MINUTES

MONTANA HOUSE OF REPRESENTATIVES
51st LEGISLATURE - REGULAR SESSION

COMMITTEE ON BUSINESS & ECONOMIC DEVELOPMENT

Call to Order: By Rep. Bob Pavlovich, on January 27, 1989, at 8:30 a.m.

ROLL CALL

Members Present: All

Members Excused: None

Members Absent: None

Staff Present: Paul Verdon and Sue Pennington

Announcements/Discussion: None

HEARING ON HOUSE BILL 341

Presentation and Opening Statement by Sponsor: Rep. McCormick, district 38, stated that his bill would amend the Small Tract Financing Act of Montana by authorizing the use of trust indentures in transactions in which the real property does not exceed 30 acres.

List of Testifying Proponents and What Group They Represent:
Jerry Loendorf, Montana Consumer Finance Association
Tom Hopgood, Montana Realtors Association

List of Testifying Opponents and What Group They Represent:
None

Testimony: Mr. Loendorf stated that the bill would amend the Small Tract Financing Act by increasing from 15 to 30 acres the size of a piece of property on which a person could use a trust indenture to secure an obligation. Under current law you can only use a mortgage to secure such an obligation. For example, suppose I am a backhoe operator and I am off of work for the winter; and I had bought one of these 20 acre parcels. I own it and I'm not doing anything, I need a little money until I start working in the spring. By utilizing a trust indenture, I can easily borrow some money, securing the loan with that 20 acre parcel. But

because I can't get a trust indenture on a tract of land over 15 acres I might not be able to obtain that loan. We would like the acreage increased to keep up with the times. The association I represents urges a do pass on this bill.

Mr. Hopgood stated that the realtors believe there should be as many different modes as possible available for financing real estate transactions. They think the trust indenture should be expanded and ask that the committee give a do pass recommendation.

Questions From Committee Members: Rep. Thomas asked Mr. Loendorf why the real need for this change to 30 acres? What is the problem we are addressing? Mr. Loendorf stated that a trust indenture cannot be used now for any tract under 15 acres. If you want to use a trust indenture to secure a loan for a tract of 30 acres you can not. You have to have a mortgage.

Closing by Sponsor: In closing, Rep. McCormick asked the committee to give this bill a do pass.

DISPOSITION OF HOUSE BILL 341

Motion: Rep. Glaser moved DO PASS.

Discussion: Rep. Thomas realizes that this is a very minor bill and it should just slide right through the committee. I would like a day at most to call a few of my friends in regards to this because I don't like trust indentures. I would like to hold this for just one day. Rep. Glaser withdrew his motion.

Amendments and Votes: None

Recommendation and Vote: None

EXECUTIVE ACTION

HOUSE BILL 218

Motion: Rep. Wallin moved DO PASS. He also moved DO PASS on the amendments.

Discussion: Rep. Kilpatrick asked if they had to pay a penalty if the report was not finished within the set time period? Paul said he was sure the general penalty section would apply. Rep. Kilpatrick stated that at one time the committee had considered the idea that the

banks would not have to pay the fees if they did not receive the report within the prescribed period of time.

Rep. Bachini asked if these amendments covered only special exams or all exams. Paul said the amendments applied to all exams.

Amendments and Vote: The amendments received unanimous DO PASS.

Recommendations and Vote: HB 218 DO PASS as amended unanimously.

HEARING ON HOUSE BILL 274

Presentation and Opening Statement by Sponsor: Rep. Quilici, district 71, Butte, MT. This bill is an act authorizing the department of state lands to investigate complaints and order changes or other appropriate mitigation concerning the use of explosives associated with hard-rock mining activities; and removing nuisance as a cause of complaint. When you amend the hard-rock mining act it affects the whole state. Six months ago I received a registered letter which was signed by approximately 60 people. These people are concerned about their homes; their homes are starting to show signs of damage. I visited several of these homes and they have received visible damage. The people say the damage is caused by the blasting being done by Montana Resources, Inc., at the Berkeley Pit in Butte.

List of Testifying Proponents and What Group They Represent:
Mrs. Caroline Janson, Butte
Rep. Bob Pavlovich
Gary Amestoy, Dept. of State Lands

List of Testifying Opponents and What Group They Represent:
Ray Tilman, MRI, Butte
Gary Langley, Montana Mining Association
Ward Shananan, Helena
Don Jenkins, President, Montana Mining Association

Testimony: See exhibit 1 for Mrs. Janson's written testimony and photos of the damage to her home.

Rep. Pavlovich stated that he lived in the area where the pit is located only a little further away than Rep. Quilici. Rep. Brown is my representative in that area

and he lives 2 blocks from Joe and I live about 6 blocks away. I feel the blast in the area where I live. I am not saying my house has been damaged but probably in time there might be some damage. I agree with Rep. Quilici, all we want is someone to tell us honestly what is going ong on.

Mr. Langley stated that his association wanted to correct operational problems before they become broadbased, statewide public concerns. I agree with Rep. Quilici that there is a problem in Butte. I don't know what is the cause of the problem, I will leave that to the people at MRI to discuss. What is really happening in Butte is based on perception of incomplete knowledge of the facts. If it's a problem only to Butte then it should be solved in Butte. The answer to solving the whole problem doesn't lie in passing another state law for another state regulation. This will place the burden on the entire mining industry. My association would urge a do not pass on this bill.

Mr. Tilman stated that he supports Rep. Quilici's effort to solve this problem. MRI has made some efforts to try and resolve the issue but obviously we haven't been successful or we wouldn't be over here talking with you. I have some data to pass out and give you information about how blasting affects the area and other environmental concerns. It is a difficult issue to try and deal with people in their homes and the perception that people have about cracks in their homes. As a personal matter when this issue started heating up, I started looking at my own home. I live approximately 3 1/2 miles from the mine. I found lots of cracks in my home that I did not know were there before. I found a crack in my fireplace that I did not know was there before, but as you start looking around you start getting concerned about these things. But as soon as a building is built, it starts developing cracks. Cracks change seasonally in buildings. The blasting in Butte has been monitored since 1955, the time the work was started in the pit. There is a very well known expert in blasting in the Butte area who has been involved in the blasting since that time. Blasting technology has continued to improve the ability to control blasting. I think what we have here is not necessarily a physical problem but a perception problem. It is up to MRI as a responsible mining company to resolve. This is a real difficult problem. We monitor every blast and have every reason to believe that the numbers are right on the reports. We operate well within the guidelines set by the Bureau of Mines, Department of Interior. I believe this is a

Butte problem and MRI will continue to litigate with our neighbors to try and deal with them and their problems. I don't think it is necessary to pass another regulation for the mining industry. I think we can solve this problem in Butte. I oppose the passage of this bill as we don't feel it is necessary. We are willing to solve this problem in Butte.

Mr. Jenkins stated that he has known Rep. Quilici for some time and that Joe has been one of the best supporters for the mining industry in general. However, I am opposed to this legislation. Obtaining permits for hard-rock mining is difficult, very expensive, and very time consuming; this bill would only add to these problems. I respectfully ask that you do not pass this bill.

Mr. Shanahan had written testimony. See exhibit 4.

Questions From Committee Members: Rep. Smith asked Mr. Amestoy how the department of state lands plans to handle this bill. Mr. Amestoy said they don't anticipate making inspections of blasting records and blasting activities a routine thing to be looked at in our mining inspections. What we will do is simply respond to various complaints and react to those accordingly. We don't have the analysis expertise in structural engineering to be able to go out to a residence, for example, and determine what caused the crack in the ceiling or fireplace. What we propose to do is to hire a structural engineer to contract his services and go out and perform that evaluation. We would go out and do some random seismographic testing when we get complaints and try to determine whether or not the blasting activity is within the standards of the U.S. bureau of mines.

Rep. Keller asked Rep. Quilici if core drilling would be included in this bill. Rep. Quilici said he was not sure because he had never addressed this. But if core drilling comes under the hard-rock mining act, there is the possibility that it could be included. Mr. Tilman stated that core drilling in itself is just taking samples, you are not really using powder. Normally in core drilling operations all you do is drill a hole and take pieces of rock from the hole.

Rep. Bachini asked Rep. Quilici how long has this been going on, since these people have come to you with this concern, the possibility that the blasting has caused some of the damage? Rep. Quilici stated that the people had been keeping charts over a year, I really

just got involved in the past 8 - 9 months. After I saw the damage that has occurred to these residences I started taking a real interest in this and looking from time to time at the homes and businesses in my neighborhood. How many meetings has the community of Butte, since I have heard from the opponents that they should settle this themselves, had with MRI to try to address their concerns? Rep. Quilici stated that he had met with them three 3 times and then a public meeting in November some time. This is the only meeting that I know of that I have attended with the residents of the community and MRI. Rep. Bachini asked what the results were of the meetings? What did MRI tell you? Are they going to do anything? Rep. Quilici said they gave us the same graphs and charts which you have here showing that in no way has the blasting damaged the dwellings and said that they will try to cooperate the best they can. This is all that has been done so far. Rep. Bachini said to Mr. Tilman, that he thought it was a reasonable request and thinks it would clear MRI if they would do something. Mr. Tilman said whether this bill is passed or not they still have to resolve this issue with our neighbors. He is more concerned that this bill is going to have a detrimental effect on future hard-rock mining operators than on MRI. Even if the bill is passed, we have to resolve this problem.

Rep. Steppler asked Mr. Langley what the amount of powder was in each blast, what the limits are, how close the blasts are to each other. Mr. Langley referred this question to Mr. Tilman. Mr. Tilman said the legal limit on blasting set by U.S. bureau of mines based on distance of the blast from properties that may be close by, is 2,300 pounds per detonation. Blasting is fairly complicated, but the blasts are designed so that one hole goes off at a time. The reason for this is so that you don't have the impact of 65,000 pounds. Rep. Steppler asked how far apart the blasts were. Mr. Tilman said they are set at milliseconds apart.

Rep. Glaser asked Mr. Amestoy about the sound and noise, mentioned in the information handed out, 110 DBL. Is this an acoustical measurement or is it a measurement of vibration? Mr. Amestoy said, first, I am not a blasting expert and not qualified to answer this question. Rep. Glaser asked what the DBL level is on the air blasting, is it above the limit of 110 DBL. Rep. Quilici said that they had a blasting expert come down from DSL to the Butte mines 4 or 5 months ago, but the gentleman is not here today. He is out of town and could not make it. He could answer your questions for

you I am sure, I will get these answers for you, Rep. Glaser.

Rep. Wallin asked Rep. Quilici what will keep people from making frivolous claims if this bill is passed. Rep. Quilici stated that any one filing a claim must provide credible evidence towards their complaint, they will have something to back up their claim. There haven't been a lot of people call MRI, but they call me and say they don't want to rock the boat, but there is some damage being done. MRI hires a lot of people and don't want to cause problems to the employment. These people aren't like that, they won't make frivolous claims.

Rep. Simon asked if, since the mining has been going on, this is the first time people have had complaints of damage to their property? Rep. Quilici said there have been other complaints, but not this numerous, and not in this particular area. The reason that he sees for the complaints is that during the past year the dwellings in this particular area have started showing signs of deterioration, cracks, etc. This has been since MRI started the operation in what we call the east ridge. There have been complaints when they were on the hill mining. People learn to live with the blasting but when they start to see deterioration of their homes something is happening. We are trying to get to the bottom and the only way is to have a third party evaluate the damage.

Rep. DeMars asked Mr. Tilman if when the blasts were set off at milliseconds apart if this was not still a continuous shock? He said no, they are small series of shocks. That a lot of research has been done on this. Rep. DeMars ask if the blasts were getting bigger over the past year or two. Mr. Tilman said they were not.

