

Lecture PA1

Accidents in the Use of Commercial Explosives in The United States, 1992-2002

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INTRODUCTION

The legitimate use of commercial explosives is well established as essential to the harvesting of our natural resources and the development and maintenance of our critical infrastructures around the globe.

In order to maintain an uninterrupted supply of these essential materials we find ourselves, today, implementing enhanced security measures in the wake of an increased terrorist threat. This, in turn, has reemphasized our commitment to product stewardship, a perennial hallmark of our industry, worldwide.

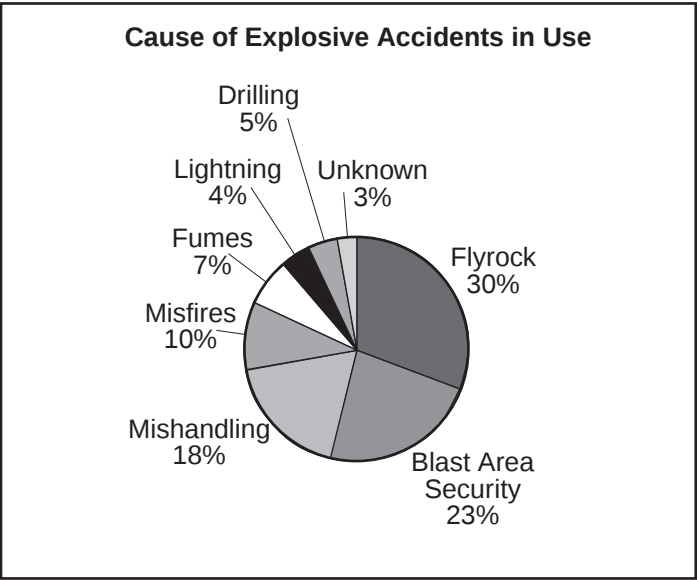
This report discusses a significant concern in the practice of that stewardship - accidental explosions during the use of commercial explosives in the United States over the last ten years. Included here are only accidents that resulted in a serious injury or fatality. Serious injuries were deemed those that resulted in lost time over one week. The source of this data comes from the IME Accident Reporting Program, U.S. Government data and media accounts of these accidents.

Included are carbon monoxide (CO) fume accidents where it is suspected that an accumulation of underground gases from blasting resulted in poisonings.

IME joins SAFEX International in the hope that with this study, we can better address the vulnerabilities of the blasting industry and eliminate future accidents in the use of commercial explosives.

SUMMARY OF ACCIDENTS IN USE IN THE UNITED STATES, 1992 - 2002

<i>Category</i>	<i>Incidents</i>	<i>Injuries</i>	<i>Fatalities</i>
Premature Detonation			
Mishandling	20	24	8
Drilling	5	17	4
Lightning	4	9	4
Unknown	3	4	0
Flyrock	34	29	6
Misfires	11	12	3
Fumes	8	14	1
Blast Area Security	<u>25</u>	<u>25</u>	<u>3</u>
Totals	110	134	29



The following occurrences demonstrate failures by blasting personnel to follow recommended practices and identify the areas where training programs must emphasize proper explosives handling procedures.

