address the issues experienced by your community.

Please complete and return this survey within the next ten (10) days. *Please use the enclosed pre-addressed, postage-paid envelope to return your survey.*

Should you have any questions about this survey, the overall study or the confidentiality of your responses, please feel free to contact Dr. Stanley S. Jacobs, Project Manager, Human Organization Science Institute, Villanova University, Villanova, Pennsylvania 19085. You may call Dr. Jacobs at 215-645-4558.

We sincerely appreciate your cooperation and assistance in this effort.

Household Information

1. **Complete Home Address:** . . . . . _____

   _____

   _____

2. **Home Telephone Number:** . . . . . _____

3. **Do you (or your family) own or rent this home?** (circle one) . . . . . Own 1
   Rent 2
   Other Arrangements 3

4. **In what year (approximately) was this house built?** . . . . . | | | | |

6. **Does anyone living in this house have any training or experience in any of the following areas?** (circle all that apply) . . . . . Blasting 1
Dredging/Logging 1
Land Clearing/Site Development 1
Mining 1
Operating Heavy Equipment 1
Operating Heavy Trucks 1
Quarry Operations 1

7. **Do you or any members of your family benefit directly from the work at the Glasgow Quarry?** (circle one) . . . . . Yes 1
If "Yes", please explain: No 0

_____

_____

House Structure Information

8. **How would you describe your house?** (circle one) . . . . . Detached/Single Family 1
Duplex/Twin 2
Multi-Family/Apartment 3
Rowhouse/Townhouse 4
Please Specify:_____ . . . . . Other 5

9. **What type of structure is your house?** (circle one) . . . . . Solid Brick/Masonry/Stone 1
Wood/Wood Frame 2
Wood Frame covered with Brick/Stone/Stucco 3
Please Specify:_____ . . . . . Other 4

10. **What type of foundation does your house have?** (circle one) . . . . . Poured Concrete 1
Concrete Block 2
Laid-Up Stone 3
Wood 4
Please Specify:_____ . . . . . Other 5

11. **What type of basement does your house have?** (circle one) . . . . . None/Slab 1
Crawl Space 2
Full Basement 3
Part Crawl Space and Part Full Basement 4
Please Specify:_____ . . . . . Other 5

12. **What is your basement made of?** (circle one) . . . . . No Basement 1
Poured Concrete Walls and Floor 2
Cement Block Walls and Poured Concrete Floor 3
Stone Walls and Concrete Floor 4
Please Specify:_____ . . . . . Other 5

13. **Which stories (floors) does your house have?** (circle all that apply) . . . . . Unfinished Basement 1
Finished Basement 1
First Floor 1
Second Floor 1
Third Floor 1
Attic 1

Quarry Operating Information

In this study, we are particularly interested in your opinions about the operations of the Glasgow Quarry during the past year (twelve months). Please answer the following questions to the best of your knowledge and experience. Please base your answers on what you have personally experienced, not on what you may have heard from others.

19. **While you have been inside your home during the past year, have you ever noticed any of these noises?** (circle all that apply) . . . . Noise from Quarry Blasting 1
Noise from Quarry Trucks 1
Noise from Quarry Machinery 1
Noise from Quarry Alarms/Sirens 1
Please Specify:_____ . . . Other Quarry Noise 1

20. **Please rate the level of your annoyance with each of the sources of noise listed below. CIRCLE the number that best describes your reaction to these noises, using the scale shown in the boxes.**

While you have been at home during the past year, how annoyed have you been by:	Not Annoyed		Somewhat Annoyed		Very Annoyed		Extremely Annoyed
Noise from Quarry Blasting	1	2	3	4	5	6	7
Noise from Quarry Trucks	1	2	3	4	5	6	7
Noise from Quarry Machinery	1	2	3	4	5	6	7
Noise from Quarry Alarms/Sirens	1	2	3	4	5	6	7
Please Specify:_____ Other Quarry Noise	1	2	3	4	5	6	7

21. **While you have been inside your house during the past year, how often have you heard anything in your house RATTLING?** (circle one) . . . . . Never 1
Almost Daily 2
Once or Twice a Week 3
Once or Twice a Month 4
Once or Twice During the Year 5

22. **Please identify what was RATTLING.** (circle all that apply) . . . . . Nothing 1
Don't Know What Was Rattling 1
Dishes/Curios 1
Pictures and/or Paintings 1
Furniture 1
Lamps and/or Light Fixtures 1
Windows 1
Doors 1
Walls 1
Plumbing 1
Please Specify:_____ . . . . . Other 1

23. **What do you think caused the RATTLING?** (circle all that apply) . . . . . Nothing Rattles 1
Don't Know What Caused the Rattling 1
Airplanes and/or Helicopters 1
Large Trucks 1
Quarry Blasting 1
Trains 1
Turnpike Traffic 1
Please Specify:_____ . . . . . Other 1

31. Considering the blasts you have actually experienced during the past year, how often did blast NOISE startle you? (circle one) . . . . . None of the Time 1
About 25% of the Time 2
About 50% of the Time 3
About 75% of the Time 4
Almost All of the Time 5

32. Considering the blasts you have actually experienced during the past year, how often did blast VIBRATION startle you? (circle one) . . . . . None of the Time 1
About 25% of the Time 2
About 50% of the Time 3
About 75% of the Time 4
Almost All of the Time 5

33. Using the numbers "1" through "6", please rank the following quarry activities in terms of their annoyance. Please assign a "1" to activity you find MOST annoying, a "2" to the activity you find NEXT MOST annoying and so on until you assign a "6" to the activity you find LEAST annoying. Please do not use the same number more than one time.