Closing by Sponsor: Rep. Quilici thanked the committee for their questions, as they helped clear the air a little bit. Why not let a third party come in and take seismographic tests and evaluate them. Under the hard-rock mining act DSL doesn't have the authority to look into this problem. The bottom line is that the company said they want to be fair, but in the past 12 to 18 months nothing has happened to help these people get anything done. There have been people from the blasting company and MRI down to look at the homes, but not an uninterested third party. All the damage is on the north side of the people's homes. I ask you to give

this bill a do pass.

DISPOSITION OF HOUSE BILL 274

Motion: None

Discussion: Rep. Pavlovich said no action would be taken today. We will wait till we get the other information.

Amendments and Votes: None

Recommendation and Vote: None

ADJOURNMENT

Adjournment At: 11:15 a.m.

REP. BOB PAVLOVICH, Chairman

BP/sp

2303.min

DAILY ROLL CALL

BUSINESS & ECONOMIC DEVELOPMENT COMMITTEE

51th LEGISLATIVE SESSION -- 1989

Date 1 27 89

NAME	PRESENT	ABSENT	EXCUSED
PAVLOVICH, BOB	✓		
DeMARS, GENE	✓		
BACHINI, BOB	✓		
BLOTKAMP, ROB	✓		
HANSEN, STELLA JEAN	✓		
JOHNSON, JOHN	✓		
KILPATRICK, TOM	✓		
McCORMICK, LLOYD "MAC"	✓		
STEPPLER, DON	✓		
GLASER, BILL	✓		
KELLER, VERNON	✓		
NELSON, THOMAS	✓		
SIMON, BRUCE	✓		
SMITH, CLYDE	✓		
THOMAS, FRED	✓		
WALLIN, NORM	✓		
PAUL VERDON	✓		

1/29/89
2:46 pm
JA

STANDING COMMITTEE REPORT

January 27, 1989

Mr. Speaker: We, the committee on Business and Economic Development report that House Bill 218 (first reading copy -- white), with statement of intent attached, do pass as amended .

Signed: _____
Robert Pavlovich, Chairman

And, that such amendments read:

1. Title, line 6.
Following: "INSTITUTIONS;"
Insert: "REQUIRING REPORT OF EXAMINATION WITHIN 120 DAYS OF COMPLETION;"

2. Title, line 10.
Following: line 9
Insert: "32-1-211,"

3. Page 1, line 14.
Following: line 13
Insert: "Section 1. Section 32-1-211, MCA, is amended to read:

"32-1-211. Examination and supervision by department. (1) The department shall exercise constant supervision over the books and affairs of all banks doing business in this state.

(2) It shall:

(a) examine, at least once every 30 months, each of those banks and verify the assets and liabilities of each and ~~so far~~ investigate the character and value of the assets of each as to ascertain with reasonable certainty that the values are correctly carried on the books; and

(b) submit in writing to the examined bank a report of the examination's findings no later than 120 days after the completion of the examination.

(3) It shall further investigate the methods of operation and conduct of business of the banks and their systems of accounting to ascertain whether the methods and systems are in accordance with law and sound banking principles.

(4) It may examine under oath any of the officers,

1/27/89
4:00pm
jd

directors, agents, clerks, customers, or depositors of a bank regarding the affairs and business ~~thereof~~ of the bank.

(5) It may, in the performance of its official duties, issue subpoenas and administer oaths. In case of a refusal to obey a subpoena issued by it, the refusal may at once be reported to the district court of the district in which the bank is located, and the court shall enforce obedience to the subpoena in the manner provided by law for enforcing obedience to the process of the court.

(6) In all matters relating to its official duties, the department has the same power possessed by courts of law to issue subpoenas and have them served and enforced.

(7) All officers, directors, agents, and employees of banks doing business under this chapter and all persons having dealings with or knowledge of the affairs or methods of a bank shall at all times afford reasonable facilities for the examinations and make returns and reports to the department as it may require. They shall also attend hearings and answer under oath the department's inquiries, produce and exhibit any books, accounts, documents, and property it desires to inspect, and in all things aid it in the performance of its duty.""

Renumber: subsequent sections

4. Page 1, line 15.
Following: "fees"
Insert: " -- report within 120 days"

5. Page 2, line 2.
Following: "function."
Insert: "The department shall submit in writing to the examined bank a report of the examination's findings no later than 120 days after the completion of the examination."

Amendments to House Bill No. 218
First Reading Copy

For the Committee on Business and Economic Development

Prepared by Paul Verdon
January 25, 1989

1. Title, line 6.
Following: "INSTITUTIONS;"
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(4) It may examine under oath any of the officers, directors, agents, clerks, customers, or depositors of a bank regarding the affairs and business ~~thereof~~ of the bank.

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ROLL CALL VOTE

BUSINESS & ECONOMIC DEVELOPMENT COMMITTEE

DATE 1/27 BILL NO. HB 218 NUMBER 1

NAME	AYE	NAY
Bob Pavlovich		
Gene DeMars		
Bob Bachini		
Rob Blotkamp		
Stella Hansen		
John Johnson		
Tom Kilpatrick		
Lloyd McCormick		
Don Steppler		
Bill Glaser		
Vernon Keller		
Thomas Nelson		
Bruce Simon		
Clyde Smith		
Fred Thomas		
Norm Wallin		
TALLY	16	

Sue Pennington
Secretary

Bob Pavlovich
Chairman

MOTION: Rep. Wallin moved DO PASS on the amendments and also DO PASS as amended.

Form CS-31
Rev. 1985

#1
1/27/89
HB274

BUTTE-SILVER BOW
DEPARTMENT OF PUBLIC WORKS
Courthouse
Butte, Montana 59701
Phone: (406) 723-8262

December 13, 1988

To Whom It May Concern:

Upon the request of Mrs. Caroline Janson, 2617 Silverbow Boulevard, I made an inspection on the afternoon of December 6, 1988. Mrs. Janson said "that recent mine blasting activities had caused extensive damage to the fireplace's brick work".

Background Information:

Mrs. Janson applied and qualified for the Butte-Silver Bow Community Development Housing Rehabilitation Program in the Greeley area. I inspected the residence and prepared a write up and put it out to bid on June 29, 1988 for the rehabilitation of the residence. The work included plumbing, heating and electrical work plus the required carpentry work to accommodate the aforementioned systems as well as minor repair work. Included in the minor repair work was the resetting of the loose bricks of the fireplace's heatalator out flow grill (vertical brick grill above the fireplace opening). To the best of my recollection, at that time one (1) brick could be removed and only 2 or 3 bricks were loose and could be wiggled.

The carpentry work by a contractor was dropped and Mrs. Janson's son took over all carpentry work as a cost saving measure. Mrs. Janson's son was to repair the grill but this work was never done. The major portion of all the contractors' work was completed around the end of September which concluded my regular on-site inspections.

Observations at December 6, 1988 Inspection

The changes that have occurred since I last observed the fireplace are as follows:

- Virtually all bricks of the heatalator grill are now loose
- The lentil over the fireplace opening has shifted and moved out from the vertical face by 1/4 of an inch.

- Various cracks exist along the mortar joints which wind up the face of the fireplace vertically.

  I.E. cracks located to the left of the fireplace opening and above at the center line.

The aforementioned damage has occurred just recently and was not present at my initial or noticed at my regular inspections. No work was performed by the contractors or by Mrs. Janson's son that would have affected the fireplace. There were no structural modifications done to the residence. The fireplaces brick work is supported by a substantial concrete foundation. Lack of adequate foundation is not the source of the fireplace's failure. There is no sign of subsidence in the concrete foundation.

There are no indications that the cause of the fireplace's failure is because of any work performed on structure or any deficiencies of construction or on site sources.

Sincerely,

Mark Reavis
Butte-Silver Bow
House Rehabilitation Architect

#2
1/27/89
HB 27

Record of Blasts

Jan. 7th 1988	approx.	1.10 p.m.	Blast shook house
" 22nd. "	"	12.25 p.m.	severe blast shook house
" 26th. "	"	12.08 p.m.	" " " "
Feb. 12th. "	"	12.09 p.m.	large blast shook house
Feb. 15th. "	"	12.09 p.m.	large blast shook house
Feb. 18th. "	"	12.03 p.m.	severe shock rocked house
Feb. 24th. "	"	12.05 p.m.	blast shook house
March 8th. "	"	1.13 p.m.	blast shook house severely
March 18th."	"	1.00 p.m.	severe blast shook house
March 25th."	"	12.00 noon	severe blast shook house
April 7th."	"	12.05 p.m.	severe blast shook house
May 5th."	"	2.30 p.m.	severe blaat shook house (Neighbour here felt shock)
May 9th."	"	12.07 p.m.	severe blast rocked house
May 24th."	"	12.05 p.m.	severe blast
June 1st. "	"	12.06 p.m.	severe blast
June 3rd.	"	12.12 p.m.	severe blast shook house
June 8th.	"	12.10 p.m.	severe blaat ahook house
June 14th.	"	12.10 p.m.	severe blast
July 1st.	"	12.10 p.m.	severe blast shook house
July 9th.	"	12.06 p.m.	severe blast shook house badly
July 14th.		12.04 p.m.	blast shook house for several seconds. Cracked brick on side of house.
July 19th	"	1.06 p.m.	severe blast ahook house badly, felt f. shake
July 31st.	"	4.00 p.m.	shook house
August 3rd.	"	minor blast, monitored.	
" 17th.		12.05 p.m.	severe blast shook house
" 23rd.	"	12.05 p.m.	blast rocked the house, house creaked
September 8th.	"	12.20 p.m.	severe blast shook house
September 14th	"	12.22 p.m.	severe blast shook house

House of Representatives
of the
State of Montana
Helena 59620

HB 274
Exhibit #1
1/27/89

Exhibit is pictures available at Historical Society Archives.

September 20th.	12.23 p.m.	blast
" 22nd.	12.15 p.m.	blast shook house
" 28th.	1.15 p.m.	severe blast shook house
October 21st.	12.18 p.m.	severe blast shook house and ground for several seconds.
" 28th.	1.15 p.m.	severe blast shook house
November 4th	2.25 p.m.	severe blast shook house rattled dishes in the cupboard
" 7th	4:50 p.m	severe blast shook house cracked part of fireplace
" 9th	1:15 p.m.	blast shook house
" 11th	3:55 pm.	blast shook house CMRI refused to take information no answer to blast
" 14th	7.55 pm.	felt blast
" 15th	2.50 pm	blast shook house Crabbit ears really rocked)
	12:15 PM	felt earth shake house and crack in fireplace get wider
" 22nd	12:20	house tremble
" 28th	12:10	house tremble
December 2nd.	12 p.m.	Severe blast shook house rattled dishes. it also, made the crack in fireplace wider ½" and more cracks appeared.
4th	12:03	shook house
9th	12:10	real severe shock
15th	12:03	very severe shock - really shook the entire house - more damage to the brick
15th	12:10	one of the hardest shocks, really shook the house. Very severe
Second blast	12:20	shook the house really bad.

SEISMIC EFFECTS OF OPEN-PIT MINE BLASTING, BUTTE, MONTANA.

FOR

MONTANA RESOURCES, INC.
BUTTE, MONTANA

BY

LEWIS L. ORIARD, INC.
HUNTINGTON BEACH, CALIFORNIA

DECEMBER 31, 1988

TABLE OF CONTENTS

LEWIS L. ORIARD, INC.