U.S. ACCIDENTS IN USE, 1992 - April 2002

<i>Date</i>	<i>City/County</i>	<i>State</i>	<i>Type of Operation</i>	<i>Injuries</i>	<i>Fatalities</i>	<i>Category</i>
1/22/02	Crisp	NC	Beaver Dam Blasting		1	Flyrock
Farmer blowing beaver dam initiated blast and was fatally struck by flying log.						
1/15/02	Pike County	KY	Road Construction		1	Security
A Staffordsville man died on 1/15/02 after he and his vehicle were covered with debris from a planned dynamite blast at a construction site. The man was checking a gas well at a road construction site on US 119 near Canada in Pike County according to KY state police. The blast went off at 1:17 pm while the man was in the immediate area.						
8/ 9/01	Alma	WI	Cleaning Boilers		1	Security
Worker was using explosives to clean coal scale and buildup from boilers for the John P. Madgett Dairyland Power Station. Worker was killed when explosives were intentionally detonated while he was in the boiler.						
10/ 3/00	Harrison Cty	IN	Surface Stone Mine	1		Flyrock
Victim was sitting in a loader about 1270' from a shot. A piece of fly rock from the shot passed through the windshield of the loader striking the victim on the side of his face causing a laceration requiring sutures.						
6/ 2/00	Princeton	IN	Shaft Sinking	3		Misfires
Miners drilled into a misfire hole in a shaft round. One person lost fingers and part of hand. Two others had minor injuries.						
3/20/00	Adrian	PA	Surface Coal Mine	3		Fumes
A shot service contractor conducted 20 overburden blasts for a very small surface coal mine with blasts progressing towards the affected home. Blasts varied in size, but averaged about 5,000 lbs of ANFO. Three occupants of a home 400 to 500 ft from the blasts were diagnosed with Carboxyhemoglobin (COHb) levels of 31, 28, and 17 percent. The family had the furnace and basement ventilation improved and installed a CO detector. On April 20, the CO detector went into alarm and authorities measured 100 to 200 ppm CO in the basement of the home.						
2/12/00	Inyo County	CA	Underground Nonmetal Mine	1		Flyrock
Debris from blast struck worker in leg.						
<i>Date</i>	<i>City/County</i>	<i>State</i>	<i>Type of Operation</i>	<i>Injuries</i>	<i>Fatalities</i>	<i>Category</i>
2/12/00	Beauregard	LA	Seismic Blasting	1	1	Mishandling
The explosion occurred when the driller of a seismic crew was handling an explosive charge at the hole, as the helper moved away. As the charge was being loaded, it exploded killing the driller instantly scattering his body over a wide area; and the helper was knocked down.						
12/21/99	Paradise	PA	Surface Stone Mine		1	Flyrock
A 32-year-old equipment operator with 7 years experience was fatally injured when he was struck by a piece of flyrock. The victim was sitting in a pickup truck guarding a road leading to a blasting site. Soon after the shot was detonated, a baseball-sized piece of flyrock entered the cab through the windshield and struck the victim.						
8/12/99	S. Craig	CO	Surface Coal Mine		1	Mishandling
A primer on the mine's blast pattern detonated unexpectedly. Preliminary data from the Mining Safety and Health Administration shows that blasting caps used to ignite a booster detonated prematurely, resulting in a small but deadly explosion.						

Date	City/County	State	Type of Operation	Injuries	Fatalities	Category
4/28/99	Berthoud	MN	Utility Construction	3		Mishandling
A construction crew was installing a water line on County Road 8E, west of Berthoud when the accident occurred. Apparently, three workers were injured when explosives were hit by a jackhammer, exploded, and launched rock debris.						
4/17/99	Stillwater Co	MT	Underground Metal Mine	1		Mishandling
Employee and two co-workers were blasting a hung chute. The charge was set. The employee retreated and lit the wrong fuse. He noticed the lit fuse had a primer on it. He started to throw it and it went off.						
3/30/99	Pike County	KY	Surface Coal Mine	1		Flyrock
Fired a shot and fly rock went approx 3200', hitting employee on the upper hip.						
3/30/99	Lake Mills	WI	Utility Construction	2		Fumes
A contractor blasting a trench for expansion of a residential development loaded holes with 3 to 4 lbs of ANFO primed with 1.5 lbs of dynamite. The occupants of a home about 150 ft from the blast were medically diagnosed with CO poisoning on March 31. Emergency responders measured 2,600 ppm CO in a sump hole in the basement of the home.						
2/15/99	Feds Creek	KY	Surface Coal Mine		1	Security
A 55-yr-old resident was riding an all-terrain vehicle (ATV) on an access trail located on his property, when a charge was set off in a mine nearby. Apparently, the man was walking in that direction approximately 100 feet down slope from the charge. His body was later found approximately 60 feet up slope from the parked ATV near the edge of the blasted material.						
2/12/99	Floyd County	KY	Underground Coal Mine	2		Security
Drill and cutter man went up into heading. They told bolt man to tell blaster not to shoot the break, but he did not hear him. The shot broke onto drill and cutter man.						
12/ 8/98	Harrisburg	PA	Construction	1		Mishandling
Workers were blasting rocks in preparation for construction on a site.						
11/ 9/98	Saline County	IL	Surface Coal Mine	1		Flyrock
The employee was removed from the blast area, but were not removed far enough and flyrock struck the employee.						
10/12/98	Romeoville	IL	Surface Stone Mine	1		Mishandling
An employee was loading 25lb cartridges into a blasting hole at the quarry, when charges suddenly detonated, blowing him five feet from the blast and into a truck.						
7/24/98	Charlevoix Co	MI	Surface Stone Mine	1		Flyrock
The injured employee was guarding a shot. After detonation of the blast, the employee was struck by flyrock.						
7/23/98	Hoover	AL	Construction	1	1	Drilling
Construction workers had loaded explosives on the lot in preparation for blasting the site. It appears that two workers were drilling in a hole where they had already placed some explosives. When they attempted to clear the drill bit from the explosives, that is when they went off.						
6/18/98	Hamilton Co	TN	Surface Stone Mine	1		Mishandling
Employee was loading holes when a premature detonation of a stemmed hole occurred.						
3/12/98	Knox County	KY	Underground Coal Mine	1		Drilling
Employee was engaged in drilling the face when a premature detonation of a stemmed hole occurred.						