Dust . . . . . ☐

Machinery Noise . . . . . ☐

Blasting Noise . . . . . ☐

Heavy Truck Traffic . . . . . ☐

Vibration from Equipment and Trucks . . . . . ☐

Vibration from Blasting . . . . . ☐

Quarry Influences on the Swedesburg/Swedeland Community

34. Did you know about the Glasgow Quarry when you first began living in this community? (circle one) . . . . . Yes 1
No 0

35. If you had the choice of moving to Swedesburg/Swedeland today, knowing what you know now about the quarry, would you choose to move to this community? (circle one) . . . . . Yes 1
No 0

36. Since you first moved to this community, would you say you have become used to the quarry's operations? (circle one) . . . . . Yes 1
No 0

44. Please describe any other ways in which quarry activities effect your house or your life.

Your Suggestions and Opinions

45. In your opinion, is the Glasgow Quarry operating in a responsible manner? (circle one) . . . . . Yes 1
No 0

46. Please explain your answer to Question #45.

47. All things considered, in what ways have the presence and activities of the Glasgow Quarry HARMED the Swedesburg/Swedeland community?

48. All things considered, in what ways have the presence and activities of the Glasgow Quarry HELPED the Swedesburg/Swedeland community?

49. In your opinion, what has the Glasgow Quarry done over the past year that has made its operations LESS objectionable to the community?

50. In your opinion, what has the Glasgow Quarry done over the past year that has made its operations MORE objectionable to the community?

APPENDIX B

Blasting Episode Diary Form

1. Family Identification Number: . . . . . ☐☐☐

2. Date of Blast: . . . . . Month ☐☐ Day ☐☐ Year ☐☐

3. Time of Blast: . . . . . Hour ☐☐ Minute ☐☐ Circle AM PM

4. Where were you at the time of the blast? (check one)

Indoors . . . . . Basement ☐
First Floor ☐
Second Floor ☐
Third Floor ☐
Outdoors . . . . . Front Yard ☐
Side Yard ☐
Back Yard ☐

5. How much did your house vibrate at the time of the blast? (circle one)

No Vibration = 1 2 3 4 5 = *Extremely Severe Vibration*

6. What was the level of rattling of your house at the time of the blast? (circle one)

No Rattling = 1 2 3 4 5 = *Extremely Severe Rattling*

7. Please describe what was rattling at the time of the blast?

_____

_____

_____

8. Please describe any other effects on your property at the time of the blast.

_____

_____

_____

9. How loud was the blast noise? (circle one)

No Noise = 1 2 3 4 5 = *Extremely Loud*

10. Considering the factors of rattling, vibration and noise, how severe was this blast compared to all other blasts you have experienced? (circle one)

One of the Mildest = 1 2 3 4 5 = *One of the Most Severe*

11. Which family members participated in rating this blast?

_____

_____

_____

Please use the other side of this sheet to make any other comments about this blast.

HUMAN ORGANIZATION SCIENCE INSTITUTE
Villanova University

Blasting Episode Diary
"Owners' Manual"

Instructions for Blasting Episode Diary

Please complete a diary page for each blasting event that you experience. We are interested in your experience with blasting events that take place both while you are in the home and while you are outdoors.

The following comments pertain to each of the items on the Diary.

Item 1 Your identification number should be entered by us on each diary page. We will use identification numbers throughout the study to maintain confidentiality of the data and to insure your anonymity.

Items 2 & 3 Enter the date and time of the blast.

Item 4 Please indicate where you were when you experienced the blast.

Item 5 On a scale of severity, from "1" to "5", with "1" indicating no vibration, and "5" indicating extremely severe vibration, circle one number which most accurately reflects your experience with vibration from this particular blast.

Item 6 We are interested in your experience with noise created as a result of the blast vibration (not the noise of the blast itself). On a scale of severity from "1" to "5", with "1" indicating no rattling and "5" indicating extremely severe rattling, circle one number which most accurately reflects your experience with rattling noises from this particular blast.

Item 7 Please be specific when you identify what was creating rattling noises at the time of the blast. Specify items and locations if possible.

Item 8 Please let us know of any other effects on your property when the blast occurred, such as movement or damage to furnishings or household effects.

Item 9 We are interested in the intensity of the noise directly resulting from the blast. On a severity scale of "1" to "5", with"1" indicating no noise was heard and "5" indicating an extremely loud noise, circle one number which most accurately reflects the intensity of the blast noise you experienced from this particular blast.

Item 10 All things considered, we would like you to evaluate your reaction to this particular blast, with reference to all other Quarry blasts you've experienced. On a severity scale of "1" to "5", with "1" indicating a very mild blast and "5" indicating an extremely severe blast, circle one number which most accurately reflects your reaction to this particular blast.

Item 11 In the event that more than one person was present when the blast occurred, and they participated in arriving at the ratings, we would like to know who participated. It is very important that the diaries be completed only by family members, without regard for neighbor's (or anyone else's) impression of a particular blast. We are attempting to isolate factors that are related to **your** experience with blast events. If your reactions are influenced by someone outside the home, we will be unable to isolate the factors that seem to effect blast severity.

Please feel free to enter any additional comments you may have on the reverse of the Diary page.

