TECHNICAL SESSION - II

ACCIDENT PREVENTION

"Research on Accident Prevention by Reinforcement of Safe Behavior" [1]

by

S. Stephen Uslan[2]

INTRODUCTION

The Occupational Safety and Health Administration (OSHA), U. S. Department of Labor, lists the shipbuilding industry as a high accident occupational area. In one publication (Occupational Hazards, April 1975) the industry is described by an OSHA official as "... a target for future compliance drives...."

Along with other industries, shipbuilders are increasingly being faced with Federal and State compliance investigations and have found wanting in hazard reduction and safety device wearing enforcement (Staff, 1975). With courts being more lenient in the number and size of monetary awards, employers are heavily relying on the enforcement of safety rules and regulations and disciplinary techniques to increase safe work behaviors. The hope, of course, is that the offending behavior will gradually be extinguished and replaced by more appropriate behaviors. The results from these attempts have been mixed: although accidents may be temporarily reduced, the injury rates still remain at an unacceptably high frequency (Sheridan, 1975). It would appear that if an increase in safe behaviors is to be obtained and sustained, the discipline model will not suffice.

The research of Skinner (1969, 1971) and his contemporaries suggest that behavior can be altered by the experimental manipulation of the consequences of that behavior of Howell (1971), Fitzgerald (1971), Scott and Rowland (1970), Uslan (1972), and as confirmed in the recent survey of W. Clay and Ellen P. Hamner (1976), first-line supervisors (whether they realize it or not) constantly shape the behavior of their employees by the

---

[1]Scientific Report: submitted to the Department of Health, Education, and Welfare; National Institute for Occupational Safety and Health.

[2]Project Director—Human Potential Development Corporation, Westlake Village, California.

way they utilize the positive rewards at their disposal. Acknowledgment of good work, occasional praise, a "pat on the back," can be very effective as reinforcers of appropriate behavior. A primary reason supervisors fail to "motivate" workers to perform in the desired manner is their failure to understand the power of social rewards on the employee (Nord, 1964).

While most of the results reported in the above studies relate to effecting increases in some productivity-related factor, there is uniform agreement that punishment—when used to effect an increase in a desired behavior—left the worker feeling coerced and controlled. The alternative, then, is to focus on what the worker does and reinforce the behavior with praise. In the positive reinforcement model, that which is done inappropriately is regarded as a training problem. The worker is told what he did correctly and what else he needs to do to have all the appropriate behaviors. There is no emphasis in the positive reinforcement model on what the worker did incorrectly: to do so would be to find fault with him. In this study, verbal praise—associated with smiles and other non-verbal communication—was the only positive reinforcement used to increase the occurrences of the desired behavior.

STUDY SETTING

The project took place at a major shipbuilding facility in the Gulf States area. The shipyard is large; more than twenty thousand workers are employed. The ships are built in modules on land, moved on rails in sections, and fitted together for launching. The work flow is unique, highly labor intensive, and controlled by management in a traditional classical style of vertical organization design; i.e. there are seven tiers of management, from the Director of Operations to the first-line superviso Management controls production through a scalar chain of command. The first-line supervisor is responsibile for day-to-day operations, individual work assignments, and material coordination. He is not responsible for scheduling, budget control, or planning. He is held accountable, on a daily basis, for his crew's ability to meet the production schedule developed by management. Management's relationship with the employees, who are representated by strong union leadership, is conducted according to contract conditions.

The workers are represented by eleven different trade unions. The Boilermakers is the largest, representing more than five thousand Shipfitters; it takes the lead in contract negotiations and operates from a position of considerable strength. Shipfitter supervisors were selected as subjects for this project and it was necessary to obtain union approval before proceeding to train them. The local union's business agent was told about the purpose of the project and was asked to report to the membership that some of them might be observed in the course of the study. No objections were raised. The business agent asked to be kept informed.

The majority of the production work is done out-of-doors. The weather in the Gulf area is seldom cold; it's often rainy, hot, and humid. The main structural parts of the ships are constructed of steel, necessitating the use of heavy equipment. The surface temperature of steel is usually five degrees hotter than air temperature; the summer temperature is 80-86 degrees. The environment, then, tends to influence workers to dress lightly and not wear protective clothing and/or devices. The importance of the environment on worker behavior was a dependent variable the researchers tracked.

The work area selected for study is the shaded area found in Figure 1. This area has the greatest concentration of workers, the highest accident/injury rate, and the greatest concentration of Shipfitter Department supervisors, the subjects for the study.

SUBJECTS

Twelve first-line supervisors were the subjects trained in the principles of positive reinforcement. Each supervisor oversees fifteen journeyman Shipfitters, three helper-combination workers, and two work leadermen (supervisor aides). Twelve men selected were among the one hundred first-line supervisors working in the subject area. They were typical of all the men: they were all former Shipfitter journeymen, were former work leadermen, and had completed approximately 80 hours of various supervisory training courses. The men ranged in age from 35 to 60; two of them (the youngest) were high school graduates, the remainder had less than an 11th grade education. The twelve supervisors worked in one cost center; i.e. they carried the same department designation. Organizationally, the hierarchy was as follows:

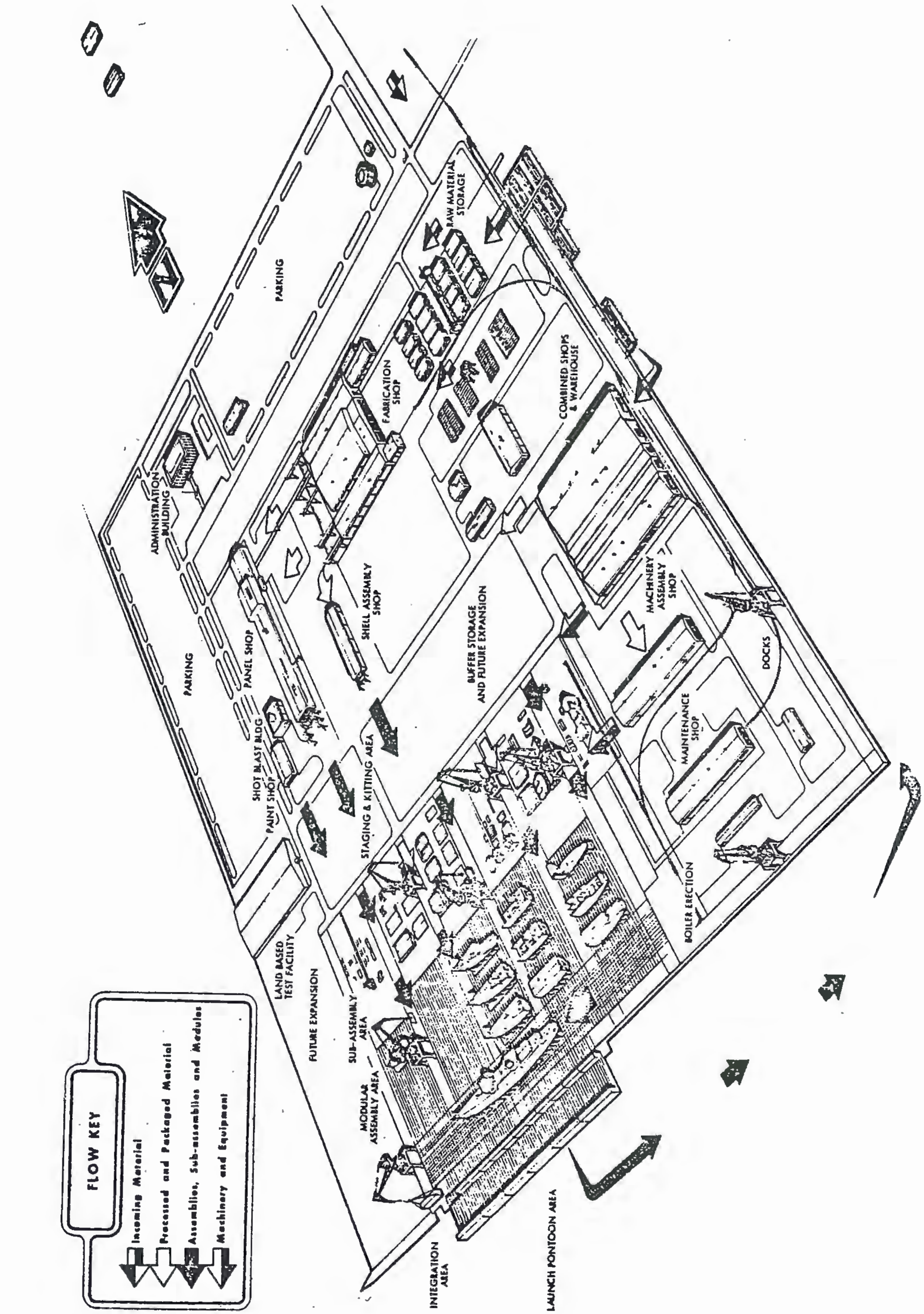
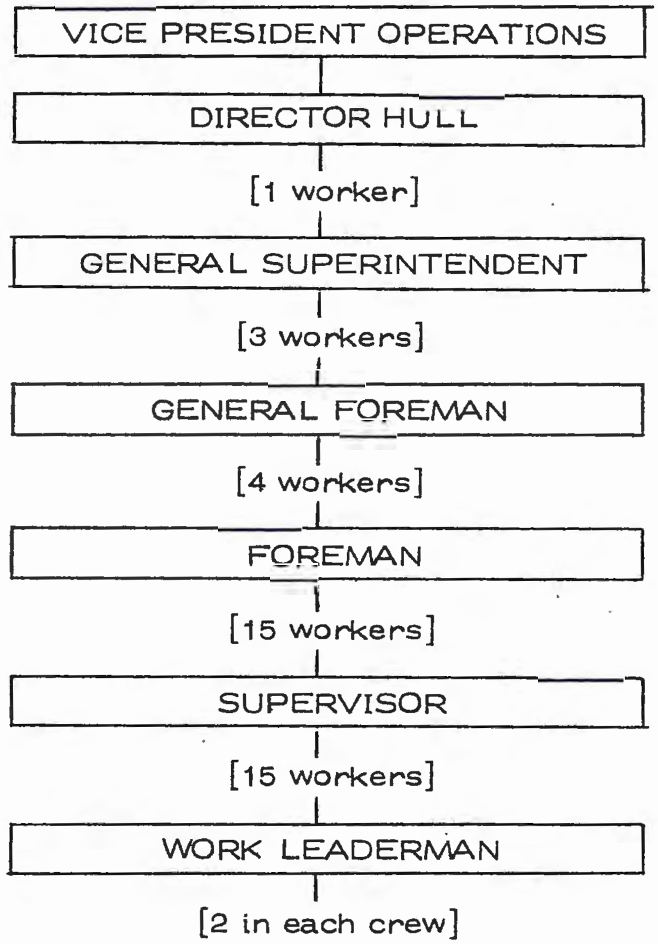


FIGURE 1. Shaded area shows work area selected for study.