Date	City/County	State	Type of Operation	Injuries	Fatalities	Category
2/13/98	Ary	KY	Road Construction	1		Misfires
A shovel operator, while loading the muck into rock trucks which then dumped into fill area, about halfway through the shot, the shovel bucket encountered an unfired hole and struck the primer causing the borehole charge to fire.						
9/30/97	Morris Co	NJ	Surface Stone Mine	1		Flyrock
Employee positioned in vehicle about 1500' from blast. A rock bounced down the ramp, went through the passenger side window and struck him in the leg.						
8/ 4/97	Atlanta	GA	Utility Construction		1	Fumes
About 45 minutes after the blast, a pipeline installer descended into a manhole about 50 ft from the trench blast and collapsed within minutes. Two co-workers entered the manhole to rescue him. One rescuer retrieved the unconscious worker, but the other rescuer died in the manhole. Carboxyhemoglobin (COHb) levels of the employees ranged from 23 to 33 percent.						
7/29/97	Nashville	TN	Road Construction	14	2	Drilling
The construction crew was preparing dynamite to clear rock and widen the highway when shot fired prematurely due to drilling into holes loaded with dynamite and det cord. Two workers killed and two injured. 12 motorists injured by flyrock on Interstate I-40.						
7/16/97	Meriden	CT	Surface Stone Mine	1	1	Mishandling
An explosion at quarry occurred when two workers were hired from independent contractor, to perform routine blasting at the site. It is unclear as to what caused the explosion. It is believed that a 3-1/2 by 16-inch dynamite cartridge got hung up 8 or 9 feet into a 50-foot-deep blast hole. It apparently detonated when attempts were made to dislodge it with a long wooden dowel.						
7/ 9/97	Story County	IA	Underground Stone Mine	2		Security
Powder crew was positioned improperly. They were in line with a break-through at an intersection. Both employees suffered multiple fractures to their arms, multiple contusions and bruises.						
7/ 7/97	Fannett	TX	Oil Well Blasting	1	1	Mishandling
Three man crew was sent to the site to cut some 2-inch steel tubing with explosives. The tubing became stuck inside the oil well and needed to be removed. The employee is believed to have been holding the materials when they exploded.						
6/ 5/97	Union County	KY	Underground Coal Mine	1		Flyrock
Employee was struck on the right middle finger and knuckle when a large rock was mudcapped. A small piece traveled approximately 150' down the long wall face, ricocheted and struck his finger.						
4/11/97	Pike County	KY	Surface Coal Mine	1		Security
Employee traveling in a pickup truck over a permitted coal haul road. Rock struck the pickup truck and injured the employee.						
2/ 3/97	Dunmore	PA	Road Construction	1		Fumes
A contractor conducted two trench blasts for a highway expansion consisting of 762 and 1,007 lbs of emulsion and ANFO. An occupant of a home about 100 ft from the last blast was medically diagnosed with CO poisoning on February 7. Elevated CO levels, some as high as 1,700 ppm were detected on February 7.						
1/31/97	Pinal County	AZ	Underground Metal Mine	1		Mishandling
Employee was attempting to adjust the connection of detonating cord to an electric detonator after having wired the cap into a temporary blasting line. The electric detonator prematurely detonated which detonated the detonating cord which employee was holding.						