GEOTECHNICAL CONSULTING

3502 SAGAMORE DRIVE
HUNTINGTON BEACH, CA 92649
(714) 846-1515 U.S.A.

December 31, 1988

Montana Resources, Inc.
P. O. Box 188
Butte, Montana 59703

Attn: Mr. Frank Gardner

SEISMIC EFFECTS OF OPEN-PIT MINE BLASTING, BUTTE, MONTANA.

Gentlemen:

In accord with your request, I have traveled to Butte, Montana to make a review of your current open-pit blasting operations and to evaluate any potential for damage that these blasting operations might have on residences in the area.

In order to conduct this investigation, I have met with various members of your staff and associates to become familiar with the details of the blasting operations, and have reviewed portions of the blasting logs and seismic data. I have been informed of the blasting complaints which have been received from residents of the area, and have seen photographs of cracks which were thought to be caused by the blasting. I have met with Mr. Peoples, Mr. Quilici and Mr. Ivanich, who have provided me with further observations and comments from the residents of the area. I understand clearly that some people living in the area believe that their houses have been damaged from the blasting operations, and that some have observed the falling of objects in their homes. In addition, I have read a report dated December 14, 1988, from the Montana Department of State Lands, summarizing their investigation of your blasting operations. Further, I have made a repeat inspection of one of the older homes in the area, which I have inspected periodically since the first time in 1979.

I am familiar with Butte mining operations. I have provided technical assistance on blasting techniques and blasting effects in Butte since 1955, at the Berkeley Pit, the Alice Pit, the Gagnon Pit and the Continental Pit. I have inspected many homes in Butte, and have spoken to many of the residents of the area.

I am now prepared to report to you the results of my recent investigation.

THE BLASTING OPERATIONS.

The blasting operations follow a concept similar to those which have been practiced in Butte since the 1960's, and typical of many open-pit bench blasting operations around the United States. Basically, the design is that of a series of vertical holes, loaded with a blasting agent, then detonated in a rapid sequence using blasting caps with a built-in timing system called a "delay". To the average listener a half mile away, this might sound like a single detonation, a sort of continuous but brief rumbling sound. In fact, however, there is a rapid sequence of many separate detonations.

THE USE OF DELAY INTERVALS IN BLASTING DESIGN.

It is very important to understand the concept of the rapid firing sequence of "delays", for the reason that the vibration intensity is determined by the amount of explosive which detonates on any single delay period, not the total amount of explosive in the entire blast. This factor forms the basis for the prediction and control of blasting effects, and is incorporated into many of the specifications, regulations and laws governing the use of explosives. Such rules limit the amount of explosives per delay interval, not the overall size of the blast.

Perhaps one way of illustrating how this concept works is to think of, say 100 people standing along the shore of a pond, each one holding a brick. At a given signal, the first person drops his brick into the water, and very quickly each of the other persons drops his brick in rapid succession. The result is a

series of small water waves starting from each brick. Of course, the results would be quite different if all 100 of the bricks were mortared together into a huge block and the block dropped into the water. We would then get a single, much larger wave.

RECORDINGS OF GROUND VIBRATION AND AIR PRESSURES.

Portable seismographs are being used to record the ground vibrations and air waves generated by the blasting operations. This data can be added to that which has been recorded in Butte since 1955, since the opening of the Berkeley Pit. More than 7000 seismograph records have been obtained for Butte blasting. Thus, the ground response characteristics are well known for the city and the surrounding valley areas.

From this large data base, we can prepare a graph showing how the vibration intensity dies out with distance from the blasting source. Such a graph is shown in Figure 1. We can make a generalized statement to the effect that the vibration dies out to roughly 1/3 of its previous intensity each time we double the distance.

Air waves do not die out quite as fast as ground vibrations, and are affected by weather conditions, but are of less concern to buildings than are the ground vibrations. Filling the upper portion of the blast holes with inert material such as dirt and drill cuttings on top of the blasting agent serves to keep the air waves under control. Just as is true for ground vibrations, it is well known what air pressures are safe and what have potential for causing damage.

SAFE LEVELS FOR BLASTING OPERATIONS.

Safe levels for ground vibrations have been established and verified many, many times over the years, and are defined by regulations in some areas. The first government-sponsored investigations began in the 1920's and 1930's, and produced the first recommendations provided by the federal government to the industry so as to avoid any damage to the public. Such investigations

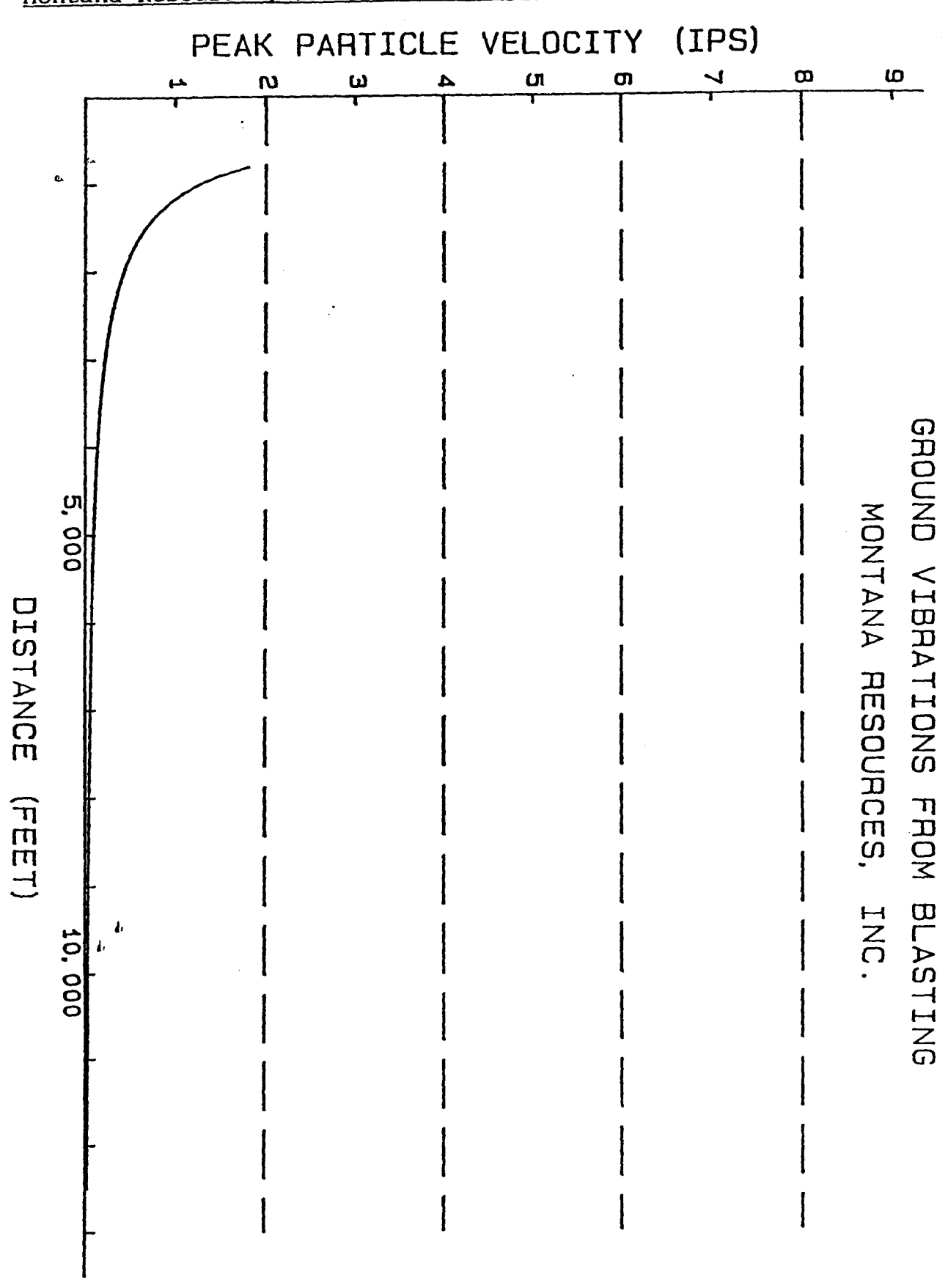

PEAK PARTICLE VELOCITY (IPS)
1
2
3
4
5
6
7
8
9
5,000
10,000
DISTANCE (FEET)
GROUND VIBRATIONS FROM BLASTING
MONTANA RESOURCES, INC.

Figure 1

have been repeated and/or continued periodically to the present time. As a result of these investigations, and the regulations which have been adopted in some areas, it has become widely accepted to limit vibrations from open-pit mining to a particle velocity of 1.0 inch per second (this is simply a way of expressing the intensity of the vibration, similar to acceleration or displacement). The most severe restrictions have sometimes limited vibrations to as little as 0.5 inches per second. This value is not considered harmful, but is sometimes recommended to reduce the public perception of the blasting.

Air waves are rarely a matter of concern to buildings, but are responsible for many of the sound effects that are heard by people inside their homes. Therefore, it is customary to limit the allowable pressures from these air waves, in addition to limiting the ground vibration. The pressures from air waves are often called airblast overpressures, where overpressures means the pressure of the air above that of atmospheric pressure, which is always present. It is customary to limit the overpressures to about 0.01 psi for open-pit mining. Many construction specifications permit about 0.03 psi. Occasional cracking of windows can occur at about 0.10 psi and extensive window breakage is expected at about 1.0 psi.

PREDICTION FORMULAS AND GRAPHS.

Because seismic waves follow consistent principles of geophysics, we can prepare curves and formulas to calculate the intensities of events which were not recorded. That is not necessary in the present case, since all of the blasting has been recorded. However, these principles of geophysics also enable us to calculate the vibration intensities at any other location of interest where there was no seismograph at the time of the blast. When a seismograph was used in the area to record known blasting, a study of the seismograph record quickly reveals the ground response characteristics of the area. These do not change, as they are a permanent characteristic of the geology. We can easily determine the intensity and characteristics of vibration

from that blast at other locations in that area.

The effect of distance is illustrated in Figure 1. One can see that the vibration very quickly drops from its high levels near the blast, and then carries on at lower levels for a long distance. That is why people can feel or hear its effects so far away. It is not expected that the average person reading this report will be interested in making calculations, but the appendix contains additional information for those who are interested.

VIBRATION INTENSITIES FROM MRI BLASTING OPERATIONS.

The open-pit covers quite a large area, so that blasting locations may be closer to a given residence on some days, and farther away on other days. Also, all the blasts are not perfectly identical. Consequently, there is variation in the vibrations transmitted to the homes in the area. Typically, the vibration intensities have been in the range of about 0.02 to 0.08 ips (inches per second), most remaining below 0.1 ips. The maximum vibration to date was generated by the blast of November 21, 1988, when a peak of 0.35 ips was reached. This blast was noticed by many people, and was the source of phone calls and complaints, as the vibration was several times stronger than usual for the area.

SUMMARY OF DAMAGE POTENTIAL.

My review of the blasting operations and the recorded measurements of vibration and airblast supports the conclusions expressed by the Montana Department of State Lands, namely that

> "All records indicated that none of the standards for ground motion and airblast set forth by the U.S. Bureau of Mines and the Office of Surface Mining Reclamation and Enforcement (OSMRE) had been exceeded".

The blasting effects have been well below those that are capable of causing minor cracking in houses.

The response of the average person will very likely be that it must have been the blasting that caused the damage he is

examining. What else could it have been? Unfortunately, there are very many things it could have been. There are many unseen, silent forces working on all of our houses all of the time.

Also, it is important to understand something about the vibration perceptions of people. In other words, why would the average person be concerned about a vibration that decades of research prove is not strong enough to cause damage to his house? Why would he be so firmly convinced that it must have? It is important to understand this. Therefore, we must not only study houses, but how we perceive and respond to vibration and sound.