Your completed diaries will be kept completely confidential. Individual names or diaries will be revealed to no one and all data analyses will use ID numbers. Only Villanova research personnel will have access to this information. Your completed diary forms are of critical importance to us. Without your help in documenting your reactions to blasting, we cannot hope to understand what can be done to decrease the level of annoyance with blasting.

Again, thank you for your help.

Stanley S. Jacobs

APPENDIX C

Summary of Diary Responses

Coding Scheme for Blasting Episode Diary

Question #4: Location
variable name: Q4
values: 1 'Basement'
2 'First floor'
3 'Second floor'
4 'Third floor'
5 'Front yard'
6 'Side yard'
7 'Back yard'

Question #5: 'Level of Vibration'
variable name: Q5
values: 1 'Little or none'
2 'Some'
3 'Moderate'
4 'Strong'
5 'Extremely severe'

Question #6: 'Level of Rattling'
variable name: Q6
values: 1 'Little or none'
2 'Some'
3 'Moderate'
4 'Strong'
5 'Extremely severe'

Question #7 and #8: Q7a 'What was Rattling'
Q7b 'What was Rattling'
Q7c 'What was Rattling'
Q8a 'Other Effects'
Q8b 'Other Effects'
values: 1 'No rattling'
2 'Don't know what was rattling'
3 'Dishes/curios rattling'
4 'Pictures rattling'
5 'Furniture rattling'
6 'Light fixtures rattling'
7 'Windows rattling'
8 'Doors rattling'
9 'Walls rattling'
10 'Plumbing rattling'
11 'Other rattling'
12 'No response'
13 'Floor/ground shaking'
14 'Whole house shaking'
15 'Foundation shaking'
16 'Cracks'
17 'Unsure of other effects'

Question #9: 'Loudness of Blast'
variable name: Q9
values: 1 'Little or no noise'
2 'Some noise'
3 'Moderate noise'
4 'Loud noise'
5 'Extremely loud'

Question #10 'Severity of Blast'
variable name: Q10
values: 1 'One of the mildest'
2 'Mild'
3 'Moderate'
4 'Severe'
5 'Extremely severe'

Table of Diary Responses

Date	Time	Case #	Q4	Q5	Q6	Q7A	Q7B	Q7C	Q8A	Q8B	Q9	Q10
07/06/92	10:05 AM	9	2	1	1	13			12		1	1
07/07/92	08:57 AM	1	2	1	1	12			12		1	1
07/07/92	08:55 AM	5	3	3	3	7			1		1	2
07/07/92	08:57 AM	12	3	2	1	12			12		2	2
07/07/92	09:02 AM	18	2	2	2	9	15		12		2	2
07/07/92	08:58 AM	20	2	3	3	7	3		17		2	3
07/07/92	09:00 AM	30		2	2	14			1		2	1
07/09/92	04:14 PM	9	2	1	1	8			1		1	1
07/21/92	10:03 AM	1	2	2	2	12			12		2	2
07/29/92	10:39 AM	20	2	4	4	7	8	3	12		3	3
07/30/92	10:40 AM	5	1			12			12		2	2
07/30/92	10:45 AM	30	2	4	3	14			12		4	2
07/30/92	10:40 AM	34	1	1	1	8			12		4	3
08/03/92	09:50 AM	8	2	2	1	1			13		2	1
08/05/92	11:52 AM	5	5	2		13			12		1	1
08/05/92	11:52 AM	8	3	3	3	9	7		17		3	3
08/05/92	11:50 AM	9	2	5	5	7	8		15		5	5
08/05/92	11:51 AM	14	3	4	3	3	4		12		4	3
08/05/92	11:50 AM	15	2	1	1	13			12		1	1
08/05/92	11:54 AM	20	2	3	3	7	8		12		4	4
08/05/92	12:00 PM	30	2	2		13			12		3	2
08/05/92	11:56 AM	44	2	2	1	1			1		1	1
08/12/92	11:39 AM	1	2	5	5	7			12		5	5
08/12/92	11:42 AM	5	2			13			12		2	2
08/12/92	11:40 AM	8	3	5	5	14			13	16	5	5
08/12/92	11:30 AM	14	2	5	5	7	3		14	13	4	5
08/12/92	11:40 AM	15	1	1	1	11			12		3	2
08/12/92	11:45 AM	18	2	5	5	7	9	15	12		4	4
08/12/92	11:40 AM	19	2	5	5	7			11		5	5
08/12/92	11:00 AM	20	1	3	3	7	8		12		4	4
08/12/92	11:41 AM	28	2	2	3	13	10		12		2	2
08/12/92	11:44 AM	30	2	5	5	3	5		14	3	5	5
08/12/92	11:40 AM	34	2			3	13		12		5	5
08/12/92	11:40 AM	38	2	5	5	7			3		5	5
08/12/92	11:30 AM	41	2	3	2	13	7		12		2	3
08/12/92	11:45 AM	44	2	2	1	12			12		1	1
08/13/92	11:31 AM	8	2	4	4	7	13		17		4	4
08/13/92	11:30 AM	15	2	3	3	12			12		3	3
08/13/92	11:40 AM	18	2	2	3	15	9		12		2	2
08/13/92	11:00 AM	20	1			12			12		4	
08/13/92	11:30 AM	30	1	3	4	13			17		4	3
08/13/92	11:30 AM	34	2	5	5	5	4	3	12		5	5
08/13/92	10:45 AM	35	2	4	4	7	14		1		5	3
08/13/92	11:32 AM	38	2	3	1	12			1		2	1
08/13/92	11:30 AM	39	2	3	2	8	7		12		2	2
08/13/92	11:36 AM	44	2	2	1	1			1		2	2
08/18/92	11:02 AM	18	2	2	2	15	9		12		2	2