By selecting one general superintendent's department we were able to obtain better cooperation, focus better control over the study, and centralize data collection.

Each of the supervisors was interviewed by the project director and was told the nature of the study, the kind of training they would receive, what was expected of them, the kinds of data they would be held responsible for, and that participation in the study was strictly voluntary. None objected: a few were concerned about the data requirement; they were assured that assistance would be given in the data collection aspect.

The volunteers had injury rates similar to the other first-line supervisors. Each had workers who suffered facial and hand burns (including eye injuries), cuts and abrasions, sprains, and muscle pulls. While one or two had slightly higher monthly rates, they could be regarded as typical. Their management regarded them as competent leaders and committed to meeting production goals. Because of their "typicalness" it was decided that any effect the training had on increasing the occurrence of safe work behaviors could be generalized to the other supervisors and to the 5, 000 Shipfitters.

DETERMINING BEHAVIORS TO BE SHAPED

The injuries occurring to Shipfitters were primarily work related; i. e. they were injured while performing a task rather than while going to or from their work site. Thus, it was necessary to perform several job task analyses to determine the physical as well as human factors associated with injuries. It was found that protective devices, such as safety glasses, hard hats, gloves, aprons, and safety shoes were not consistently worn by Shipfitters, even though clearly mandated by company policy. Observation by the project staff also disclosed that fewer than ten percent of the supervisors wore their safety glasses while on the job. Possibly, the workers were merely following the example of their superiors. It was decided that the positive reinforcement training would focus on increasing the number of times the workers who reported to the twelve supervisors wore their safety devices. If safety device wearing behaviors increased, related injuries should decrease.

POSITIVE REINFORCEMENT TRAINING

An important aspect of positive reinforcement training is being able to accurately observe behavior and record its frequency to form a baseline measurement (Uslan, 1972).

On a typical work day in the shipyard a supervisor can see his workers about three times. The workers do not work together; they perform work in various sections of ship modules under construction, and it can take up to 20 minutes to get to where a worker is. For example, it is often necessary to climb 40-foot ladders; step over, around, and under obstacles; descend ladders; stoop low while walking to clear vents, piping, and steel bulkheads. As an average, a supervisor spends no more than 15 minutes with a worker before he moves on to see the next one.

The training schedule required that each supervisor be trained individually. This was necessary at the start to test the program's content; it became a procedure to follow for the remainder of the study because it was difficult to get more than one supervisor free from his duties at one time.

Approximately four hours of classroom time were spent with each subject supervisor to explain the kinds of behavior to observe and record. Drills were held. Next, the trainer accompanied the supervisor through his actual daily activities. He was coached whenever appropriate. This phase lasted two days. The supervisor was then instructed to observe and record "wearing behavior" three times per day for three weeks. When the observing behavior became stabilized, positive reinforcement training began.

Positive Motivation Safety Training (POMOST) was 28 hours: 12 hours in a classroom setting, and 4 hours on the job for four days. Training of the supervisors began in February 1975, and continued through October 1975. POMOST, per se, began in April 1975, and continued through October 1975. Each of the supervisors of the experimental group was provided all phases of the training program. (Eight supervisors were trained by October 1975; subsequently, two dropped out of the program: one retired, and one went into the hospital for an extended period of time.)

Midway in the training program, management decided they wanted a more widespread training program. Their notion was that the program seemed to be working, and it would be unjust not to diffuse the program further. Although this would theoretically affect the experimental design, additional training was provided. In a series of after-hours training programs, eighty-two foremen, general foremen, and superintendents were given twenty hours of POMOST. However, our intent to compare trained vs. untrained crews became confounded. Thus, all crews were tracked for injury frequencies and specific comparisons were no longer possible.

DATA COLLECTION

The basic data for this study was collected through hospital logs. The main "effect" of this experiment was designed as injuries to hands and eyes. The use of hospital logs thus allowed a count of all appropriate injuries that were in fact reported. Minor injuries which were not reported to the hospital are not included in this data. Since a reduction in total injuries logically follows from a reduction in eye and hand injuries, records were also maintained of injury totals from the hospital logs.

In an attempt to measure the effect of training on the wearing of protective devices, a second set of measurements was taken. After training, observations were made of the incidence of wearing gloves and glasses for each of the eight experimental crews. These observations were recorded by two independent raters: the crew supervisor and an outside researcher. Data collection consisted of daily observations of each crew through October 1975. In addition, as a base for comparison, similar observations and recordings were made for a two-week period on an untreated crew. These were done by the researcher only, and from a distance, to reduce the effect of the observer. For all crews, observations were made at random intervals. A comparison of the wearing rates (frequency/number in the crew), although not conclusive, could serve to support and enrich the hospital log based accident data referred to above.