BUTTE TEST HOUSES.

Some persons in Butte have been concerned about the damage potential of blasting operations since the beginning of open-pit mining operations in the Continental Pit. As one means of providing information on the subject, a series of "test" houses have been periodically inspected over the years. Some of these were very close to the pit, and were eventually removed as the pit expanded onto that property. None of these were damaged by the blasting operations. Two additional houses are farther away, still in existence. These two were first inspected in 1979, and have been inspected a number of times since then. They have not been damaged, either, by the blasting operations, although they have undergone changes from environmental forces. Some of these changes, of course, are cyclic and seasonal, as is common with some of the environmental forces that cause them.

THE RESPONSE OF HOUSES.

Because of the concerns that people have about their houses when they perceive motion or sounds within them, blasting effects on houses have been studied thoroughly for decades. These serve as the basis for the regulations and recommendations to prevent blast damage. Unfortunately, it is not so easy to prevent damage to houses from all the environmental forces that continually act on them. Some of these act on the superstructure above the ground line, others act from the ground surface downward.

Even after a house is constructed, if we assume that it was properly constructed, it must be properly maintained to slow down its normal aging process and the deterioration that occurs through the invasion of natural destructive agents such as water, wind, chemical decay, mechanical deterioration, loss of elasticity and friction, warping, humidity changes, drying, freezing and thawing, corrosion, erosion, settlement, rust, lichens, algae, topography, expansive soil changes, vegetation incursion, and others. With the passage of sufficient time, and without proper maintenance to counterbalance the effects of these destructive agents, the structure or material can undergo serious deterioration. No building can escape, since environmental forces are present everywhere. As we see from examining old ruins, the result of many of these forces is the breakdown and eventual destruction of the material or building.

Because these environmental forces rarely make any noise, and often (though not always) work slowly, many people are not aware of them, but will be startled and concerned if they feel vibration or hear the rattles and creaks that often accompany vibration.

STUDY OF ENVIRONMENTAL FORCES.

A group of researchers from Texas A & M University conducted a study of some 400 slab-on-grade houses in relation to the effects of factors below the ground surface, with particular emphasis on the clay in soils that so often causes damage. ("System Interaction of Expansive Soils With Light Foundations", Association of Engineering Geologists, 1980). They identified nine independent variables of importance:

1. Antecedent rainfall ratio. (Rainfall before construction).
2. Age of the slab.
3. Lot drainage.
4. Topography.
5. Pre-construction vegetation.
6. Post-construction vegetation.

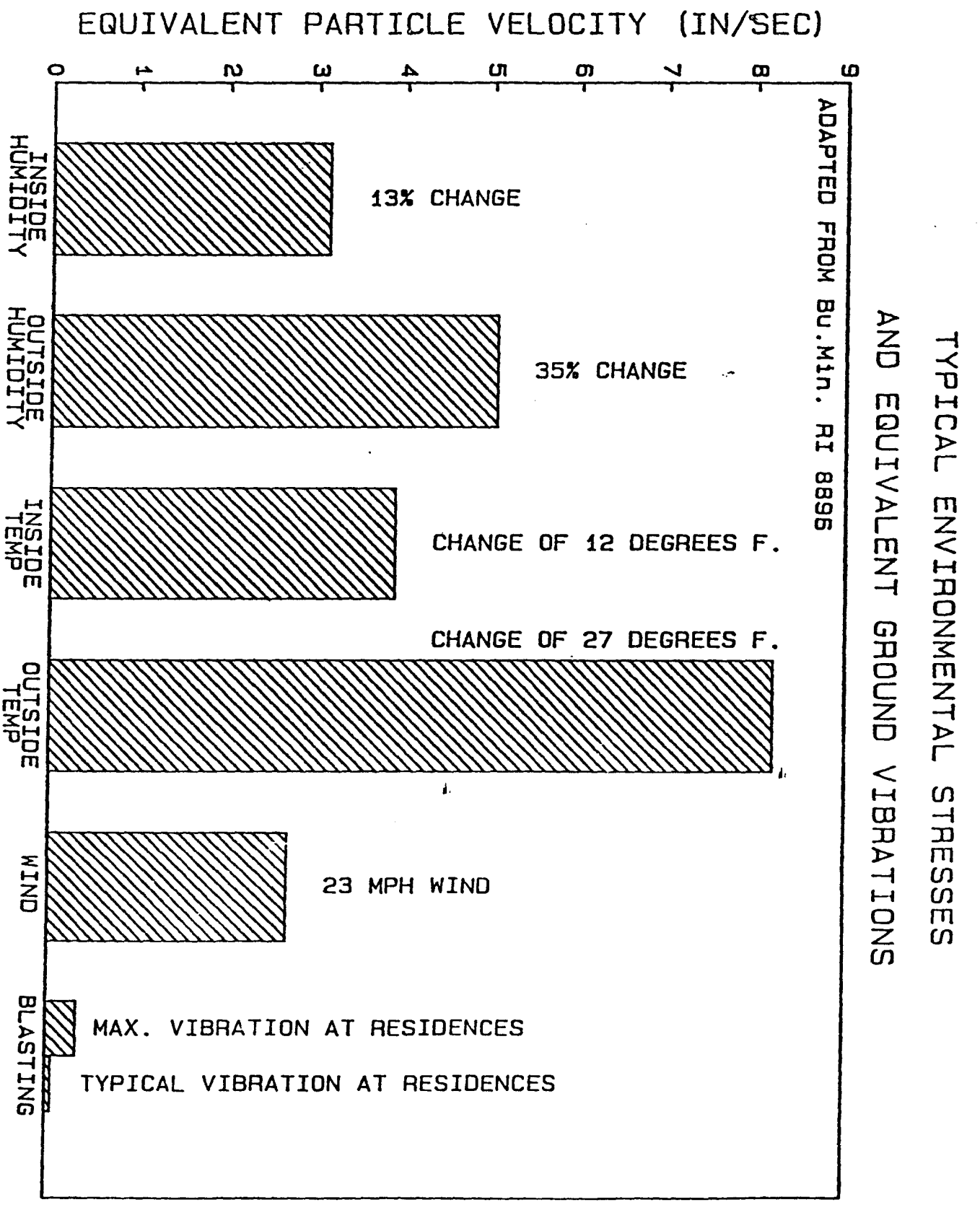
7. Foundation shape measure.
8. Effective plasticity index.
9. Depth of the active zone of expansive soil.

Of course, in Butte, it is important to add at least one other factor to this list, that is freezing and thawing, a very important element in determining the expansion, contraction and settlement of foundations, walks, driveways and patios. Freezing and thawing has caused a great deal of residential damage in Butte.

House construction details have an important effect on how it ages, expands and contracts, where curing and environmental cracks appear, and the like. (This is also true, of course, about the manner of preparing the soils and the foundation supporting the house). Because there are so many differences in materials and design of houses, a single list would not apply to all houses. One older publication provided a listing of 40 reasons related to common construction details showing why houses crack (Architects' Small House Service Bureau of the United States).

Recent studies by the U. S. Bureau of Mines help us make a more direct comparison between vibration effects and those from a few of the more common environmental forces. Bureau researchers carefully instrumented a test house and monitored its response to changes in inside and outside temperature, changes in inside and outside relative humidity, and wind. They also monitored its response to large-scale blasting operations. This information is reported in Bureau of Mines Report of Investigations 8896, "Effects of Repeated Blasting on a Woodframe House". With this data, we can show how much ground vibration would be required to generate the same amount of strain as was generated by certain changes in temperature or humidity or by the wind against the house. This information is presented in Figure 2. Also plotted on Figure 2 is a comparative illustration of the amount of vibration generated by MRI blasting operations. It should be noted

Figure 2


EQUIVALENT PARTICLE VELOCITY (IN/SEC)
0
1
2
3
4
5
6
7
8
9
INSIDE HUMIDITY
13% CHANGE
OUTSIDE HUMIDITY
35% CHANGE
INSIDE TEMP
CHANGE OF 12 DEGREES F.
OUTSIDE TEMP
CHANGE OF 27 DEGREES F.
WIND
23 MPH WIND
BLASTING
MAX. VIBRATION AT RESIDENCES
TYPICAL VIBRATION AT RESIDENCES
ADAPTED FROM Bu.Min. RI 8896
TYPICAL ENVIRONMENTAL STRESSES
AND EQUIVALENT GROUND VIBRATIONS

that the weather conditions in Butte are far more severe than those observed by the Bureau of Mines in their test house. Seasonal changes often include relative humidity changes as great as 80%, changes in temperature of well over 100 degrees, and winds far higher than the 27 MPH tested by the Bureau.

Figure 2 provides a dramatic illustration of how powerful are ordinary environmental forces, as silent and unseen as they are. Unless a person measures the strains in a building, he would probably not be aware of how much it expands and contracts with changes in temperature and humidity. I have measured changes of 1% to 5% in the dimensions of old studs between winter and summer in one test house in Butte, and have measured a 5% volume shrinkage in timbers in one house I occupied a few years ago. These strains cause cracks to appear and grow, and to expand and contract seasonally.

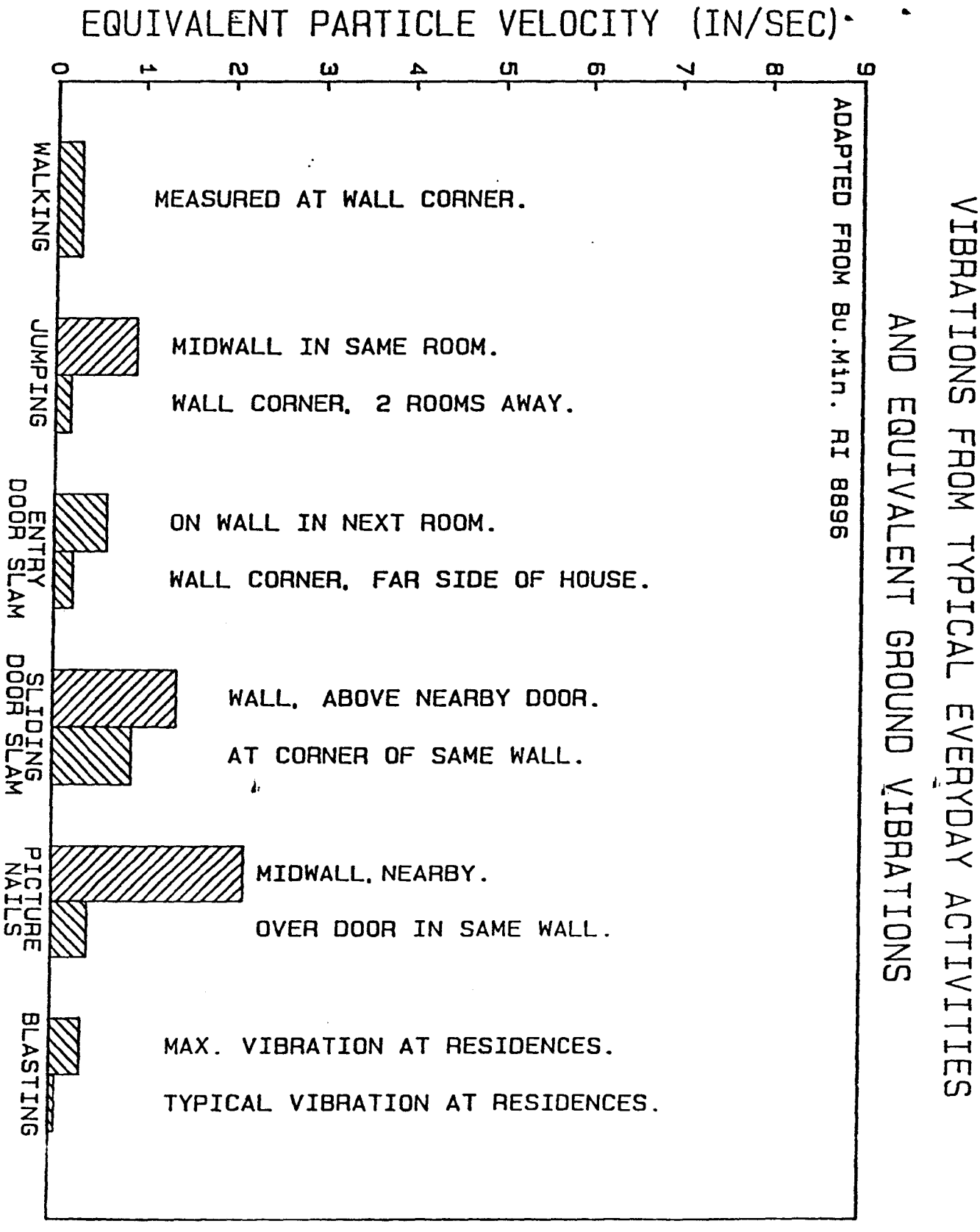
In another comparison, the Bureau of Mines has provided data showing how much vibration was generated during everyday activities by the occupants of houses, such as pounding nails, walking, jumping, slamming doors, and the like. This type of information is presented in Figure 3. Of course, these effects are more localized than environmental forces. For example, slamming the front door might generate an intense vibration nearby, but would die out quickly and not have much effect on the far side of the house. It is not unusual for things to fall off shelves, and pictures to move askew on walls near where doors are opened and closed.

