JOM
August, 1985 Vol. 27, No. 8

Psychology in Health Risk Messages for Workers

Alexander Cohen, Ph.D.; Michael J. Colligan, Ph.D.; and Philip Berger, Ph.D.

The content, style, and mode of company communications directed to workers regarding job hazards and health risks are frequently based only on concerns for technical accuracy and legal liability. These considerations as shaping factors in informational messages do not ensure worker understanding and responsiveness. Moreover, the uncertainty of health threats posed by many workplace chemical and physical agents, and the delayed, insidious disorders they may portend, present formidable obstacles in this regard. This report describes guidelines that attempt to overcome these difficulties, with specific reference to printed forms of informational material. The guidelines are based on concepts from the cognitive and social psychology literature, with additional input from experts in those fields as well as representatives from management and labor who have responsibilities for worker health education in their respective organizations. Selected guidelines are presented and critiques are offered of samples of hazard information materials directed to workers in light of the guidelines' prescriptions. Field trials are planned as a follow-up.

Informing workers of occupational hazards and health risks has both a legal and ethical basis. For example, provisions of the Occupational Safety and Health Act of 1970 dictate that employees be apprised of any toxic hazards in their work environment that are regulated by federal standards.[1] More recent directives require that the manufacturers of chemicals known to be toxic develop a hazard communication plan to ensure the disclosure of information to their employees (and downstream users) regarding the apparent hazards and steps needed for protection.[2] Minimum elements of such plans are to include hazard labels and material safety data sheets on the chemicals in question and training.

Giving impetus to this new federal rule are right-to-know ordinances enacted in many states and municipalities that direct employers to make workers aware of any known or suspect health hazards connected with their jobs.[3-6] Although a preemption provision is included, it remains to be seen whether the new federal hazard communication requirements will allow the state and/or local ordinances to stand, some of which are stricter or more health protective in design.[6,7]

In discussing issues of informing workers about occupational cancer, the National Academy of Sciences in 1977 agreed that the workers' right to know the risks in their jobs met a fundamental ethic in our society.[8] It acknowledged that those possessing knowledge about health threats have an obligation to impart it to those who stand to be most affected. In actuality, this duty to inform has become the cornerstone of the new field of toxic tort law, the courts holding the risk generator responsible for duly informing those who must bear such risks. A major difficulty has been to define what findings of fact are needed for triggering the duty to warn and what kind of warning is sufficient.[9] Current tort law provides for qualitative criteria only, the general standard being one of "reasonableness." In this regard, courts have required manufacturers of products known to have toxic properties not only to apprise those exposed to the potential risk but also to inform them of appropriate safeguards. Generally, the warnings must be complete, timely, and well communicated to satisfy the reasonableness criterion.

Communications about hazards and health risk present difficult problems. Typically they involve probabilistic rather than certainty information, for which members of the public have little appreciation.[9,10] Complicating matters can be cautions about the data base or even different interpretations of the data by the experts, yielding disparate conclusions about the likelihood of an adverse outcome. As a consequence, controversial scientific knowledge may be put on an equal footing with popular beliefs, inviting more speculation and insecurity. To most persons, risk statements framed in terms of "statistical lives affected" or

From the Applied Psychology and Ergonomics Branch, Division of Biomedical and Behavioral Science, National Institute for Occupational Safety and Health, Cincinnati (Drs. Cohen and Colligan); and the James W. Martin School of Public Administration, University of Kentucky, Lexington (Dr. Berger).

Address correspondence to Applied Psychology and Ergonomics Branch, Centers for Disease Control, National Institute for Occupational Safety and Health, 4676 Columbia Pkwy., Cincinnati, OH 45226 (Dr. Cohen).