At the same time that the wearing of protective devices was observed and recorded, subjective assessment was made of five environmental factors which purportedly related to frequency of injuries. These were 1) noise, 2) lighting, 3) temperature/humidity, 4) housekeeping (messiness), 5) line control (loose wires and rope). The scale used was 1 = poor, 2 = average, 3 = good. When the researcher made his observations of "wearing behavior" he also assessed each of the above five variables. The general hypothesis was that injury variance would <u>not</u> be related to variance in any of the five environmental variables, but rather to the onset of training and the application of positive reinforcement.

RESULTS

The basic intent of this study was to determine whether awareness and POMOST applications led to reduced injuries. The data in support of that determination is presented in Table I.

In Table I the injuries are listed by supervisors in the training groups and by untrained supervisors, for each month beginning with June 1973 and ending October 1975. Each cell entry thus represents a hospital visit by a member of the various crews in each approrpriate time interval. It should be noted that these frequencies include all injuries and not just those that might have been prevented by the wearing of the various protective devices that were addressed by POMOST. However, if POMOST had an effect the total number of injuries should have decreased by the amount of reduction in eye and hand injuries, the major thrust of the program. Thus, for these frequencies one should not expect a precipitous reduction in injury rates.

To test whether the drop in injury rate was significantly related to training, a chi-square contingency table was developed and is presented in Table II.

Each cell contains the monthly injury rates that were above or below the median for the entire period as previously stated. Thus, there were 13 months of injuries above the median and 8 months of below-median injury rates. The chi-square value for this table is 8.02, which is significant beyond the 1 % level. It would therefore seem that reduction in injuries was related to the training program.

The basic rationale for this form of analysis was that the information and interest generated by awareness and POMOST in injuries would "spill over" to all crews. In such a setting it would be nearly impossible to keep the experimental groups pure. Thus, it was believed that the onset of the POMOST program would affect the total labor force. Further, per company requests, all the supervisors were provided POMOST instruction at the onset of the training portion of the program. This fact supports the notion that training results should not be expected solely from the experimental groups. The significant reduction in injury frequencies for the total department thus supports the hypothesis that training, both awareness and POMOST, has a desirable effect.

Related to the overall injury frequency is the frequency of injuries related to eyes and hands only, presented in Table III. In Table III each cell represents the frequency of eye and handinjuries for Department 7 personnel for the months and years indicated. These figures were derived from the hospital logs. This table roughly parallels the figures for overall injuries, e. e. heavy at the onset, a gradual leveling up to the period of training, then a post-training dip and plateau up to the close of the period. Since the first curve of overall injuries showed a significant reduction following training, the results in Table III seem to support the

TABLE I

Injury Frequencies by Month/Year

TOTAL INJURIES FOR EACH SUPERVISOR (BY MONTH)

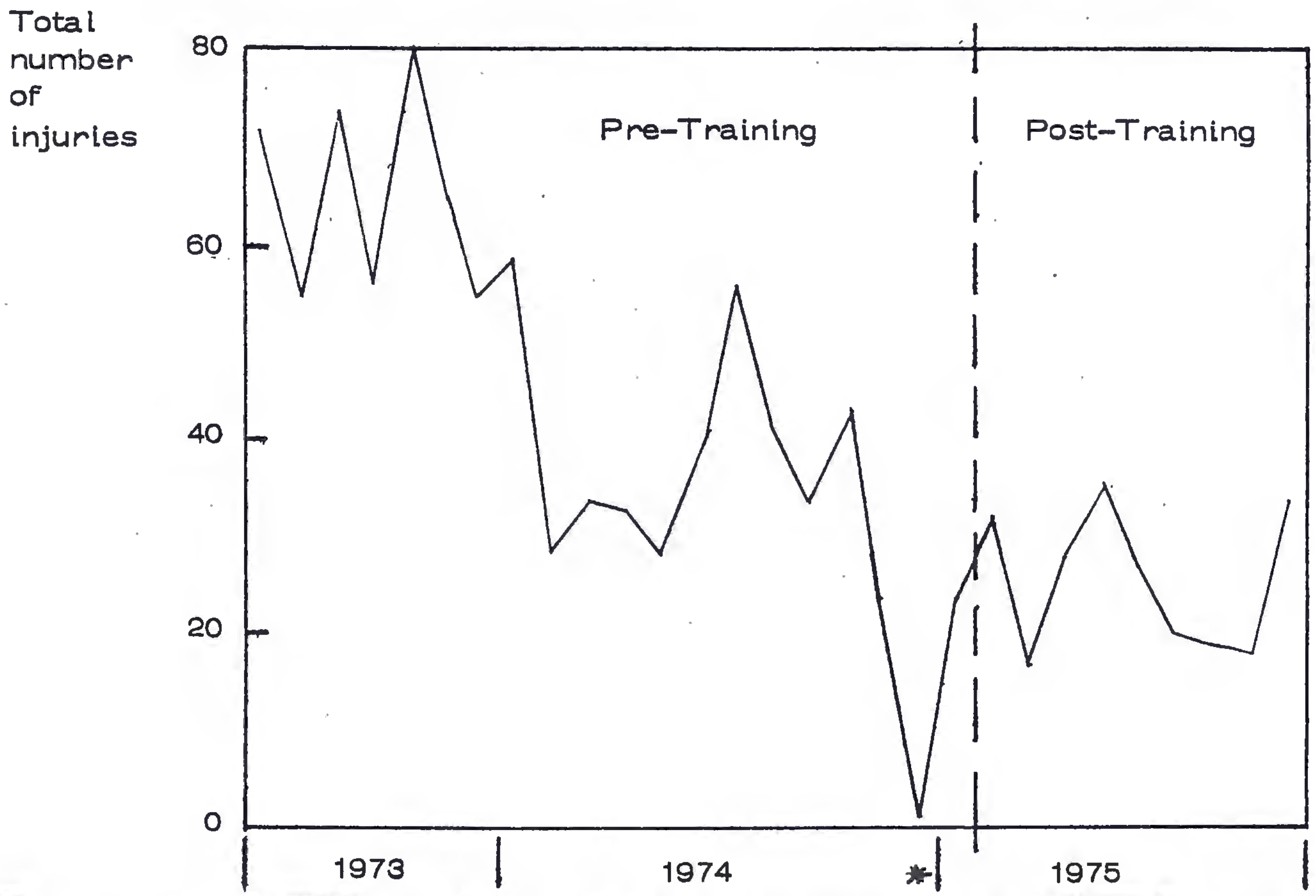
MONTH / SUPV.	6/73	7/73	8/73	9/73	10/73	11/73	12/73	1/74	2/74	3/74	4/74	5/74	6/74
02	3	2	3	1	1	2	5	2	–	–	–	–	2
05	8	2	10	4	5	3	1	2	1	1	1	2	3
06	4	3	3	1	2	1	1	–	–	1	1	–	–
08	3	4	4	4	6	–	4	7	4	4	2	3	3
22(#55)	5	3	8	5	13	9	7	4	7	2	4	3	5
29(&44)	–	1	1	2	4	3	4	6	1	–	3	5	8
OTHER	49	40	45	39	49	47	34	38	16	26	22	15	22
TOTAL INJURIES BY MONTH	72	55	74	56	80	65	56	59	29	34	33	28	43