As can be seen from these two graphs, environmental forces are by far the more serious sources of damage.

FALLING OBJECTS.

To the average person, the falling of an object during the passage of an externally generated vibration is very dramatic. Few people are well enough informed on this topic to realize that the occasional falling of objects does not represent sufficient

Figure 3


EQUIVALENT PARTICLE VELOCITY (IN/SEC)
0
1
2
3
4
5
6
7
8
9
WALKING
MEASURED AT WALL CORNER.
JUMPING
MIDWALL IN SAME ROOM.
WALL CORNER, 2 ROOMS AWAY.
ENTRY DOOR SLAM
ON WALL IN NEXT ROOM.
WALL CORNER, FAR SIDE OF HOUSE.
SLIDING DOOR SLAM
WALL, ABOVE NEARBY DOOR.
AT CORNER OF SAME WALL.
PICTURE NAILS
MIDWALL, NEARBY.
OVER DOOR IN SAME WALL.
BLASTING
MAX. VIBRATION AT RESIDENCES.
TYPICAL VIBRATION AT RESIDENCES.
ADAPTED FROM Bu.Min. RI 8896
VIBRATIONS FROM TYPICAL EVERYDAY ACTIVITIES
AND EQUIVALENT GROUND VIBRATIONS

intensity of vibration to cause damage to a house. Of course, if the vibration were sufficiently intense to cause damage to a house, there would be falling objects. The important difference is that most loose objects would be toppled or displaced, not just a few. In the order of sensitivity to vibrations, some animals are the most sensitive, then people are next, then loose objects, and finally buildings. Loose objects are more sensitive than anything that is fastened down or part of a building. When many objects of different sizes and shapes fall, it is reasonable to start looking for the first signs of damage to old plaster. When plaster damage is extensive, we would look to more serious damage, such as cracking of chimneys.

Perhaps the best way to develop some perspective of the relative importance of some of these things is to read the Modified Mercalli intensity scale for earthquakes. There are some differences between the longer duration and greater displacements of earthquakes compared to blasting, but it is valuable to note the order of sensitivity of people, objects, and elements of building damage.

I have taken the Modified Mercalli scale, divided it into three columns and abbreviated it for easier reading. To make it easier to compare the different columns, I am presenting the scale on a separate page. If the reader would like to read further on this topic, he might wish to refer to "Elementary Seismology", by Richter, published by Freeman, 1958.

RESPONSE OF PEOPLE.

No matter how well we understand the behavior of houses to vibrations and environmental forces, we will not fully appreciate situations like the present one until we are personally present in many houses when vibrations occur, where we can analyze our own perceptions and those of many other people.

All of us are very much more sensitive to sounds and vibrations than our houses. We can all easily feel a vibration

ABRIDGED SUMMARY OF MODIFIED MERCALLI SCALE

MM	PEOPLE	OBJECTS	STRUCTURES
I	Not felt.		
II	Felt, persons at rest.		
III	Duration estimated.	Hanging objects swing.	
IV	Jolt.	Objects swing. Windows, doors, dishes rattle. Glasses clink.	Walls and frames may creak.
V	Felt outdoors. Sleepers awakened.	Liquids disturbed. Objects displaced or upset. Doors swing. Shutters, pictures move. Pendulum clocks affected.	
VI	Felt by all. Many frightened and run outside.	Windows, dishes broken. Items off shelves. Pictures off walls, furniture moved, overturned.	Weak plaster and Masonry D cracked.
VII	Difficult to stand.	Furniture broken.	Cracks in masonry D. Weak chimneys broken at roof line. Fall of plaster, loose bricks. Few cracks in msnry C.
VIII			Partial collapse. Damage to B. none to A. Fall of stucco, walls, chimneys. Houses moved on foundations.
IX	General panic.		Msny D destroyed, C collapsed, serious dam- to B. Structures off foundations.
X			General destruction. Large landslides. Soil failures. Rails bent slightly.
XI			Pipelines out of service.
XII			Damage nearly total. Objects thrown.

that is only about 1/100 of that needed to cause a minor crack, and most of us would agree that it could be called a strong vibration at about 1/4 of what might be needed to cause a minor crack in an average house. All of us are predisposed to believe that our houses have about the same sensitivities that we have. If it feels strong to us, we believe intuitively that it must be potentially damaging to the house. During the first few years of my professional practice, it required a considerable amount of factual test data and observation on houses for me to finally understand this. My reactions were the same as any other ordinary person, and it seemed to me that damage must surely accompany vibrations that I perceived as strong. Careful research, and the studying of much information from many sources, finally convinced me that I could not rely on my perceptions. I would have to obtain physical data.

Understanding this point is still not enough. It is equally important to understand thoroughly at least two more very important facts. One is that we are not only very sensitive, but we are not very accurate observers. I have learned that I cannot rely just on my visual observations and recollections alone. Even though I have studied many hundreds of houses, including every house that I have lived in, I know that I cannot tell whether or not there has been any change unless I check carefully the dimensions that I have measured before and carefully written into my records. Even more difficult to understand is how we can think we've actually watched a crack travel across a wall or ceiling, only to discover later that it was sealed over with old paint, or had other clear evidence of age or cause that proved it had no relationship to the recent vibration. I've had that experience myself, and can fully appreciate how puzzling it is. I've also seen that puzzled look on the faces of others when looking at the old seal of paint over a crack, or grass growing in it, or other clear evidence of age, when they though they had just watched it appear for the first time. The simple fact is that we are just not very accurate visual observers, and must rely on very careful, written notes, sketches and measurements to

know if something is different from the last time we looked.

The other half of that puzzle requires an answer to the question, "If the blasting did not cause the crack, what did, because nothing else has happened here." With the information I've provided above, I hope the reader will begin to appreciate how much silent stress and strain is going on all the time in his house. I've personally lived in houses where certain large, unsightly cracks were a complete frustration in the sense that they could never be permanently patched. They changed dimensions between seasons and ruined my previous patching. This is very common. Also, it is well known that more cracks continue to appear and grow as a house gets older, whether or not it has ever been subjected to vibration. This is part of the aging process. Therefore, our research on buildings must continue through seasonal changes and long-term changes to understand fully what takes place.

If we want to learn whether or not vibration is adding to these effects, we can make inspections before and after, as well as subjecting test houses to continuous vibrations for long periods of time.

REPEATED BLASTING.

Intuition would guide us to expect that repeated blasting over a long period of time would be potentially harmful, even if individual vibrations were not severe. This believe is strongly reinforced by all of the well-known events where metal fatigue has occurred, followed by disasters, wrecks, or injuries.

Again our intuition is wrong, and that is fortunate in this case because it eliminates a source of concern. Testing and observations for many years have clearly shown again and again that materials, beams, houses and other structures can be subjected to a long series of vibrations if they are not strained to more than about 1/2 of the yield strain. Above that, the life of the item is increasingly shortened accordingly to the strain

level. Of course, even just one event beyond yield strain is damaging. At lower levels, the number of vibrations can be increased to where it is no longer of matter of concern. The levels of vibration we are discussing here are very low and could be repeated beyond the life span of these houses. If the reader would like to have more information on this subject, he is encouraged to read Bureau of Mines RI 8896.

CONCLUSIONS.

1. The blasting effects generated by MRI Butte operations are well below accepted standards, and would not be judged to have the capability of causing damage to houses. However, it is possible that there could be the occasional falling of a loose object at the time of the blasting.

Figure 1 illustrates the manner in which the vibrations die out with distance from the open pit.

2. Most of the blasts would be easily perceived by all persons in the vicinity of the pit at the time. Occasional blasts will even be perceived by people at much greater distances, if they happen to be inside a quiet house at the time. It is perfectly normal that many of these people, upon feeling the vibration, and hearing the accompanying sounds in their houses, such as rattling doors and windows, creaking frames, etc., would intuitively conclude that such effects surely must be associated with damage. Fortunately, that is not the case. People are far more sensitive than houses, and begin to worry about damage at levels far below those are actually damaging to buildings.

3. Environmental forces are continuous, very serious forces at work on all houses. They are especially serious in Butte, where seasonal weather changes go through severe extremes. These forces cause damage to all houses in varying degrees, and will continue to work on all houses throughout their lifetimes. Periodic inspections of houses in Butte in the residential area

near the operating pit shows that they undergo seasonal changes between winter and summer, as would be expected, but are not suffering damage from vibration.

4. Although it is expected that the blasting operations will continue for a long time, this factor need not be a matter of concern. At these levels of strain, the houses can tolerate repeated vibration for much longer than their lifetimes.

If you would like to have additional information, or explanation of the items in this report, please contact me at your convenience.

Yours very truly,

LEWIS L. ORIARD, INC.