Date	Time	Case #	Q4	Q5	Q6	Q7A	Q7B	Q7C	Q8A	Q8B	Q9	Q10
08/18/92	11:00 AM	34	2	2	2	1			12		2	2
08/24/92	10:00 AM	1	2	4	4	7	8		12		4	4
08/24/92	10:00 AM	8	2	3	3	13			16		3	3
08/24/92	10:00 AM	9	2	3	3	8			12		3	3
08/24/92	10:00 AM	12	2	3	1	12			13		3	3
08/24/92	10:00 AM	14	3	2	1	12			12		2	1
08/24/92	10:00 AM	15	2	1	1	11			12		1	1
08/24/92	10:01 AM	20	2	5	5	14			12		5	5
08/24/92	10:00 AM	30	2	3	3	1			14		3	3
08/24/92	10:00 AM	34	2	4	4	5	13		12		4	4
08/24/92	10:00 AM	39	2	1	1	11			1		1	1
08/24/92	10:00 AM	41	2	2	1	1			1		1	1
08/24/92	10:00 AM	44	2	2	1	12			12		2	2
08/25/92	09:15 AM	8		1	1	1			1		1	1
08/25/92	09:18 AM	9	2	3	3	8			12		3	3
08/25/92	09:18 AM	12	2	3	2	3			13		3	3
08/25/92	09:20 AM	15	2	1	1	12			12		1	1
08/25/92	09:20 AM	30	2	2	1	13			1		2	1
08/25/92	09:25 AM	34	3	1	1	1	11		12		2	2
09/03/92	10:15 AM	18	2	2	2	11			1		2	2
09/14/92	12:39 PM	1	2	5	5	7	13		4		5	5
09/14/92	12:40 PM	5	2	2	2	13			12		2	2
09/14/92	12:40 PM	8	2	5	5	14			14	16	5	5
09/14/92	11:38 AM	9	2	4	4	13			12		3	4
09/14/92	12:39 PM	14	2	3	3	7	3		12		2	2
09/14/92	12:40 PM	15	2	4	4	6			12		4	4
09/14/92	12:40 PM	18	2	5	5	14			15	5	3	5
09/14/92	12:40 PM	20		5	5	14			1		4	4
09/14/92	12:39 PM	22	2	5	5	7	3		10		5	5
09/14/92	12:41 PM	28	2	4	4	10	13	3	17		4	4
09/14/92	01:40 PM	30	2	4	5	3			14		5	5
09/14/92	12:40 PM	38	2	5	5	7	13		12		5	5
09/14/92	12:40 PM	39	2	2	2	13			12		2	2
09/14/92	12:41 PM	44	2	2	1	12			12		2	3
09/14/92	01:42 PM	45	2	4	4	14	3		12		4	4
09/15/92	09:13 AM	8	2	2	2	13			7		2	2
09/15/92	09:10 AM	12	2	3	3	7			12		3	3
09/15/92	09:12 AM	14	2	4	3	3			13		3	3
09/15/92	09:15 AM	18	2	2	2	11			15		2	2
09/15/92	09:30 AM	22	2	1	1	12			12		1	1
09/15/92	09:14 AM	30	2	2	2	13			1		2	1
09/15/92	09:12 AM	34	2	3	2	12			12		4	4
09/22/92	10:25 AM	9	2	5	5	8	3		13		5	5
09/22/92	10:25 AM	12	2	3	2	8			13		3	3
09/22/92	10:23 AM	14	2	4	3	7	3	4	12		2	3
09/22/92	10:30 AM	18	2	4	4	7			16		3	4
09/22/92	10:25 AM	22	2	3	3	7	5		12		3	3
09/22/92	10:26 AM	28	2	1	1	12			12		2	1
09/22/92	10:30 AM	30	2	1	1	1			1		1	1
09/22/92	10:25 AM	34	2	4	4	3	13	7	12		4	4