MONTH / SUPV.	7/74	8/74	9/74	10/74	11/74	12/74 ①	1/75	2/75 ②	3/75	4/75	5/75	6/75	7/75	8/75	9/75	10/75
02	–	1	1	–	2	–	1	2	2	1	3	1	1	–	–	2
05	4	3	1	2	–	1	1	2	1	1	2	–	1	–	–	3
06	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	2
08	2	8	6	4	2	–	3	3	1	4	2	1	7	3	3	2
22(#55)	10	7	2	3	1	–	4	1	–	4	4	4	3	1	–	–
29(&44)	6	3	3	4	1	–	–	2	2	2	3	6	1	2	–	2
OTHER	33	20	21	30	19	–	16	22	10	16	21	15	7	13	15	23
TOTAL INJURIES BY MONTH	56	42	34	43	25	1	25	32	17	28	35	27	20	19	18	34

① SHIPYARD CLOSED ② START OF TRAINING

TABLE I a

Graph of Table I



Month	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
Total Number Of Injuries	72	55	74	56	80	65	56	59	29	34	33	28	43	56	42	34	43	25	1	25	32	17	28	35	27	20	19	18	34

* Shipyard Closed

TABLE II

The Relationship of Injury Frequencies
Before and After Training

	ABOVE MEDIAN	BELOW MEDIAN	
BEFORE	13	6	$X^2 = 8.02$
AFTER	1	8	

TABLE III

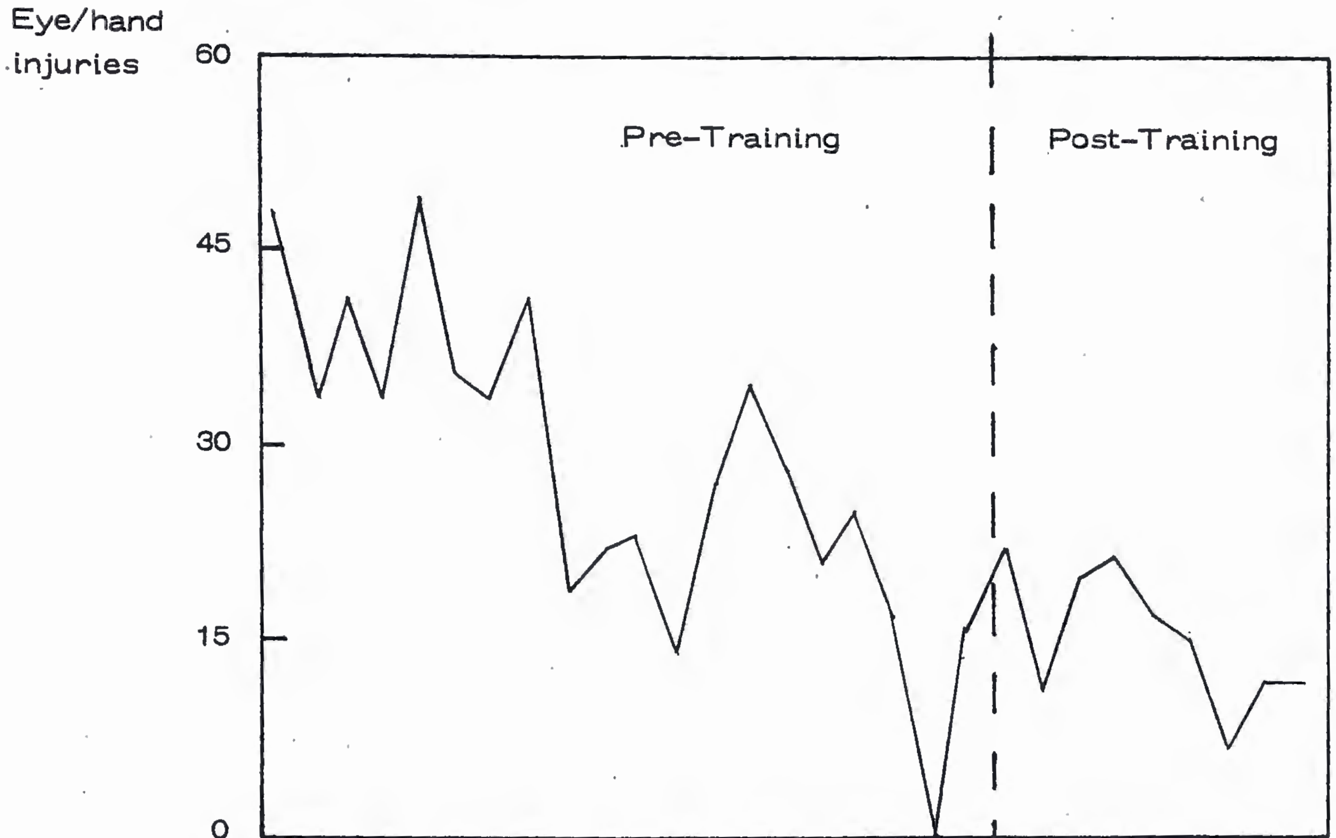
Eye/Hand Injuries by Month

MO./YR.	6/73	7/73	8/73	9/73	10/73	11/73	12/73	1/74	2/74	3/74	4/74	5/74	6/74	7/74	8/74	9/74	10/74	11/74	12/74 ①	1/75	2/75 ②	3/75	4/75	5/75	6/75	7/75	8/75	9/75	10/75
FREQ.	48	34	41	34	49	36	34	41	19	22	23	14	27	35	28	21	25	17	–	16	22	11	20	22	17	15	7	12	12

① SHIPYARD CLOSED ② START OF TRAINING

TABLE III a

Graph of Table III



	1973							1974											*	1975									
Month	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
Eye/Hand Injuries	48	34	41	34	49	36	34	41	19	22	23	14	27	35	28	21	25	17	–	16	22	11	20	22	17	15	7	12	12

* Shipyard Closed

contention that the overall curve would be affected by the POMOST concentration of eyes and hands injury prevention. Table III a, the graph of Table III, more dramatically demonstrates the gross change as a result of the training program.

The data was also subjected to a chi-square analysis. The results appear in Table IV.

TABLE IV

The Rates of Eye and Hand
Injuries as a Function of Training

	ABOVE MEDIAN	BELOW MEDIAN
BEFORE	13	4
AFTER	0	7

$^*X^2 = 11.71$

*Significant beyond .001

The cell frequencies for Table IV were derived from the monthly injury totals in Table III. The number of months below and above the median for the pre- and post-training periods were tabulated in appropriate cells. The resultant chi-square value as 11.71, well beyond the .001 level of significance. It may thus be concluded that a strong relationship exists between training and the incidence of eye and hand injuries. It would therefore seem that awareness and POMOST introduction in February 1975 led to a significant reduction in eye and hand injuries as determined through hospital visit logs. Insofar as the training program concentrated on the wearing of protective glasses and gloves, one could assume that the crews increased their use of the protective devices and thereby reduced the incidence of injury.