Date	City/County	State	Type of Operation	Injuries	Fatalities	Category
1/ 2/97	Eddy County	NM	Underground Nonmetal Mine		2	Security
As employee prepared to exit the mine at end of shift, the powderman detonated the routine blast. The blast concussion extended into the waiting area and employees were knocked to the ground and stuck with debris. Excessive concussion was caused by open detonation of excess ANFO in conjunction with production shot.						
12/25/96	Big Sky	MT	Avalanche Control	1	1	Mishandling
A ski patroller was killed and another injured in an explosion near the top of an 11,166-foot mountain. The incident occurred when a powder charge intended to trigger potential avalanches detonated accidentally. Apparently, the patroller planned to lower a 2-lb. explosive over an overhang of snow—a cornice—on a ridge coming off on Lone Mountain. Investigators believe the fuse was ignited from an initial pull but she did not realize it when she tried it a second time						
10/21/96	Boone County	MO	Surface Stone Mine	1		Flyrock
Employee was waiting on a shot to go off, standing behind the bucket of a loader. A piece of rock from the shot hit the ground beside him and then struck his right leg.						
10/ 6/96	Pershing Co	NV	Underground Metal Mine	1		Security
Employee walked around the corner of blasting site too soon after shot fired. A separate fuse primer and had not gone off and it went off as employee approached the site.						
10/ 3/96	Heard County	GA	Surface Stone Mine	1		Security
While blasting two boulders with 5 holes loaded, fly rock came up on top of hill striking one employee in the leg.						
7/24/96	Northampton Co	PA	Surface Stone Mine	1		Security
The charge was detonated prematurely by a co-worker while employee was kneeling next to the hole.						
7/19/96	Knott County	KY	Underground Coal Mine	1		Security
The driller told the blaster to wait until he drilled #4 heading before shooting #5 left break. The driller drilled #4 heading then moved to the #3 entry and told the blaster to go a head and shoot. The driller then decided to go back into #4 intersection to check a test hole in roof.						
7/16/96	Holt County	MO	Surface Stone Mine	1		Flyrock
Haul truck driver alleged that flyrock struck him in the head while in his truck.						
6/ 7/96	Burnsville	MN	Surface Stone Mine	1		Mishandling
Premature detonation incident during use at quarry.						
6/ 6/96	Dakota County	MN	Surface Stone Mine	6		Lightning
Blaster went out onto the shot to try to determine if there were any open electrical circuits. While trying to determine this, lightning strike occurred detonating the shot.						
5/ 8/96	Rushland	PA	Surface Nonmetal Mine		1	Mishandling
Laborer was killed by the premature detonation of a detonator/cast booster assembly. The detonation was apparently caused by forcing the detonator into the booster.						
4/ 5/96	Warrick County	IN	Surface Coal Mine	1		Security
Employee reported that he was operating a road grader on the haulage road near the pit entrance when he was struck on the lower left leg by a softball sized rock from an overburden shot approximately 850' from his location.						

Date	City/County	State	Type of Operation	Injuries	Fatalities	Category
12/ 8/95	Stuarts Draft	VA	Construction		1	Flyrock
Fatal accident at construction site when blasting flyrock killed 28 year old concrete inspector in a nearby trailer.						
10/19/95	Jefferson Co	AL	Underground Coal Mine	1		Misfires
Driller drilled into misfired explosive, blasting cap went off, injuring right foot.						
10/12/95	Eureka County	NV	Surface Metal Mine	1		Unknown
Employee was tying-in the last part of a blasting pattern when the blasting cap he was holding prematurely detonated.						
10/ 6/95	San Marcos	CA	Surface Stone Mine		1	Drilling
A worker drilling into granite was killed when his drill struck an explosive charge in a loaded hole.						
9/28/95	Greenlee Co	AZ	Surface Metal Mine	1		Misfires
The injured employee was operating a shovel, digging in the bank with the dipper, when an unplanned explosion occurred causing him to receive a concussion.						
8/22/95	Pike County	KY	Surface Coal Mine	1		Security
A cutoff occurred when a blast was initiated. After rewiring, the blaster and helper shot the remaining holes, from underneath a d-10 dozer, 800 feet from the blast. Flyrock hit the dozer blade and a piece broke off the larger rock, going underneath the dozer and striking employee in the neck.						
8/16/95	Louisburg	NC	Utility Construction	3		Misfires
Construction worker attempted to drill a blasting hole with a jack hammer in a 10-foot rock-filled trench and struck a previously misfired charge of dynamite.						
8/ 7/95	Sparta Town	PA	Logging	1		Mishandling
In attempt to split a large log, the logger was using black powder when he received facial and head injuries resulting from the blast.						
7/30/95	Ontonagon Co	MI	Underground Metal Mine	1		Security
Blasting misfired heading with partner when employee was struck in right knee with flyrock.						
7/28/95	Bunker	MO	Underground Metal Mine	1		Mishandling
Blaster was using a bench grinder to remove a burr from a cap crimping tool while holding about 6 fuse caps in his other hand. The fuse caps detonated severely injuring his hand.						
3/30/95	Oxford County	ME	Surface Nonmetal Mine	1		Security
The victim was in close proximity of the blast site at the time the explosives were detonated.						
3/ 1/95	Millheim	PA	Utility Construction	2		Fumes
A contractor conducted three blasts, each consisted of 10 holes loaded with 4 to 5 lbs of pelletized TNT. The following day, 2 occupants of a home about 35 ft from the blasts were diagnosed with 23 and 14 percent COHb levels. Emergency responders detected CO concentrations of 1,480 ppm in the basement of the home.						
1/25/95	Blackhawk	CO	Building Construction	1		Flyrock
The explosion occurred while a woman was crossing Main Street and the flying debris caused injuries to her head, resulting in loss of her sense of smell, taste and cognitive sense of memory.						