Date	Time	Case #	Q4	Q5	Q6	Q7A	Q7B	Q7C	Q8A	Q8B	Q9	Q10
09/22/92	10:25 AM	45	2	4	4	14			12		4	4
09/23/92	10:58 AM	8	2	2	2	7	13		17		2	2
09/23/92	10:55 AM	9	2	3	3	8			13		3	3
09/23/92	10:57 AM	12	2	2	1	1			12		2	1
09/23/92	10:57 AM	14	2	2	2	7			12		2	2
09/23/92	10:59 AM	22	2	2	2	13			12		2	2
09/23/92	10:58 AM	28	2	1	1	12			12		2	1
09/23/92	10:57 AM	34	2	4	4	7	3	13	12		4	4
09/23/92	11:00 AM	45	7	3	3	12			13		3	3
09/24/92	10:55 AM	8	2	2	2	13			1		2	2
09/24/92	10:55 AM	15	2	1	1	12			12		2	2
09/24/92	11:00 AM	18	2	4	4	15	5	7	12		4	4
09/24/92	10:56 AM	20	2	4	4	14			12		4	4
09/24/92	10:56 AM	28	7	1	1	12			12		2	1
09/24/92	11:00 AM	30	2	2	2	1			1		2	2
09/24/92	10:55 AM	34	2	3	3	13	3		12		4	4
09/24/92	10:55 AM	44	2	2	1	12			12		1	1
09/24/92	11:00 AM	45	2	3	3	3	5		14		3	3
09/24/92	10:55 AM	48	2	5	5	12			12		1	4
09/28/92	11:27 AM	45	2	3	3	3			12		3	3
09/29/92	10:56 AM	8		1	1	1			1		1	1
09/29/92	10:53 AM	9	2	3	3	13	8		12		3	3
09/29/92	10:55 AM	15	2	1	1	12			12		1	1
09/29/92	10:55 AM	18	6			12			13		2	2
09/29/92	10:55 AM	28	2	1	1	12			12		2	1
09/29/92	10:53 AM	34	2	2	2	1	11		12			
09/30/92	10:56 AM	1	2	5	5	7	11	13	12		5	5
09/30/92	10:57 AM	5	3	2	2	7			12		1	2
09/30/92	10:55 AM	9	2	5	5	8	7		13		5	5
09/30/92	10:54 AM	14	3	2	2	7			12		2	2
09/30/92	10:55 AM	15	2	1	1	12			12		1	1
09/30/92	10:55 AM	18	2	4	4	15	7	5	12		4	3
09/30/92	11:57 AM	22	1	3	3	7			13		3	3
09/30/92	11:00 AM	30	2	4	4	7			1		4	5
09/30/92		34	3	5	5	14	7	13	12		5	5
09/30/92	10:58 AM	39	2	2	2	13			12		2	2
09/30/92	10:57 AM	44	2	2	1	12			12		2	1
09/30/92	11:00 AM	45	2	5	5	3			13	14	5	5
10/02/92	10:23 AM	9	2	3	3	8			13		3	3
10/02/92	10:26 AM	15	2	2	2	14	7		12		3	3
10/02/92	10:00 AM	18	1	3		7	9	6	12		2	3
10/02/92	10:23 AM	34	2	4	4	3	7	13	12		4	4
10/02/92	10:25 AM	45	1	3	3	3			13		3	3
10/02/92	10:28 AM	48	2	5	5	12			12		2	5
10/07/92	10:02 AM	1	2	4	4	7	13		16		4	4
10/07/92	10:03 AM	5	2	4	4	7			12		3	3
10/07/92	10:01 AM	9	2	5	5	7			13		5	5
10/07/92	10:02 AM	12	2	3	2	7	13		12		2	3
10/07/92	10:05 AM	14	2	3	3	7	8	3	13		4	3
10/07/92	10:05 AM	19	2	4	3	7			12		4	3

Date	Time	Case #	Q4	Q5	Q6	Q7A	Q7B	Q7C	Q8A	Q8B	Q9	Q10
10/07/92	10:05 AM	45	2	5	4	3			12		5	5
10/08/92	10:00 AM	14	2	3	3	7	8		3	13	4	4
10/08/92		18		4	4	7	9	4	12		3	4
10/12/92	10:50 AM	30	2	5	4	7			13		4	4
10/13/92	10:50 AM	1	2	3	3	13			12		3	3
10/13/92	10:48 AM	15	2	1	1	12			12		1	1
10/13/92	10:50 AM	22	2	2	2	7			12		2	2
10/14/92	10:52 AM	1	2	5	5	7	13		11		5	5
10/14/92	10:53 AM	5	2	3	2	12			12		2	2
10/14/92	09:52 AM	8	2	4	4	7			16		4	4
10/14/92	10:50 AM	12	5	3	1	12			13		4	3
10/14/92	10:55 AM	14	2	4	4	7	8	3	13		4	4
10/14/92	10:51 AM	15	2	1	1	11			12		2	1
10/14/92	10:50 AM	19	2	2	1	7			12		2	2
10/14/92	10:52 AM	34	2	2	2	11			12		2	2
10/14/92	10:55 AM	45	2	5	4	3			13		5	5
10/14/92	10:51 AM	48	2	4	4	12			12		1	4
10/15/92	09:08 AM	9	2	3	3	13			8		3	3
10/15/92		18		3	3	7	15		12		2	3
10/15/92	09:11 AM	34	3	4	4	7	13		12		4	4
10/19/92	11:00 AM	14	2	5	5	8	7	3	13		5	5
10/19/92	10:58 AM	19	2	3	2	3			12		3	2
10/19/92	10:58 AM	22	2	4	4	7	5		12		4	4
10/19/92	10:57 AM	34	2			7	3		12		5	5
10/19/92	10:59 AM	44	2	2	1	12			12		2	1
10/19/92	10:55 AM	45	2	3	3	3			12		3	3
10/21/92	10:20 AM	18	2	2	2	11			1		2	2
10/22/92	09:58 AM	5	2	3	3	13			12		2	2
10/22/92	10:00 AM	18	2	4	3	7	3		12		2	4
10/22/92	10:00 AM	22	3	2	2	7			12		2	2
10/22/92	09:57 AM	34	2	4		8	7	13	12		4	
10/22/92	09:57 AM	45	1	5	5	3			13		5	5
10/22/92	09:57 AM	48	2	4	4	11			12		1	1
10/28/92	11:23 AM	9	2	3	3	7			13		3	3
10/28/92	10:17 AM	14	3	5	5	7	8	3	13		5	5
10/28/92	11:17 AM	45	2	3	3	6			13		3	3
10/29/92	10:10 AM	5	1	1	1	12			12		2	2
10/29/92	10:15 AM	8	2	5	5	7	3		13	16	5	5
10/29/92	10:20 AM	18	2	3	4	7	5		12		3	3
10/29/92	10:18 AM	34	2	5	5	13	7	8	14		5	5
10/29/92	10:20 AM	45	2	3	3	3	5		13		3	3
11/06/92	10:42 AM	1	2	5	5	7	8	13	13	4	5	5
11/06/92	10:45 AM	9		3	1	7			13		1	1
11/06/92	10:30 AM	14	3	3	3	4			13		3	2
11/06/92	10:44 AM	44	2	2	1	12			12		1	1
11/09/92	10:30 AM	8	2	1	1	1			1		1	1
11/09/92	10:31 AM	34	2	1	1	1			12		1	1
11/13/92	10:26 AM	1	2	5	5	7	11		13		5	5
11/13/92	10:25 AM	8	2	3	3	3	7	11	16		3	3
11/13/92	10:30 AM	9	2	5	5	7	8		13		3	5