A close look at before/after injury frequencies in Table I reveals that the entire set of Shipfitters was on a downward trend irrespective of training. Accordingly, an interpretation of the obtained results in Tables II and III could be that the rate would have dropped even if there were no training. Since, as previously discussed, all the crews were apparently aware of training, none could be singled out as a control for the avove interpretation. However, the Riggers and Carpenters each had starting injury frequencies close to the Shipfitters, and could possibly serve as a comparison group. Consequently, the eye/hand injuries were tabulated for a one-year pre-training period and the same nine-month post-training period as the experimental groups. These were then placed in a chi-square contingency table, similar to Table IV.

TABLE IVa.

The Rates of Eye/Hand Injuries for Riggers and Carpenters (Comparison Group) as a Function of Training

	ABOVE MEDIAN	BELOW MEDIAN
BEFORE	3	7
AFTER	6	3

$X^2 = 2.57$

A X^2 of 2.57 was not interpreted as significant. Therefore, it would appear that no relation exists between training and injury reduction in the comparison group. Thus, the downward trend in injuries at the shipyard seems to be more related to training in the experimental group than other uncontrolled factors. The logical question becomes why did the downward trend continue for the experimental crews and not for the comparison crews as well. Since the crews began with similar rates and ended with different rates, the answer seems to be related to the effects of training.

The above assumption, i.e. incidences of wearing protective devices increased after the training cycle, was also subjected to test. Each experimental (trained) crew was observed daily by both the supervisor and by an outside researcher. In addition, a control group (untrained) was observed for a period of two weeks, and served as a comparison base. It should be noted that no measures of the wearing of these devices occurred during the pre-training phase of the study. Consequently, no determination of the increase in their use was possible. Table V contains this data.