Date	City/County	State	Type of Operation	Injuries	Fatalities	Category
12/27/94	McLean County	KY	Surface Nonmetal Mine	1		Flyrock
Employee's left thigh was struck and broken by flyrock when shot was detonated.						
12/26/94	Knott County	KY	Underground Coal Mine	1		Security
Employee was moving out of the line of fire of an underground shot when an object hit him in the left shoulder. Employee was 120ft away and off to the right break.						
9/29/94	Winchester	VA	Road Construction	1		Misfires
An excavator bucket struck a cast booster and detonator causing it to explode and injure an employee at the construction site. A cut-off between the top and bottom decks of charges was caused by a previous blast leaving the det and booster intact after the shot. No other undetonated explosives were found in the investigation.						
9/27/94	Henderson Co	KY	Surface Coal Mine	1		Security
Employee was shoveling coal away from the coal conveyor next to the highwall. Employee was suddenly hit by multiple pieces of rock, knocking him to the ground. The falling rock was caused by a nearby blast. The employee was not given any notice that the blast was to occur.						
9/ 6/94	Outagamie Co	WI	Surface Stone Mine	1		Flyrock
After a blast, a rock rolled approximately 300 yds and struck the leg of employee that was working on a crushing spread.						
7/22/94	Floyd County	KY	Underground Coal Mine	1		Security
Blaster gave his warning 3 times. Employee heard him, but did not think the blasted coal would reach him.						
6/25/94	Pinal County	AZ	Underground Metal Mine	1		Unknown
Employee was standing very close to some explosives when they went off.						
5/31/94	Andrus Cove	LA	Oil Well Blasting	2	2	Lightning
Explosion on oil drilling rig resulted in 2 deaths and 2 serious injuries. Dynamite charge detonated near the surface while crew engaged in a "plug and abandon" shot. Severe thunderstorm in area.						
5/29/94	Carlton	GA	Surface Stone Mine	1		Mishandling
Blaster was injured when a charge a black powder in a plastic bag ignited while being loading into a borehole.						
5/23/94	Madison Co	IL	Surface Stone Mine		1	Flyrock
A blast was set off and victim was struck by flyrock.						
5/20/94	Barre	VT	Surface Stone Mine		1	Misfires
Apparently, failure to clear explosives that had not detonated in a previous blast caused an explosion when an employee was operating a channel burner and encountered misfired charges.						
4/29/94	Rutland County	VT	Surface Stone Mine	1		Flyrock
Employee was doing his regular work as a rockman. Another crew set off a blast and a stone from the blast hit the ground and then hit employee on the right leg.						
4/28/94	Floyd County	KY	Underground Coal Mine	1		Security
Employee was on a cutting machine when the shot firer shot a place and the flying coal from the shot hit the employee in the head.						