Date	Time	Case #	Q4	Q5	Q6	Q7A	Q7B	Q7C	Q8A	Q8B	Q9	Q10
11/13/92	10:30 AM	14	2	5	5	9	13	4	11		5	5
11/13/92	10:25 AM	18	2	4	4	15	13	5	12		3	4
11/13/92	10:26 AM	22	3	3	2	7			12		3	3
11/13/92	10:28 AM	34	2	5	5	7	8	13	12		5	5
11/13/92	10:27 AM	45	2	4	4	6	10		13		4	4
11/13/92	10:26 AM	48	2	4	4	12			12		3	3
11/15/92	12:09 PM	14	2	4	4	7	4		13		4	4
11/16/92	12:10 PM	18	2	5	5	5	3	7	12		4	4
11/16/92	12:07 PM	34	2	5	5	3	7	8	12		5	5
11/16/92	12:07 PM	39	2	1	1	1	11		12		1	1
11/16/92	12:08 PM	45	2	5	5	5	6		13		5	5
11/18/92	10:56 AM	1	2	5	5	7	8		4		5	5
11/18/92	10:56 AM	5	2	1	1	7			12		1	1
11/18/92	10:55 AM	8	1	2	2	13	9		17		2	3
11/18/92	10:58 AM	9	2	5	4	8			13		3	5
11/18/92	10:55 AM	14	7	4	4	8	7	11	13		4	4
11/18/92	11:55 AM	18	2	4	4	7	3	15	12		4	4
11/18/92	10:56 AM	22	2	3	3	7	10		17		3	3
11/18/92	11:00 AM	30	2	4	5	7			3		5	5
11/18/92	10:52 AM	39	3	5	5	8	3		13		5	5
11/18/92	10:57 AM	45	2	5	5	5	3		13	10	5	5
11/19/92	10:27 AM	45	2	5	5	5	3		13	10	5	5
11/20/92	10:25 AM	1	2	1	1	12			12		1	1
11/20/92	10:25 AM	5	2	2	2	12			13		2	2
11/20/92	10:27 AM	9	2	5	5	14			13		5	5
11/20/92	10:25 AM	22	3	3	3	12			12		3	3
11/20/92	10:25 AM	34	3	4	4	7	13		12		4	4
11/20/92	10:32 AM	48	3	5	5	14	5		12		5	5
11/20/92	10:25 AM	53	2	3	2	5	3		12		1	1
02/05/93	11:30 AM	8	2	2	2	13			17		2	2
02/05/93	11:30 AM	9	2	5	5	7	8		13		5	5
02/05/93	11:29 AM	34	2	3	3	3	4		12		4	3
02/05/93	11:28 AM	45	2	5	5	3	5		12		5	5
02/05/93	11:29 AM	48	2	5	5	13			11		5	5
02/08/93	11:14 AM	34	1	4	4	8	7	3	12		4	4
02/10/93	11:13 AM	1	2	5	5	7	13		4		5	5
02/10/93	11:15 AM	8	2	4	4	7	3		16		4	4
02/10/93	11:15 AM	9	2	4	4	7	8		13		3	4
02/10/93	11:13 AM	22	2	2	2	7			12		2	2
02/10/93	11:15 AM	45	2	4	4	3			12		4	4
02/10/93	11:15 AM	53	2	2	1	12			12		2	1
02/24/93	12:35 PM	9		3	2	13			1		1	1
03/01/93	01:05 PM	5	1	2		1			13		1	1
03/01/93	12:55 PM	18	3	4	4	7	5		13		3	4
03/10/93	10:50 AM	9	2	5	5	13			17		5	5
03/16/93	10:00 AM	28	2	2	1	12			12		2	1
03/25/93	10:20 AM	18	2	3	3	7	5		13		3	3
03/30/93	10:08 AM	9	2	2	2	1			13		1	1
03/30/93	10:15 AM	18	1	5	5	6			13		5	5
03/31/93	10:20 AM	5	3	3	3	7			13		3	2