TABLE V

The Incidence of Wearing of Glasses and Gloves in an Experimental and Control Group as Observed by the Supervisors and Researcher

	EXPERIMENTAL GROUP %		CONTROL GROUP %	
	SUP/RES GLASSES	SUP/RES GLOVES	SUP/RES GLASSES	SUP/RES GLOVES
CREW #				
1	80/59	96/90	65	38
2	87/81	68/73		
3	39/58	47/70		
4	87/72	98/88		
5	89/92	86/99		
6	76/76	92/100		

Table V contains the rates of wearing of devices by crew as recorded by two independent observers. The rates in percentages represent the mean of all observations for each crew. As previously discussed, the control group was observed unobtrusively for two weeks, and their rates are also the mean incidences for that period. If both observers' results are viewed together and compared with the control group, it is obvious that 9 of the "glasses" observations were above that of the control and 3 were below. For "gloves" all 12 of the measures were above the mean of the control. It would therefore seem that the training program did, in fact, lead to a higher incidence of wearing of the protective devices stressed in the training program. One can intuitively assert that if workers increase their use of glasses and gloves, injuries should decrease proportionately. The results of the analysis of eye/hand accidents in Table IV tend to support that notion.

Within the experimental group an attempt was made to determine whether a relationship existed between total accidents after the training period and subjective measures of various environmental variables. The variables in the environment selected for measure were:

1. Housekeeping - how messy was the area;
2. Line control - the prevalence of cables and lines;
3. Heat - temperature/humidity;
4. Noise - amount of noise adjacent to work;
5. Lighting - amount of illumination in work area.

At the time the researcher made each observation on the wearing of protective devices he also rated each of the above variables either good, average, or poor. Each of these was averaged for the month and were then correlated to the injury rate for the month. Table VI contains these results.

TABLE VI

*Correlation Between Measures of Five Environmental Variables and Total Injuries by Month, by Supervisor

	CORRELATIONS PER SUPERVISOR NUMBER				
	05	08	13	29	06
Housekeeping	.35	.32	—	.48	.67
Line control	.40	.00	—	.36	.20
Heat	—	.10	—	.60	.20
Noise	—	.24	—	.39	.04
Lighting	.17	.20	—	.20	.17

*Pearson Product-Moment

As can be seen from Table VI, the correlations ran from 0. 67. The small number of degrees of freedom does not allow for an interpretation of significance for any of the correlations. Thus, it is not possible to make an assertion of any relationship between any of the five environmental variables and total injuries within any of the experimental crews. One of the factors influencing the relatively small size of the obtained correlation coefficients was the low number of injuries in the various work crews following training. A low injury variance obviously leaves little for which to account. Should injuries increase and vary over the remainder of the study, a possibility then exists for obtaining significant relationships.

As previously interpreted however, injuries are not explainable by the five environmental variables. This finding lends some support to the notion that injury variations are more explainable by the POMOST program than by other variables. That is, observed reductions in injuries are related to training and wearing of protective devices, and are not dependent upon other external conditions.

CONCLUSION

An important hypothesis of Skinner's work is that the subject's environment can both cue and reinforce his behavior. To understand the implication of this relationship, the term "environment" has to be defined subjectively: It is anything at the workplace the worker is aware of, or thinks he is aware of, that can have an effect on him. Whether that environment has any real substance of its own does not really matter. If a worker perceives that management's actions are punitive, non-supportive, indifferent, or the opposite, it is real to the worker.

Because of the difficulty in tracking any specific management action as it transects the chain of command, the full impact of an order such as "all workers must wear their safety glasses...or else" cannot be accurately determined. While management's intent is to have a concerted drive to try to reduce the number of eye injuries, the way it "comes across" is subject to an interpretation by each tier of management.

For example, the director of Operations might say to the director of the Hull Department, "starting tomorrow, let's see if we can get everyone—including the supervisors—to wear their safety glasses." The order is specific and the intention is free of dire consequences. Each level of management passes down the directive, perhaps embellishing it with more inferred authority. The workers, many of whom have been conscientiously wearing their safety glasses, hear the threat and feel that management is not aware of what is going on. Because he feels he can do little to make management aware and appreciative of his own personal desires to work safely, the worker's strategy is to make the best of an unkind fate and to forego any illusions of trying to change his environment. Much labor/management conflict results from failure to realize that the other fellow often operates under a different set of rules. It would appear that there is an underlying order to worker behavior on the job: people constantly seek to serve their own best interests; but because they do not share a common belief in what is "best procedure" or "for their own good," they define their best interests in a variety of ways. For most, getting management to do what they want is accomplished at the bargaining table. Others feel that given the chance, they can show management that they are all working toward the same goal. It may be that a worker behaves appropriately when he feels that he has control over the events that affect him and/or he considers the rewards worthwhile.

This is the phenomenon on which so many well-intentioned and carefully prepared safety campaigns have foundered. Management cannot assume that its view of the environment (one free of accidents and injuries) will occur because it posts a caricature of a worker foolishly stumbling over a ladder, or that workers will "do the job correctly" because slogans appear on posters. Although this seems self-evident, it is, nonetheless, not yet widely accepted in this shipyard. Management, with its bird's-eye view of the organization, can easily misjudge the perspective from which the individual employee, with his worm's-eye view of the same organization, will judge its actions. If management is to create a safe environment it must do so from the worker's point of view.