Date	City/County	State	Type of Operation	Injuries	Fatalities	Category
4/28/94	Pax	WV	Surface Coal Mine	3		Mishandling
The premature detonation of a hole within a blast site resulted in three injuries. Victims were two members of a shot service crew and a sales representative. Reportedly, sales rep backed his vehicle over a loaded hole to permit bulk truck access to last row of holes to be loaded. When vehicle was driven forward, the detonation occurred blowing the vehicle some 70 feet in the air. Hole contained about 640 lbs explosive. Suspect shock tube snap and shoot.						
4/27/94	Norfolk County	MA	Surface Nonmetal Mine	1		Flyrock
While standing on the conveyor catwalk, employee was hit in the left ankle by a piece of fly rock from a blast at the quarry.						
4/15/94	Owen	IN	Surface Coal Mine		1	Flyrock
At a surface coal mine, an employee involved in shot service was fatally injured when struck in head by flyrock that traveled 236 feet. Company was blasting between two coal seams. Two or three holes had an accumulation of water and when the charges were detonated, the forces were sent vertically instead of horizontally. Second individual able to obtain "cover" and avoided injury.						
4/ 2/94	Kenai	AK	Oil Well Blasting	4	1	Mishandling
Explosion at facility resulted in 1 death and 4 injuries. Loading of perforator guns involved. About 600 feet had been loaded before explosion took place. Fire following explosion destroyed warehouse. Cause presently unknown. One possible cause is dropping bullplug on booster attached to end of detcord.						
3/29/94	Madison Co	GA	Surface Stone Mine	1		Mishandling
Employee was loading black powder to make a block lift. Black powder prematurely ignited causing an explosion.						
3/18/94	Brookeville	AL	Underground Coal Mine	1		Flyrock
Blaster was using sheathed explosive charges to break-up boulders on a longwall face. Blaster placed two charges on a boulder behind the shearer and took shelter between longwall shields. Blaster was struck in the face by flying debris.						
2/28/94	Rowan County	NC	Surface Stone Mine	1		Drilling
Made a shot, checked area and found 1 hole that did not go off. He then drilled in the same hole after being told not to and the charge went off.						
1/30/94	Cpe Girard Co	MO	Surface Stone Mine	1		Flyrock
Two employees were blasting built-up material off walls of 4th stage cyclone on the 6th floor of tower. A shot was loaded through a two-inch porthole (formed with a two-inch metal pipe sleeve and plug welded to the vessel) using nonelectric caps. When the blast was fired, pieces of metal struck employee in the right leg above knee.						
1/25/94	Henderson Co	KY	Surface Coal Mine	1		Flyrock
Lead blaster initiated shot while standing 425ft from the nearest blasthole and beside 1-ton truck. Approximately 4 baseball sized rocks flew his direction one rock struck him in the lower back while he was attempting to get under the truck for protection.						
10/28/93	Floyd County	KY	Underground Coal Mine	1		Security
Worker was coming through break when a shot was fired.						
10/18/93	Pierce County	WA	Surface Stone Mine	1		Flyrock
The injured person was standing approximately 410' from the blast site. Fly rock from the blast struck the person.						

Date	City/County	State	Type of Operation	Injuries	Fatalities	Category
10/13/93	Sullivan	MO	Underground Metal Mine	1		Mishandling
Blaster set-up mud-cap charges on two boulders using detonating cord to tie them together. Blaster did not cut detonating cord from spool and was killed by the spool of detonating cord when the shot fired.						
9/15/93	Luzerne County PA		Surface Coal Mine	1		Lightning
Worker was on drill during a severe thunderstorm, lightning struck and set off loaded holes.						
9/15/93	Bernalillo Co	NM	Surface Stone Mine	1		Flyrock
Lack of burden allowed shot to throw rock in direction of safety personnel. Similar blasts have been made over last 4 years and personnel normally would have been in safe zone. Personnel were not sheltered when blast was initiated.						
8/17/93	Schuylkill Co	PA	Underground Coal Mine	1		Security
Employee returned to area where shots were to be fired at time of detonation.						
8/ 6/93	Whitley County	KY	Underground Coal Mine	1		Misfires
Driller was drilling the face and he drilled into misfired explosives.						
7/31/93	Stillwater Co	MT	Underground Metal Mine	2		Fumes
Employees shot a large round, waited in a crosscut, which was not well ventilated and were overcome by smoke and fumes.						
6/30/93	Taney County	MO	Surface Stone Mine	1		Flyrock
Flyrock struck office employee in hand breaking a bone.						
6/15/93	Knox County	KY	Underground Coal Mine	1		Security
Man was operating coal drill in #2 heading. Coal from blast detonated in #6 cross cut blew out the back of the shot and struck the man as he was coming out of #2 heading.						
6/ 4/93	Caryville	TN	Surface Coal Mine	1		Flyrock
Flyrock from a coal mine blast killed a 16 year old boy riding with his family on Interstate 75. The blast, which sent rocks and debris flying across I-75, was detonated 200 feet from the highway. Rock landed on top of a vehicle killing the 16 year old passenger.						
4/14/93	Durham County	NC	Surface Stone Mine	1		Flyrock
Superintendent was supervising production shot from location 1100 ft from pit. During shot, a piece of flyrock left pit and struck him in lower left leg.						
4/ 2/93	Perry Hall	MD	Residence Construction	3		Fumes
An occupant of a home about 15 to 20 ft from the closest blastholes reported smelling a "burnt concrete" odor in the home on the evening of April 1 but thought nothing of it. The occupants of the home reported experiencing symptoms of moderate to severe CO poisoning that night and emergency responders detected 210 ppm CO in basement.						
1/19/93	La Salle County	IL	Surface Stone Mine	1		Security
Employee was loading out previous shot. Contractor did not check face for activity and communication did not reach loader employee. Shot pushed loader back, injuring loader employee.						
11/16/92	Grand View	ID	Utility Construction	1		Misfires
32-year old construction worker seriously injured at pipeline operation site when a hydraulic hammer he was using struck dynamite in a misfired hole and caused it to detonate.						
11/13/92	Nicholas Co	WV	Surface Coal Mine	1		Flyrock
Employee was struck by flyrock. The powder crew positioned themselves approximately 1,000 ft from the blast site. When the blast occurred, the injured employee recognized a rock coming his way and sought shelter in his truck. The rock came through the back window and struck him on the shoulder.						