L. L. Oriard

Lewis L. Oriard

APPENDIX A

CALCULATIONS FOR GROUND VIBRATIONS FROM BLASTING

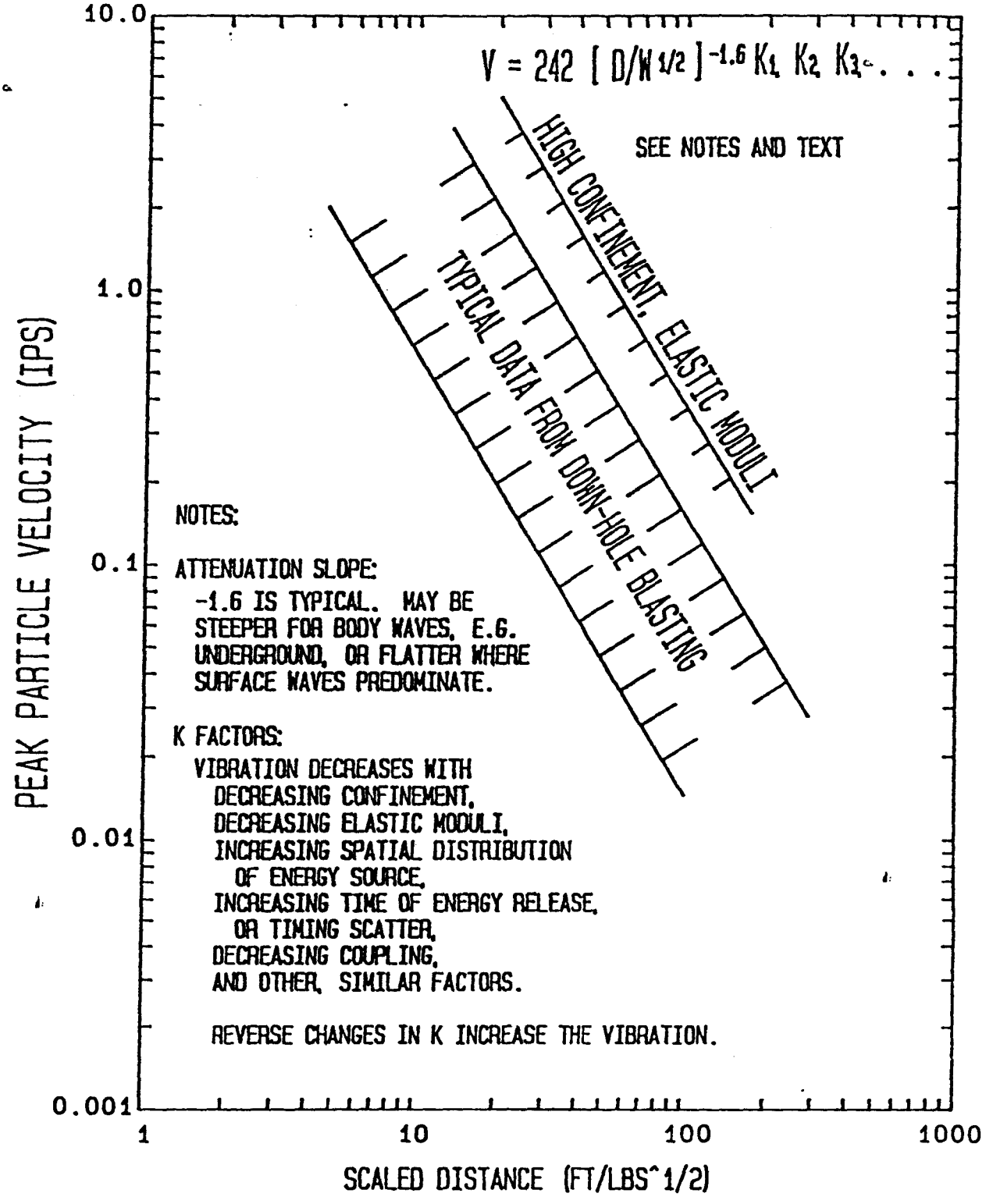
PREDICTION FORMULA FOR GROUND VIBRATIONS FROM BLASTING.

If we wish to normalize ground vibration data from blasting operations, we can do so by dividing the distance by the charge weight of explosives which detonates at any give instant of time, and plotting that value versus the peak particle velocity of the vibration. This relationship can be expressed mathematically in the following manner:

$$PPV = H\ (D/W^{0.5})^{-B}\ k_1,\ k_2,\ k_3,\ \ldots$$

where PPV = the peak particle velocity in inches per second
H = ground response factor, unitless
D = distance, in feet
W = charge weight per delay, in pounds

The k factors express various design-related factors, such as confinement, spatial distribution of charge, timing scatter, time of energy release, coupling, elastic moduli, and the like.



ORIARD CURVES FOR GROUND VIBRATION
TYPICAL DOWN-HOLE BLASTING

APPENDIX B

QUALIFICATIONS OF THE AUTHOR

LEWIS L. ORIARD
Lewis L. Oriard, Inc.
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Huntington Beach, CA 92649
(714) 846-1515

GEOTECHNICAL CONSULTING
Geophysics, Geology
Rock Mechanics
Explosives Engineering
Shock and Vibration

EDUCATION
B.S., Civil Engineering, Major in Structural Engineering, Gonzaga University.
Master of Science in Geophysics and Geology, St. Louis University.
Partial completion of Ph.D. in Geophysics, St. Louis University.

AFFILIATIONS
ASCE, ISRM, SME, USCOLD, SSA, SEG, SEE, AEG, UTRC

REGISTRATIONS (STATE OF CALIFORNIA)
Geophysicist - GP 92 (12/19/73)
Geologist - RG 2693 (1/14/71)
Engineering Geologist - EG 788 (1/14/71)

PROFESSIONAL HISTORY
Lewis L. Oriard, Inc., President, 1977 to date.
Woodward-Clyde Consultants, from Associate to Consulting Principal and Partner, 1965-1977.
Independent Consultant, 1951-1965.
Oriard Powder Co. (Explosives), Part Owner and Technical Adviser, 1951-1955.
St. Louis University, administrative and teaching faculty, 1947-1951.

EXPERIENCE

Mr. Oriard has had over 40 years experience in practical problems in all phases of geotechnical consulting, including engineering geology and geophysics, rock mechanics, explosives engineering, structural dynamics and related questions in the general fields of civil construction, mining, and research. He has consulted on more than 1000 projects in some 35 countries. His experiences include rapid transit systems, tunnels, dams, underground powerhouses, open-pit and underground mines, quarrying operations, nuclear power plants, nuclear waste disposal, pipelines, off-shore facilities, highways, canals, airports, other facilities and research projects. Examples of representative assignments would include:

Service on Consulting Boards or Review Boards.
Feasibility or pre-bid studies, evaluation of specific site conditions.
Construction problems, methods, technical assistance during construction.
Blasting technology, development of special techniques, evaluation of hazards, consultation on products and methods.
Blasting effects, including shock, ground vibration, airblast overpressures and underwater effects, as applied to residences, slopes and embankments, underground openings, civil structures and facilities, construction materials, marine organisms, people and human activity.
Study of physical properties of materials (field and laboratory).
Geological and geophysical exploration.
Rock mechanics problems, including stability of underground chambers, tunnels, shafts, openings and slopes; reinforcement or support, stabilization and construction techniques.
Instrumentation.
Noise and Vibration.
Tunnel Boring Technology.
Consultation regarding contracts and specifications.

Mr. Oriard has been an invited lecturer at many universities and conferences, both domestic and foreign, and is the author of many technical papers in his fields of specialization.

EXAMPLES OF PROFESSIONAL ACTIVITIES OF LEWIS L. ORIARD

Mr. Oriard has provided technical assistance to federal agencies, private industry and universities in many countries, including some 22 federal agencies in the U.S. He has served as a technical adviser on over 1000 projects in some 35 countries. He has lectured widely and has served as an adviser on many applied research efforts. Representative examples follow:

Member of advisory panel selected by U.S. National Research Council (Academy of Science and Academy of Engineering) to provide technical assistance to U. S. Navy Civil Engineering Laboratory Research & Development Program involving dynamic stresses in hard rock concerning propellant embedded seafloor anchors.

Invitation from Geomechanics Committee of Society of Mining Engineers to present technical paper at 113th Annual Meeting of AIME, 1984.

Invitation to serve as Technical Adviser to Underground Technology Research Council Committee on Perimeter Control Blasting.

Invitation to serve as a member of the Conference Panel on Perimeter Control Blasting, Society of Explosives Engineers.

Provided technical assistance to the Government of Sri Lanka for complex rock excavation on the world's largest irrigation project. Involved questions pertaining to physical and geological characteristics of the site, blasting technology, concrete structures, specifications and contracts.

Provided technical assistance to the Government of Colombia, South America, for one of the world's largest coal field developments, including port and harbor, highway, railroad, and new city. Involved questions pertaining to geological exploration, physical properties of materials, quarry development and blasting technology, study of the feasibility/design of "coyote" blasting of several million pounds of explosives.

Provided technical assistance to the Government of Canada for large tunneling operation extending from Novia Scotia under the Atlantic Ocean to a large undersea coal field. Involved evaluation of geological setting, estimate of stress fields, feasibility of existing development proposals and final recommendations for tunneling methodology (machine boring and pre-cast lining).

Provided technical assistance for feasibility studies for the largest rock excavation project in the world for civil construction, a regional airport between Hong Kong and Macao.

Provided technical assistance for delicate blasting operations in Kota Kinabalu, Malaysia, involving evaluation of seismic waves and the effects of vibrations on nearby concrete, cinder block and residential structures, as well as the schedule and technology for accomplishing the work.

One of 3 nominees to represent the United States at Australian Conference of the International Society of Rock Mechanics, Panel on Rock Fragmentation and Blasting.

Invited to join a technical delegation to China and present a technical paper on explosives engineering.

Invited by Society of Explosives Engineers to serve as Chairman of a committee of specialists to evaluate the research work done by the U. S. Bureau of Mines regarding the effects of ground vibrations and air overpressures on residences and other small structures.

Invited to teach a short course in explosives engineering at Montana State University, and to teach part of an additional short course in aggregates for the U. S. Forest Service.

(Overall, have lectured or presented technical papers at some 16 universities in the United States, and for universities and professional groups in many foreign countries.)

Invited to participate with Panel For Defining Critical Rock Mechanics Research Requirements, U. S. National Committee for Rock Mechanics, with special emphasis on rock fragmentation and the use of explosives.

Invited to present at an international conference in Canada the State-of-the-Art paper on the effects of ground vibrations on unstable slopes.

Invited to serve on Consultants' Board of Review regarding an underseas tunnel crossing between Labrador and Newfoundland.

Invited to serve on Board of Consultants for the largest underground excavation complex in the world at that time, the Peace Power Development in Canada.

Provided technical assistance on the James Bay Project, Canada, the world's largest hydroelectric development at that time.

Invited to serve on Board of Consultants for the Turimiquiri Project in Venezuela, involving quarry development, two rock fill dams, water control facilities, long rock tunnel, underseas pipeline and public resort area.

Provided technical assistance on the Palabora Project in the Northeast Transvaal, Africa. This operation achieved a world's record for the largest quantity of rock excavation in a single day.

Provided technical assistance on the Rossing Project in Namibia, Africa, the world's largest uranium mining operation.

Provided technical assistance to the Chivor Project in Colombia, South America, involving a number of complex geotechnical questions associated with the construction of the world's highest rockfill dam at that time.

Provided technical assistance to the Government of Venezuela for critical blasting operations on one of the world's largest hydroelectric projects, the Guri Hydro Project. Among other tasks, involved blasting under 70 ft. water at a distance of only 10 ft. from the walls and stoplogs of a $200 million power-house (concrete structure) supplying 50% of the country's electricity.

Invited by the Government of Mexico to serve as Visiting Professor to the National University in Mexico City, to offer a short course in explosives engineering to faculty and professional attendees.

Invited to serve as Visiting Professor to Colegio de Ingenieros Civiles de Mexico, Monterrey, Nuevo Leon, Mexico, to offer a seminar in explosives engineering.

Provided technical assistance to an association of quarry operators and to individual operations in Monterrey, Mexico. Involved development methods, blasting technology, and an evaluation of ground vibrations and air overpressure effects on nearby residential communities.

Provided technical assistance to the Government of Mexico regarding blasting operations on the Laguna Verde Project, Mexico's nuclear power station.

Presented the United States' state-of-the-art in explosives excavation to the Government of Portugal. Also represented were Russia, Sweden and West Germany. Evaluation of feasibility of constructing an ejecta dam at Funcho, Portugal (casting rock across a valley with about 10 million pounds of explosives) and corollary evaluation of associated blast effects on surrounding communities.