The researchers' findings did not indicate that the shipyard top management regards the employees as stupid, ignorant, childlike, or inept; yet there were times when corrective action to effect change, taken by middle and lower management, gave such an impression. Rather than resulting in the behaviors sought, the action had no effect...the workers behaved as before. The failure of management to clearly explain its intentions or convincingly deliver its message is not as much a fault of organizational structure as it is a lack of trained supervisors. But more than that is at fault. Everyone's position in the power hierarchy and functional role will influence their view of the organization, their view of their work environment, and also their opinion of how the organizational should be run. The typical top manager is educated, experienced, and sophisticated; his view of the organization is broadly based and lacks specifics. As the hierarchial pyramid widens to its base (the chain of command) the workers at each level have increasingly parochial views. In other words, there are many competing schools of thought within the organization as to what its mission is, what its relationship to the workers should be, and how to best motivate the workers. The first-line supervisor, lacking the experience and perceptions of top management, does the best he can with what he is told.

Regrettably, the end result of this is often the use of the "or else" method of control (a method researchers reported being used before the training). All things being equal, workers will be primarily motivated by what their future holds for them: they will be quite tolerant of the present provided their hopes are bolstered by occasional evidence that their future will be worth the aggravation.

Taking away the worker's future by threatening his employment results in a demoralized employee who will become intolerant of the present, finding fault with the trivial as well as with the substantial aspects of his daily life. If he happens to be an aggressive person he may tell others of his dissatisfaction with his supervisor and become, in effect, an agitator; even if he is less vocal he will be no easier to get along with an will work only as safely as he must to keep his job.

If we can assume that most men's working careers last about forty-five years (from 20 to 65), then each passing year is judged by how it produced the rewards sought. The average age of the supervisors was thirty, the workers thirty-five; these are the years during which most men reach their pinnacle of achievement, if there is to be one, or during which it becomes clear that their expectations are not going to be realized. The limits of possible attainments become more clearly defined, and it is no longer realistic to cling to dreams that have not begun to be realized. These are the showdown years in which rewards are reaped or written off.

The morale of men in this age group is usually determined not so much by what they have actually achieved as by a comparison of their attainments to their earlier expectations. If the present includes praise for a good job, there is still hope. If management fails to understand that its employees want recognition on an individual basis, it takes away hope and offers dispair. If there is no priase, no recognition, no sense of achievement, there is no hope that tomorrow will be any better than yesterday or today. If a worker feels he has no future working for a supervisor then he can at least have the satisfaction of not wasting any extra effort to help him build his.

Praise, therefore, can act as a two-way street toward building an environment that facilitates change. It must start with top management praising the chain-of-command for its successes and giving clear instructions to each level in how to create a safe job site. The safety literature accurately and adequately emphasizes the first-line supervisor's role in job safety. But the importance of top management's role, though implied, is seldom specified.

There is still much research needed before we are fully able to understand the variables in the workplace that affect safe behaviors. It is time that management's interactions are investigated for their cause and effect.

REFERENCES

Fitzgerald, T. H., "Why Motivation Theory Doesn't Work," Harvard Business Review, Vol. 40, No. 4 (1971), pp. 37-44.

Hamner, W. Clay and Ellen P., "Behavior Modification on the Bottom Line," Organizational Dynamics, American Management Association, Spring 1976, pp. 2-21.

Howell, M. A., "Time Off as a Reward for Productivity," Personnel Administration, Vol. 34, No. 6 (1971), pp. 45-51.

Nord, W. R., "Beyond the Teaching Machine: The Negative Area of Operant Conditioning," The Theory and Practice of Management, Organizational Behavior and Human Performance, 1964, No. 4, pp. 375-401.

Scott, W. E. and K. M. Rowland, "The Generality and Significance of Semantic Differential Scales and Measures of Morale," Organizational Behavior and Human Performance, Vol. 5 (1970), pp. 560-591.

Sheridan, Peter J., "1970-1976 American in Transition - Which Way Will the Pendulum Swing: Evolution of America's Industrial Safety Movement," Occupational Hazards, Industrial Publishing Co., September 1975.

Skinner, B. F., Contingencies of Reinforcement: A Theoretical Analysis, New York, Appelton-Century-Crofts, 1969.

____________, Beyond Freedom and Dignity, New York, Bantam Books, 1971.

Staff, "Job Safety and Health," U. S. Department of Labor (OSHA), September 1975, Vol. 3, No. 9.

Uslan, S. S., "Operation Pathfinder: Use of Positive Reinforcement to Shape Work Behaviors," Final Report, U. S. Dept. of Labor, Washington, D. C., 1972.

August 31 and
September 1-2, 1976

SEVENTH ANNUAL INSTITUTE ON COAL MINING HEALTH, SAFETY & RESEARCH

PROCEEDINGS 1976

Center for Continuing Educatio
VIRGINIA POLYTECHNIC
INSTITUTE and
STATE UNIVERSITY
Blacksburg, Virginia

COAL MINING HEALTH, SAFETY & RESEARCH

Co-sponsored by:

MINING ENFORCEMENT and SAFETY ADMINISTRATION

UNITED STATES DEPARTMENT of the INTERIOR
BEREAU of MINES

DEPARTMENT of MINING and MINERALS ENGINEERING
VIRGINIA POLYTECHNIC INSTITUTE and STATE UNIVERSITY

Proceedings edited by:
DR. WILLIAM E. FOREMAN
Associate Professor

DEPARTMENT of MINING and MINERALS ENGINEERING
VIRGINIA POLYTECHNIC INSTITUTE and STATE UNIVERSITY
Blacksburg, Virginia