Date	City/County	State	Type of Operation	Injuries	Fatalities	Category
10/26/92	Cookson	OK	Surface Stone Mine		2	Lightning
Two employees were killed when lightning caused electric detonators to initiate quarry holes prematurely.						
9/22/92	Medina County	TX	Surface Stone Mine	1		Security
Blaster sought protection from the blast near a rock ledge. The blast vibration caused a piece of the ledge to fall about a foot and strike the blaster.						
9/11/92	Harlan County	KY	Surface Coal Mine	1		Security
Employee was driving a truck on an access road. The shot was fired when he was driving near the blast site.						
8/25/92	Tuscarawas Co	OH	Surface Coal Mine	1		Flyrock
Employee was 1,000 yds away from shot when flyrock went out of blast area. The employee was hit in the back when diving for cover under a truck.						
7/29/92	Brick Chrch Pike	TN	Road Construction	2		Flyrock
Blast at construction site threw "bowling ball" size pieces of flyrock some 600 feet and into pickup truck where two men were sitting. Both injured. According to newspaper article, blaster had no license and told inspectors no warning was sounded before detonation. Other charges reported to include beer drinking and improper storage.						
7/13/92	Pikesville	KY	Surface Coal Mine	1		Flyrock
A shot service lead blaster with over 10 years experience was seriously injured in a flyrock incident. The blaster was partially protected by a bulk ANFO truck parked 430 feet directly in front of a 54 hole shallow depth shot. A walnut sized rock struck him with a glancing blow directly under his hard hat at the hairline.						
7/ 1/92	Princeton	WV	Surface Stone Mine		1	Misfires
Shovel operator was killed by falling rocks when his bucket impacted a misfired charge in the muckpile.						
6/18/92	Princeton	WV	Surface Stone Mine		1	Misfires
At an open pit stone quarry, 4 holes misfired and had to be reshot. Additional explosives were found in muck pile. On July 1, the victim, a 39 year old male, was loading shot rock onto a truck with a shovel. 3 witnesses head loud noise similar to a blast. A rock weighing about 150 tons came off the muck pile striking the shovel and killing the victim. Appears explosives in muck pile detonated causing the large rock to slide down the muck pile.						
4/10/92	Marion County	KY	Surface Coal Mine	1		Flyrock
Shot discharged and flyrock broke right side of window. Glass shattered and caused multiple lacerations to face.						
2/ 7/92	Lawrence Co	SD	Underground Metal Mine	2		Unknown
Unexpected blast from detonators.						
2/ 1/92	Wharncliffe	WV	Surface Coal Mine	1		Flyrock
Portion of pattern misfired. Blaster hooked up and subsequently fired misfired portion. Blaster was in front of shot and under a truck at distance of about 700 feet. Piece of flyrock weighing about 300 pounds pinned blaster between rock and truck axle.						
1/15/92	Gila County	AZ	Underground Metal Mine	1		Flyrock
Three employees were blasting the bottom of slusher trench. When the explosives detonated, a piece of one inch square by 1/8 thick steel ricocheted off of a steel station beam, embedding in the right forearm of one employee.						

1/ 3/92 Lawrence Co SD Underground Metal Mine 1 Fumes
Employee blasted a slab round. Thinking that the blast would damage the air door, he left it open. After the blast, he went back to the air door to close it but the fumes had already reached him.

Summary:

Total Accidents:	110
Total Fatalities:	29
Total Injures:	134

CONCLUSIONS

Reported here are only accidents that resulted in death or serious injury over the last ten years. The report documents 110 accidents, 29 fatalities and 134 serious injuries, all apparently a result of deviations from safety recommendations published by the industry.