Provided technical assistance on the enlargement of the Salto de Villarino hydroelectric facilities in Spain, involving blasting within 20 feet of operating turbines and generators, and within 5 feet of delicate electric control facilities. Similar work was done on the Salto de Castro project.

Provided technical assistance for the Franco-Belga open-pit mine near Bilbao, Spain. Involved such questions as blasting technology, slope stability, and the effects of noise and vibration on a hospital and residential community 900 feet away.

In the same region in Spain, technical assistance was provided for the construction of the Superport at Bilbao.

Provided technical assistance for the construction of railroad tunnels between Oviedo and Leon, Spain. Required blasting parallel tunnels within 10 feet of existing old tunnels in such manner as not to damage the old tunnel linings and electrical facilities 10 feet away.

Provided technical assistance for the delicate blasting operations that were required for the construction of the New World Trade Center in downtown Kowloon, Hong Kong.

Provided technical assistance on the Ord River Project in Australia, involving the largest detonation of chemical explosives that had ever taken place on the Australian continent. Involved prediction of ground motions and the effects that would take place on a variety of man-made and natural items, including a nearby regional fault and a tall intake tower that was in the process of being slip-formed with freshly poured concrete.

Provided technical assistance on the Manapouri Project in New Zealand, involving blasting a solid rock cofferdam, 400 ft. long and 50 ft. high, that came within 3 ft. of the intake structure.

Provided technical assistance on the Tarapoto Project in Peru, involving blasting effects and earthquake effects on high, unstable cut slopes along a highway in the foothills of the Andes.

TECHNICAL ARTICLES AND LECTURES PREPARED BY L. L. ORIARD

"The Scale of Effects in Evaluating Vibration Damage Potential", Prepared for Annual Conference on Explosives and Blasting Techniques, Society of Explosives Engineers, New Orleans, February, 1989.

"Recent Advances in Explosives Engineering", Invited paper for 2nd International Conference on Gold Mining, Vancouver, B.C., November, 1988.

"Resolution of Some Common Problems in Highway Blasting", invited paper for Transportation Research Board Annual Meeting, Washington, DC, January, 1987.

"Close-In Blasting Effects on Structures and Materials", invited paper for ASCE National Meeting, Boston, October, 1986.

"Observed High-Rise Building Response to Construction Blast Vibrations", co-authored with T. L. Richardson and K. P. Akins for presentation at the ASCE National Convention, Detroit, Michigan, October, 1985.

"Seismic Waves Transmitted From Rock to Water: Theory and Experience", invited Paper prepared for 11th Annual Conference on Explosives and Blasting Techniques, San Diego, CA, January, 1985.

"Rock Blasting Techniques and Practices", Short Course prepared for New Mexico Institute of Mining and Technology, in cooperation with their Center for Explosives Technology Research, Socorro, New Mexico, November, 1984.

"Lake Thistle Emergency Drainage Project", co-authored with R. J. Essex and S. T. Freeman for presentation at the 25th U. S. Symposium on Rock Mechanics, Evanston, IL, June, 1984.

"Geomechanics Principles For Complex Blasting," prepared at the request of the Geomechanics Unit Committee, 113th Annual Meeting of Society of Mining Engineers of AIME, Los Angeles, CA, March, 1984.

"Modified Site Response Blasting: The Role of Rock Mechanics in Perimeter Control", prepared at the request of the UTRC Committee on Perimeter Control Blasting, Proceedings, 10th Annual Conference on Explosives and Blasting Technique, Orlando, FL, February, 1984.

"Underwater Explosives Detonations and Structural Responses, Guri Hydro Project, Venezuela", invited paper for Waterpower '83, International Conference on Hydropower, Knoxville, TN, September, 1983.

"Innovations In Technology For Complex Rock Excavations", International Conference on Underground Pumped Hydro and Compressed Air Energy Storage, sponsored by the American Institute of Aeronautics and Astronautics, San Francisco, CA, September, 1982.

"Blasting For Maximum Dragline Productivity: A Case Study", co-authored with representatives of Bauer, Calder & Workman, Inc., Woodward-Clyde Consultants, and Old Ben Coal Company, Indiana Coal Mining Institute, March, 1982.

"Development of New Blast Designs to Improve Dragline Stripping Rates", contributing author and consultant, U. S. Bureau of Mines research contract No. ET-77--C0109124, and Department of Energy Contract No. DOE-AC01-77ET11239, 1977-1982.

"Blasting Effects And Their Control", Invited paper for Section 7 of 'Underground Mining Methods Handbook,' Society of Mining Engineers of AIME, Library of Congress Catalog Card Number 80-70416, 1982.

"Influence Of Blasting On Slope Stability: State Of The Art", invited state-of-the-art paper for the Third International Conference on Stability in Surface Mining, Society of Mining Engineers of AIME, June, 1981, Library of Congress Catalog Card Number 81-70690, 1981.

"Field Tests With Fracture Control Blasting Techniques", invited paper for Rapid Excavation and Tunneling Conference, Society of Mining Engineers of AIME, May, 1981, Library of Congress Catalog Card Number 81-65517, 1981.

"Time Correlations Between Building Cracks And Blasting", Proceeding of the Seventh Conference on Explosives and Blasting Technique, Phoenix, Arizona, January, 1981.

"Drilling, Blasting And Dredging Techniques For Deepening The Panama Canal", invited paper for World Dredging and Marine Construction, Vol 16, No. 6, June, 1980.

"Underground Vibrations From Surface Blasting At Jenny Mine, Kentucky", contributing author and consultant on U. S. Bureau of Mines Contract No. J0275030, 'Criteria for Proximity of Surface Blasting to Underground Mines,' November, 1979.

"Seminar In Explosives Engineering", presented as Visiting Professor to Colegio de Ingenieros Civiles de Mexico, Seccion Monterrey, A. C., Monterrey, Mexico, April 15, 1980.

"TVA's Criteria For Blasting Effects On Concrete", co-authored with J. H. Coulson, American Society of Civil Engineers Specialty Conference on Minimizing Detrimental Construction Vibrations, Portland, Oregon, April, 1980, ASCE Preprint No. 80-175.

"Blast Damage Criteria For A Massive Concrete Structure", co-authored with R. G. Tart and J. H. Plump, American Society of Civil Engineers, Specialty Conference on Minimizing Detrimental Construction Vibrations, Portland, Oregon, April 1980, ASCE Preprint No. 80-175.

"Rockfill Quarry Experience, Ord River, Australia", co-authored with J. L. Jordan, Journal of the Construction Division of the American Society of Civil Engineers, Vol 106, No. CO1, March, 1980.

"Short Course in Aggregates And Quarrying", presented at Montana State University for the U. S. Forest Service. Oriard contributions to the short course included quarry blasting and blasting practices, geological considerations and geophysical exploration methods.

"Short Course In Explosives Engineering", as a two-day extension of the above-described short course. Offered at Montana State University, March, 1980.

"Observations On The Performance Of Concrete At High Stress Levels From Blasting", Sixth Annual Conference on Explosives and Blasting Technique, Tampa, Florida, February, 1980.

"Response Of Deep Rock Masses To Vibrations Induced By Nearfield Earthquakes, Blasting or Rock Burst Phenomena", invited presentation, Seismic Design Workshop for Underground Repository, Office of Nuclear Waste Isolation, U. S. Department of Energy, and Rockwell International, Seattle, February, 1980.

"Short-Delay Blasting At Anaconda's Berkeley Open-Pit Mine, Montana", co-authored with Merle Emmert, Society of Mining Engineers of AIME, Preprint No. 80-60, February, 1980.

"The Effect Of Rock Mass Discontinuities On Machine Tunneling: Buckskin

Mountains Tunnel, Arizona", co-authored with S. T. Freeman, invited presentation to the Association of Engineering Geologists, Los Angeles, August, 1979.

"The Atlanta Research Chamber", invited paper for 'Monographs On The State-Of-The-Art Of Tunneling,' prepared for the U. S. Department of Transportation, Office of Technology Development and Deployment, June, 1979.

"Controlled Trench Blasting In Frozen Ground", co-authored with R. G. Tart, prepared for the State-Of-The-Art Conference On Pipelines In Adverse Environments, American Society of Civil Engineers, New Orleans, January, 1979.

"Using Explosives To Excavate Frozen Ground", co-authored with R. G. Tart, prepared for presentation at the joint United States-U.S.S.R. Seminar On Building In Cold Climates And Permafrost, Leningrad, Russia, 1978.

"A Critical Review Of Certain Criteria Used In Explosives Engineering", invited paper, Specialty Conference On Soil Dynamics And Earthquake Engineering, American Society of Civil Engineers, Pasadena, June, 1978.

"Urban Blasting: Problems And Techniques", invited paper, American Society of Civil Engineers Rock Excavation Seminar, New York, October, 1976.

"Physical Properties And Geologic Structures Of Rock Which Determine Its Failure Characteristics Under The Action Of High Explosives", short course presented as Visiting Professor to the National University of Mexico, Mexico City, 1976, repeated, 1978.

"Explosion-Induced Waves In Water, Air, Soil And Rock, And The Response Of Structures And People To These Blasting Effects", short course presented as Visiting Professor to the National University of Mexico, Mexico City, 1976, repeated, 1978.

"Rapid Dam Construction Using The Directed Blasting Method", co-authored with H. M. Ewoldsen and A. Mahmood, invited paper, Second Iranian Congress of Civil Engineering, Pahlavi University, Shiraz, Iran, May, 1976.

"Design Considerations And Stress Analysis For Multiple Underground Openings In Anisotropic Rock", co-authored with B. C. Yen and J. N. Mathur, invited paper, Society of Mining Engineers of AIME, Annual Meeting, Tucson, Arizona, 1975.

"Geophysical Exploration For Deep Underground Structures", co-authored with R. J. Bielefeld, Association of Engineering Geologists, Annual Meeting, Denver, 1974.

"Controlled Blasting", invited paper, Workshop on Tunnel Blasting, jointly sponsored by the Underground Construction Research Council, Society of Mining Engineers of AIME and the University of Maryland, November, 1974.

"Vibration Control", invited paper, Workshop on Tunnel Blasting, jointly sponsored by the Underground Construction Research Council, Society of Mining Engineers of AIME and the University of Maryland, November, 1974.

"Blasting Techniques And Safeguards Used In Enlarging The Underground Powerhouse At Salto De Villarino, Spain", co-authored with H. M. Ewoldsen and J. Y. Perez, invited paper, Rapid Excavation and Tunneling Conference, American Society of Civil Engineers and Society of Mining Engineers of AIME, San Francisco, June, 1974.

"Geotechnical Feasibility Of Underground Reactor Siting", co-authored with H. M. Ewoldsen, Water Resources Conference of the American Society of Civil Engineers, Los Angeles, January, 1974.

"Earthquake Source And Effect Concepts Related To Long-Range Planning Of U. S. Government Facilities Throughout The World", co-authored with R. L. McNeill, invited seminar for representatives of various federal agencies, including State Department, Bureau of Reclamation, Geological Survey, Air Force, Bureau of Standards, Corps of Engineers, and the World Bank, October, 1973.

"Urban Blasting", invited paper, First Annual Conference of the State of Kentucky Bureau of Mines, Division of Explosives and Blasting, Lexington, Kentucky, June, 1973.

"A Guide To Evaluate Damage Potential To Pipelines From Nearby Construction Blasting", a field manual prepared for Alyeska Pipeline Service Co. for the Trans-Alaska Oil Pipeline, 1972.

"Specifications For Controlled Blasting In Civil Engineering Projects", co-authored with A. J. Hendron, Jr., invited paper, Proceedings of the First North American Rapid Excavation and Tunneling Conference, ASCE, SME and other organizations, June, 1972, Library of Congress Catalog Card Number 72-86918, 1972.