Date	Time	Case #	Q4	Q5	Q6	Q7A	Q7B	Q7C	Q8A	Q8B	Q9	Q10
03/31/93	10:17 AM	9	2	3	3	8	7		13		3	3
03/31/93	10:15 AM	34	2	4	4	8	7		12		4	4
03/31/93	10:15 AM	45	2	3	2	3			1		3	3
03/31/93	10:16 AM	48	2	5	5	14			12		5	5
04/06/93	11:40 AM	5	2	1	1	7			12		1	1
04/06/93	11:40 AM	9	2	2	2	12			13		1	1
04/07/93	11:45 AM	1	2	5	5	13	7		4		5	5
04/07/93	11:50 AM	9	2	5	5	7	8		13		5	5
04/07/93	11:45 AM	14	2	3	3	8	7		12		3	2
04/07/93	11:48 AM	34	2	4	4	14	7	8	12		4	5
04/07/93	11:50 AM	45	1	5	4	3	10		13		4	5
04/12/93	11:02 AM	34	2	4	4	14	8	7	12		4	4
04/13/93	10:52 AM	1	1	5	5	7			11		5	5
04/13/93	10:54 AM	8	2	1	1	1			1		1	1
04/13/93	10:55 AM	9	2	5	5	13			8	7	5	5
04/13/93	10:52 AM	48	3	3	3	12			12		2	2
04/13/93	12:44 PM	48	2	3	3	12			12		1	1
04/14/93	10:11 AM	1	2	3	3	13			12		3	3
04/14/93	10:15 AM	45	2	3	3	3			3		3	3
04/16/93	10:33 AM	1	2	2	2	12			12			
04/16/93	10:40 AM	5	6			12			11		2	2
04/16/93	10:38 AM	9		4	4	8	7		13		4	5
04/21/93	11:31 AM	8	2	2	2	7	4		16		2	2
04/21/93	11:32 AM	12	2	2	2	7			12		2	2
04/21/93	11:33 AM	34	2	4	4	14	8	7	12		4	4
05/19/93	10:10 AM	5	3	2	2	7			12		2	2
05/19/93	10:08 AM	34	2	4	4	13	8	7	12		4	4
05/20/93	10:20 AM	5	3	3	2	7			16		2	2
05/20/93	10:30 AM	8	3	1	1	1			1		1	1
05/20/93	10:21 AM	34	3	4	4	7	13		12		4	4
05/20/93	10:20 AM	39	2	1	1	12			12		1	
05/21/93	09:41 AM	34	3	4	4	7	13		12		4	4
05/21/93	09:40 AM	39	2	1	1	12			12		1	1
05/26/93	11:02 AM	5	7			13			12		3	3
05/26/93	10:58 AM	9	2	3	3	8			13		4	2
05/26/93	10:57 AM	34	2	1	1	11			12		1	1
06/02/93	11:20 AM	9	2	2	2	8			13		2	1
06/03/93	10:01 AM	34	3	2	2	13			12		2	2
06/04/93	09:37 AM	9	2	4	4	12			13		5	5
06/04/93	09:25 AM	39	2	1	1	12			12		1	1
06/09/93	10:47 AM	12	2	2	1	12			12		2	2
06/09/93	10:47 AM	34	2	4	4	7	8		12		4	4
06/09/93	10:45 AM	201	2	5	4	11			16		4	4
06/10/93	10:50 AM	9	2	3	3	13			12		3	3
06/10/93	10:50 AM	39	7	1	1	12			12		1	
06/11/93	10:20 AM	12	2	2	2	7			12		2	2
06/11/93	10:20 AM	201	2	2	2	8	11		12		2	2
06/15/93	09:10 AM	5	3	3	2	12			12		2	3
06/15/93	09:10 AM	9	2	4	3	8			13		3	3
06/15/93	09:10 AM	39	7	1	1	11			12		1	1

Date	Time	Case #	Q4	Q5	Q6	Q7A	Q7B	Q7C	Q8A	Q8B	Q9	Q10
06/22/93	10:46 AM	5	2	3	3	13	7		12		4	3
06/22/93	10:45 AM	201	2	5	5	7	8	5	13		5	5
06/28/93	11:10 AM	9		5	5	7	8		13		5	5
07/01/93	10:10 AM	22	2	3	3	7			12		3	3
07/01/93	10:07 AM	201	2	4	4	7	8		12			
07/06/93	09:44 AM	39	2	1	1	12			12		1	1
07/06/93	10:29 AM	201	2	5	5	3			12		4	4
07/07/93	10:49 AM	34	2	4	4	7	8	13	12		4	4
07/09/93	10:02 AM	1	2	2	2	12			12		2	2
07/09/93	10:02 AM	39	2	2	2	12			12		2	2
07/09/93	10:03 AM	201	2	4	4	7			12		4	4
07/16/93	11:35 AM	8	2	1	1	1			12		1	1
07/16/93	11:40 AM	22	2	4	4	7	8	3	12		4	4
07/16/93	12:35 PM	201	2	4	4	12			12		4	4
07/19/93	11:19 AM	1	5	3	3	12			12		3	
07/19/93	11:20 AM	5	2	3	2	7			12		2	1
07/19/93	11:21 AM	8	2	2	2	3			16		2	2
07/19/93	11:20 AM	9	2	5	5	12			13		5	5
07/19/93	11:25 AM	22	2	4	4	11	7		13		4	4
07/23/93	11:11 AM	1	2	3	3	7			12			
07/23/93	11:15 AM	5	3	2	2	7			12		1	1
07/23/93	11:12 AM	9		4	4	8	7		13		4	4
07/23/93	10:10 AM	12	2	2	2	7			12		2	2
07/23/93	11:12 AM	201	2	5	5	7	11		12		5	4
07/27/93	09:45 AM	39	7			12			12		1	1
07/29/93	09:06 AM	1	2	5	5	11	7		4		5	
07/29/93	09:10 AM	5	2	3	3	7	3		12		3	2
07/29/93	09:07 AM	34	2	4	4	7	8	13	12		4	4
07/29/93	09:05 AM	39	2	3	3	3			12		2	2
08/04/93	10:55 AM	5	2	1	1	12			12		1	1
08/04/93	10:53 AM	9	2	3	3	8			13		3	3
08/04/93	10:58 AM	34	2	4	4	14			12		4	
08/06/93	10:28 AM	5	5	1	1	12			12		1	1
08/06/93	10:25 AM	8	2	1	1	12			12		1	1
08/06/93	10:30 AM	12	2	4	4	5	7		12		3	4
08/06/93	10:28 AM	34	3	4	4	7	13		12			
08/09/93	09:38 AM	9	2	4	4	8			13		5	4
08/11/93	11:52 AM	9	2	5	5	8			13		3	5
08/17/93	09:55 AM	5	3	4	4	7			4		4	4
08/17/93	10:00 AM	8	3	3	3	14			11		3	3
08/17/93	09:55 AM	9	2	5	5	8			13		5	5
08/17/93	09:54 AM	34	2	4	4	5	8	7	12		4	
08/20/93	12:53 PM	9	2	3	3	8			13		5	3
08/26/93	10:10 AM	12	2	2	2	7			12		2	2
09/03/93	10:45 AM	5	3	1	1	11			12		1	1
09/03/93	10:45 AM	34	3	5	5	14			17		5	5
09/03/93	11:43 AM	201	2	3	3	12			13		3	3
09/16/93	10:03 AM	5	3	4	4	7	3		16		4	4
09/16/93	10:12 AM	34	3	4	4	7	13		12		4	4
09/20/93	09:55 AM	9	2	5	3	8			13		3	5