The categories of Blast Area Security and Flyrock are somewhat open to interpretation as accidents could be considered under either heading. In any case, it can be concluded from the data presented here that failure to observe established good blasting practices is the cause of the vast majority of accidents in use. It may therefore be concluded that:

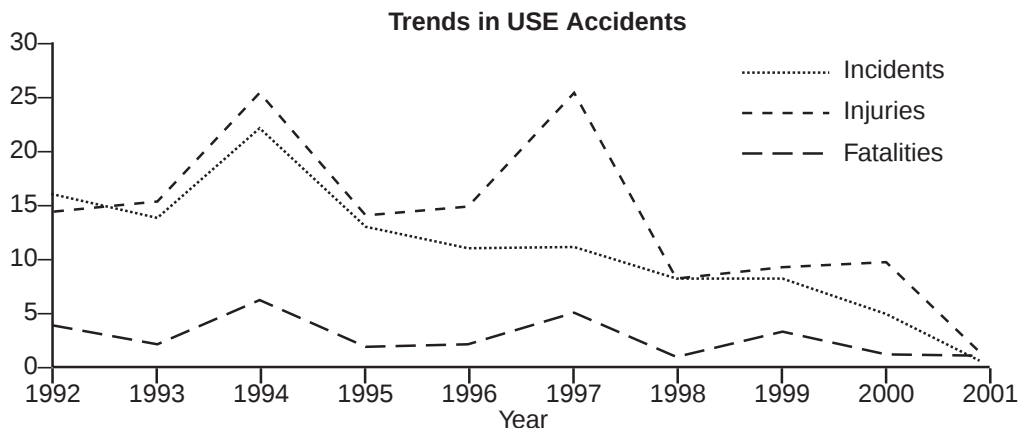
Premature detonations are the largest cause of fatal accidents.

Eliminating or minimizing flyrock must be the objective of every shot firer.

Failure to secure the blast area is a significant cause of fatalities.

Training and certification of blasters is essential to the safe use of explosives.

The chart below illustrates that the trend in use accidents is decreasing, which may be attributed to enhanced training and added emphasis on the supervision of those conducting explosives operations.



RECOMMENDATIONS

The stated purpose of accident reporting programs such as those maintained by SAFEX International and IME is the sharing of information and the analysis and communication of failings so that similar accidents may be avoided in the future. However, the litigious nature of our society today renders accident details hard to come by, and thus the timely sharing of data becomes increasingly difficult.

Every effort must be made to overcome this obstacle so that timely reporting can lead to improved training programs and an elimination of repetitive failings in blasting operations.

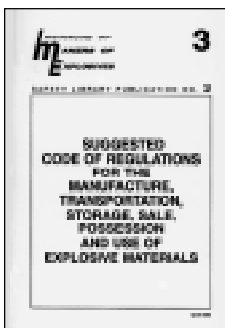
Accidents in the use of explosives in the United States could be greatly reduced or even eliminated if established best practices were carefully followed in the following areas:

- Mishandling explosives
- Drilling into loaded holes
- Lightning strikes
- Flyrock control
- Digging and drilling into Misfires
- CO Fume Migration
- Blast Area Security

Repetitious failures to observe established safety procedures in these areas must be emphasized in training programs at all levels. Only through uniform training, testing and certification of blasters and vigilant oversight of blasting operations can we hope to eliminate future accidents in the use of commercial explosive materials.

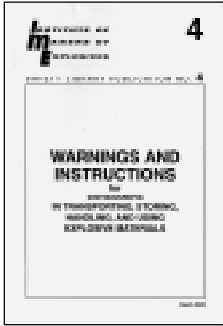
For nearly 90 years, The Institute of Makers of Explosives has developed recommendations for the safe handling of commercial explosives in blasting operations, training programs, and as an assistance to government bodies in promulgating regulations. Likewise, The Federation of European Explosives Manufacturers has developed and published their Codes of Good Practice addressing proper blasting recommendations for the same purpose in Europe.

The following IME publications provide recommendations addressing the most common causes of accidents in the use of commercial explosives as demonstrated in this report.



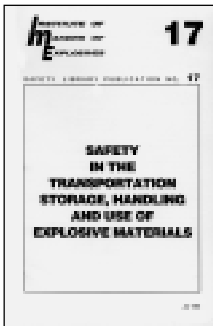
SLP 3 OPERATIONS MANAGEMENT

- Drilling, Loading, Clearing
- Blast Area Security
- Supervising of Blasting Operations
- Radio Frequency Concerns
- Ground Vibration Limitations
- Air Blast Calculation
- Scaled Distance Equations
- Flyrock Control



SLP 4 ALWAYS AND NEVER

Blast Area Security
Drilling
Handling Explosives
Assembly of Initiation Systems
Loading Holes
After Blast Procedures
Handling Misfires
Fume Control



SLP 17 MATERIAL HANDLING

Handling of Materials and Equipment
Blasting Applications and Practices
Electronic Detonator safety
Use of Initiation Systems
Ground Control of Vibration and Airblast
Shot Firing
Handling of Misfires
Fume Awareness and Control