"Blasting Effects And Their Control In Open Pit Mining", 'Geotechnical Practice for Stability in Open Pit Mining,' invited paper, Proceedings of the Second International Conference on Stability in Open Pit Mining, Vancouver, Canada, November, 1971, Library of Congress Catalog Card Number 72-86923, 1972.

"Blasting Operations In The Urban Environment", Association of Engineering Geologists Annual Meeting, Washington, D. C., October, 1970. Published in Bulletin of the Association of Engineering Geologists, Vol IX, No. 1, 1972.

"Dynamic Effects On Rock Masses From Blasting Operations", Invited presentation at Slope Stability Seminar, University of Nevada, May, 1970.

"Geophysical Exploration Methods", Invited Cooperating Scientist, Crustal Movement Monitoring, Technical Report No. 26, The Coordinating Committee For East Bay Fault Slippage, Hayward, California, November, 1969.

"A Seismic Method For Evaluating The Apparent Refusal Of Driven Piles", prepared for Woodward-Clyde & Associates, 1967.

"Design Techniques For The Control Of Blasting Effects", prepared for Woodward-Clyde & Associates, 1967.

"Utilization Of Space and Time Distributions To Control Explosion-Generated Ground Vibrations", American Geophysical Union, Washington State University, 1963.

"Magnetic And Electrical Exploration Methods In Engineering And Hydrology", American Geophysical Union, University of Idaho, 1960.

EXPERIENCE OF L. L. ORIARD WITH BUTTE BLASTING OPERATIONS

Mr. Oriard has provided technical assistance on blasting techniques and to control vibrations and airblast for Butte blasting operations since 1955, at the following locations:

- Berkeley Pit
- Alice Pit
- Gagnon Pit
- Continental Pit

He was present to set up a portable seismograph for the first blast in the new Berkeley Pit in 1955, and later for the Alice Pit, the Gagnon Pit and the Continental Pit. All told, he has taken some 7000 or more seismic tests of Butte blasting operations.

He has inspected many homes in Butte, and has spoken to many residents of the area. He set up a program of periodic inspections of a few houses to serve as demonstrations of cyclic environmental effects and comparisons with blasting effects and human responses, in order to help interested persons better to understand blasting phenomena.

Mr. Oriard has been an invited guest speaker for Montana Professional Engineers and Montana Tech.

OTHER EXPERIENCE IN MONTANA

Mr. Oriard was asked mutually by the State of Montana and Burlington Northern Railroad to set blasting criteria and vibration limits for the highway blasting that took place immediately above the railroad tunnel through Bozeman Pass. Burlington Northern would not permit this work to take place over their tunnel unless Mr. Oriard were to be the specific individual to set the criteria and guide the work.

Mr. Oriard has provided technical assistance to mining projects at the following locations:

- Near Whitehall
- Near Bridger
- Near Hardin

He has also provided technical assistance to a number of highway projects in Montana, including the following:

- West of Missoula
- Sout of Helena
- East of Butte
- A small project at Great Falls

IV
1/27/89
HB274

TESTIMONY OF WARD SHANAHAN
Submitted on behalf of
Stillwater Mining Company

Opposition to HB 274-Mitigation of Use of Explosives

Ms Chairman and Members of the Committee: For the record my name is Ward Shanahan, I live in Helena and have practiced law here for more then thirty years. I am the registered lobbyist for Chevron Resources which is one of the joint venturers in Stillwater Mining Company which operates a hardrock mine at Nye, Montana. We produce Platinum and Palladium ore and have an expanding operation. The other joint venturer is Manville Corporation. We oppose HB 274 as an unnecessary duplication of existing safety precautions, and an attempt to create another layer of bureaucracy on an already heavily regulated industry.

Our company responds to safety regulations with respect to explosives under the Federal Mine Safety and Health Act(MSHA) and under the Montana Mine Safety Act(Title 50,Chapter 72 Parts 1 & 2). Our Mine is permitted to operate under the Operating Permit issued by the Department of State Lands(82-4-335) this Act(82-4-303)provides that our Operating Plan shall include"procedures proposed to avoid foreseeable situations of public nuisance,damage to human life and property...". Prior to the commencement of operations we were required to comply with the Hard Rock Mining Impact Act(90-6-301 M.C.A.). In addition to all of these regulations we are liable in damages for any injury to property which is the proximate result of operations at our mine,including those resulting from the use of explosives.

HB 274 represents an attempt to encourage claims to be brought against our company, even though we have been,and are now being required to meet stringent safety requirements, particularly in the case of explosives. This bill will require the employment and training of additional "experts" and the establishment of another hearing process, to address a problem for which there are a very small number of claims.

We respectfully submit, that House Bill 274 should be given the recommendation DO NOT PASS.

Ward Shanahan
442-8560
301 First National Bank Bldg
P.O. Box 1715
Helena,Montana 59624

HB 274
1/2

DEPARTMENT OF STATE LANDS

TED SCHWINDEN, GOVERNOR

CAPITOL STATION

STATE OF MONTANA

(406) 444-2074

1625 ELEVENTH AVENUE
HELENA, MONTANA 596

December 14, 1988

Representative Joseph Quilici
730 South Arizona Street
Butte, Montana 59701

RE: Montana Resources Inc., Blasting Complaints

Dear Representative Quilici:

This letter summarizes the results of the Department of State Lands investigation into the blasting procedures at the Montana Resources Mining Incorporated (MRI) mining operation in Butte.

On the morning of November 29, 1988, Dave Paszkiet of this Department met with you, Butte/Silver Bow Commissioner Joe Ivanich, and Montana Standard Reporter Eric Williams in Butte. The purpose of the meeting was to visit with several concerned citizens who have indicated that their property is being damaged by excessive vibrations being generated by the blasting activities at the MRI mining operation.

The residences of Caroline Janson, Don Greenleaf, Esme' LaBreche and Ann Fisher were visited. The homeowners provided Dave with a summary of the dates and times of the blasts that resulted in their complaints. They also indicated that they had some photographs that they believed documented that the cracks were developing as a result of the vibrations from the blasts. Dave also took some photographs of the cracks.

That afternoon, Dave went to the MRI mine office and met with Steve Walsh and George Burns of MRI, and Kiel Kemp of IRECO. The blasting and seismograph records for November and the severe blasts that had been identified by the homowners were thoroughly reviewed. All records indicated that none of the standards for ground motion and airblast set forth by the U.S. Bureau of Mines and the Office of Surface Mining Reclamation and Enforcement (OSMRE) had been exceeded. However, there were some seismograph records identifying airblasts above a level that would likely be perceived by the homeowners as causing annoyance and complaints. This level is at 110 dBL (2 Hz high-pass) as identified in the OSMRE "Blasting Guidance Manual." According to this manual, page 115, an airblast may be perceived as follows:

"It is usually perceived as anything from a dull thump to a loud bang. A loud bang is not always a "high" airblast, and converse-

ly, a dull thump may in fact be one. It might even be inaudible! The house may well react, or respond, the structure may creak, the windows may rattle, and, if a person is not expecting it, it may be quite startling. It is most unlikely ever to cause damage."

MRI officials reported that the blasting operation had been aware of the citizens complaints for quite some time and have been experimenting with various blasting techniques to attempt to remedy the concerns outlined by the citizens. They reported that in one specific instance the company received six complaints after shooting over 140 holes in one area of the mine, and then when returning to the same area to blast the next lower bench, after shooting only one-half as many holes, received 12 complaints.

MRI also indicated that they have been aware of the federal standards and regulations for quite some time. They reported that the company has been using and will continue to use these standards and regulations to control its blasting procedures although these standards are not specifically required by law.

In an attempt to determine whether or not they are complying with the standards, MRI is monitoring all its blasts using one or two seismographs. The monitoring is usually done by IRECO, the blasting contractor. In addition, there are other measures that MRI plans to try to attempt to lessen the impact of its blasting operations on the homeowners. These items are described below:

1. Most of the complaints generated by citizens occur when MRI conducts its blasting operations in a zone of alluvium material. MRI has mentioned that this zone appears to generate lower frequency vibrations, which are highly perceived by the home owners. Due to the likelihood of having these lower frequency vibrations in this zone, MRI will experiment in delay sequencing, that is adjusting the time interval of when the individual holes will detonate. This procedure can result in controlling the vibrations.

2. MRI will try to provide a free face (rock face exposed to air) in this zone to relieve some of the confinement. Due to the location of this zone being at the edge of the pit, it has been previously blasted using a V-cut. This V-cut pattern is used to start the mining sequence of the next bench to be mined. MRI will try to start its V-cuts at the other end of the pit as production allows. The material at the other end of the pit is harder crystalline material (quartz monzanite). This harder material generates higher frequency vibrations which appears to result in less complaints when blasted.

3. MRI is digging unblasted alluvium material when feasible. Sometimes conditions permit the mining of this material without prior blasting. However, this practice is limited by production scheduling and equipment costs.

4. Kiel Kemp of IRECO has been responding to individual complaints when telephoned. Mr. Kemp has been visiting some of the home owners to discuss their concerns. It appears that MRI wishes to continue this practice in the future. This may improve relations between MRI and the citizens.

5. MRI has a video tape available to the public regarding blasting. This tape may alleviate some of the homeowners concerns by educating the general public of safe blasting and design procedures used to control adverse effects. The video tape is for a VHS-VCR and made available upon request through the company.

In the short term, an operating modification that could possibly reduce some of the ground vibration intensity is that MRI will not be blasting the alluvium material after the Spring of 1989 for several years. After that time, this material will not be encountered again until approximately 2,000 feet further north of the present operation. This may substantially reduce the vibration intensity on the neighborhoods in question.

The Department has recently sent a copy of the OSMRE "Blasting Guidance Manual" to MRI as a reference document outlining procedures used to control the adverse effects of blasting on coal mining operations. This manual also includes damage criteria, recordkeeping procedures, methods to conduct pre- and post-blasting surveys and a chapter describing citizen interests. MRI may find this document informative to understand the guidelines used by regulatory authorities in the coal industry for pursuing citizen complaints and evaluating possible damage.

In addition, the Department has suggested to MRI that they may want to conduct surveys of the various residences to document any additional damage to the structures. This documentation should provide the homeowners and MRI with additional information to monitor the future damage to these structures. However, it must be emphasized that this documentation will not provide any information on the cause of the existing damage, only that damage does in fact exist at the time of the survey and the extent of that damage. MRI has indicated that they are considering discussing this issue with their consultants to determine the feasibility and utility of conducting house surveys.

In closing, the Department is willing to attend another public meeting if requested. Please contact me for future arrangements concerning this matter.

Sincerely,

Gary Amestoy, Administrator
Reclamation Division

DP/ss

c: Don Peoples, Chief Executive (Butte/Silver Bow)
Commissioner Joe Ivanich (Butte/Silver Bow)
Steve Walsh (MRI)
Dave Paszkiet (DSL)

VISITORS' REGISTER

Business & Economic DEVELOPMENT COMMITTEE

BILL NO. HB 274 HB 341 DATE 1/27/89

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Don Jenkins	Whitehall, MT.		HB274
WARD SHANAHAN	HELENA, MT.		274
John North	Helena		
Gary Amestoy	Helena		
Tom Hopgood	Mont. Assoc. Realtors	341	
Nancy Matheson	Helena	2	
Roy Tilman	Butte	[redacted]	HB274

IF YOU CARE TO WRITE COMMENTS, ASK SECRETARY FOR WITNESS STATEMENT FORM.

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.