Date	Time	Case #	Q4	Q5	Q6	Q7A	Q7B	Q7C	Q8A	Q8B	Q9	Q10
09/20/93	09:50 AM	22	2	5	5	7	3	10	16		5	5
09/20/93	09:53 AM	34	2	4	4	14			12		4	4
09/24/93	09:49 AM	22	2	4	4	7	3		12		4	4
09/24/93	09:48 AM	34	3	5	5	7	13		12		5	5
09/29/93	10:07 AM	9	2	5	5	8	7	11	13		2	5
09/29/93	10:05 AM	34	3	5	5	13	7		12		5	5
09/30/93	09:30 AM	9	2	3	3	8	7		13		3	3
10/06/93	10:57 AM	8	2	1	1	12			12		1	1
10/06/93	09:55 AM	9	2	5	4	8	7		13		4	4
10/11/93	11:53 AM	9	2	5	5	8	7		13		5	4
10/12/93	09:37 AM	8	2	3	3	3			16		3	3
10/12/93	09:38 AM	9		5	5	8	7		13		5	5
10/12/93	09:35 AM	22	2	4	4	7	3	10	16		4	4
10/14/93	09:40 AM	8	2	2	2	4	3		16		2	2
10/15/93	09:36 AM	9	2	5	5	8	7		13		5	5
10/15/93	09:36 AM	22	2	3	3	12			12		3	3
10/18/93	11:00 AM	9	2	5	5	8	7		13		5	5
10/18/93	10:59 AM	22	2	4	4	7			12		4	4
10/20/93	09:50 AM	5	2	4	4	7	11		12		4	4
10/27/93	11:34 AM	201	2	5	5	10	7		12		5	5
11/10/93	10:00 AM	9	2	5	5	8	7		13		5	5
11/12/93	11:30 AM	5	2	2	2	12			12		1	1
11/12/93	10:33 AM	9	2	5	5	8	7		13		5	5
11/12/93	10:35 AM	22	2	3	3	7	3		13		3	3
11/18/93	12:15 PM	8	2	5	5	14			16	4	5	5
11/18/93	12:10 PM	30	2	5	5	14	3	7	11		5	5
11/19/93	12:10 PM	5	2	3	3	3			16		3	3
11/23/93	10:30 AM	9		3	3	7			13		3	3
12/01/93	10:50 AM	5	2	1	1	12			12		1	1
12/01/93	10:53 AM	8	2	3	3	3			12		3	3
12/01/93	10:50 AM	30	3	5	5	3	7		14	15	4	5
12/03/93	11:55 AM	5	3	3	3	7			12		3	3
12/03/93	11:50 AM	8	2	3	3	7	13		16		3	3
12/03/93	11:50 AM	9	2	5	5	8	7		13		5	5
12/03/93	11:49 AM	22	2	2	2	12			12		2	2
12/07/93	12:55 PM	8	2	5	5	14			12		5	5
12/07/93	12:55 PM	9	2	5	5	14			14		5	5
12/07/93	12:55 PM	22	2	4	4	13	7	10	12		4	4
12/10/93	08:50 AM	9	2	5	5	8	7		13		5	5
12/15/93	11:16 AM	9	2	3	3	8	7		13		3	3
12/17/93	11:55 AM	9	2	5	5	8	7		13		5	5
12/20/93	12:05 PM	5	2	3	3	3	13		12		3	3
12/20/93	11:55 AM	22	2	4	4	7	10	13	12		4	4
03/31/93	04:00 PM	9	2	3	3	8	7		13		3	3
03/31/93	04:00 PM	28	2	2	1	12			12		2	2
03/31/93	03:58 PM	34	3	4	4	7			12		4	
09/29/93	01:27 PM	22	2	4	4	7	14	13	11		4	4