"average" social costs and benefits are not meaningful; they prefer to have their concerns addressed in more individual, personal terms. Technical analysis, too, may be expressed in quantitative terms or language not readily interpretable by the target group.[11,12] The complexities can be further aggravated should there be a sense of mistrust between the source or communicator of the information and the recipient group.[13]

These and other problematic factors indicate the complexities of the risk communication process, reflecting elements of perception, learning, attitude formation, and cultural or contextual influences. The latter considerations have common roots in cognitive and social psychology, for which there is an expansive literature that could provide insights and suggestions for improved construction and transmittal of risk information. This is the essential aim of this report.

Informing workers of workplace hazards and health risks has not been a high-priority matter for occupational health and safety professionals. For example, Corn[14] states, "Although now obvious to many, only 10-20 years ago the prevalent philosophy was that managers be knowledgable regarding occupational hazards and utilize their authority to compel employees to follow safe procedures without unnecessarily alarming workers by informing them of the risks being addressed." Basic texts on occupational medicine and industrial hygiene do not include chapters on or significant mention of suitable communication of hazards to workers. In fact, the 1958 edition of Patty's *Industrial Hygiene and Toxicology*,[15] used to train a generation of industrial hygienists, specifically warns the hygienist against giving any impression that harmful materials may be present in the work environment under study. While occupational health and safety professionals have now come to recognize the importance of risk disclosure, they still would appear to lack training and practical experience in optimizing the hazard communication process.[16] Under the circumstances, it is perhaps understandable that decisions regarding the content, style, and mode of communication directed to workers on workplace health and safety in many cases are based solely on concerns for technical accuracy and legal liability. Indeed, there is the contention that legal departments in many establishments determine the form in which such information will be transmitted to workers to avoid possible litigation. Technical and legalistic references as the primary shapers of information materials directed to workers regarding suspect carcinogens, toxins, and other hazards in their jobs would not ensure their being assimilated and understood by the target group at risk. Clearly, other communication factors need to be considered in achieving this objective.

Recognizing this need, a project was undertaken in the National Institute for Occupational Safety and Health (NIOSH) to develop guidelines for designing health risk messages that could (1) have a high potential for increasing worker assimilation and understanding of the job hazards and risks, and that would, in turn, (2) promote the adoption of safe work practices intended to reduce such threats. These guidelines were seen as aids to health and safety practitioners responsible for activities intended to inform workers of workplace hazards or others having tasks of drafting health and safety communications to workers.

In defining the scope of the project it was decided to focus on printed materials used to communicate information about workplace hazards and control measures and to consider only those of expanded text (e.g., safety and health guides, pamphlets, newsletters, and alert bulletins), as distinct from briefer forms (e.g., hazard labels and posters). While they lack the glamour of other media and the intimacy of face-to-face interaction, printed messages remain the most convenient, practical means for informing workers on health and safety concerns as well as other employment issues. Printed matter also gives workers a source of information for easy referral.

A second restriction was that the guidelines were to address those workplace hazards posing chronic types of health problems. Typically, these outcomes are produced by long-term exposures to toxic chemicals and harmful physical agents, and their insidious, delayed onset presents formidable obstacles to effective health risk communications.

Methodology

The plan for this project envisioned the following steps:

1. Formation of an advisory panel that included outside scientists with specialty knowledge bearing on communications and health issues. There were four such specialists whose expertise spanned areas of risk perception, behavioral medicine, reading education, and organizational psychology. A first task for each of these experts was to submit a review paper highlighting critical elements and considerations in designing effective health risk messages from their particular perspective.
2. Obtaining reactions to these inputs from four other panel members consisting of management and union representatives responsible for health education functions in their respective organizations. A first set of ideas for the proposed guidelines resulted from this process.
3. NIOSH staff elaboration of these ideas, drawing on the relevant literature and examinations of samples of printed materials used in industry for hazard communication purposes, to make a case for their use as guidelines.
4. NIOSH staff formulation of a set of draft guidelines based on the panel outputs and subsequent review work.
5. Circulation of the draft guidelines for reaction by the advisory panel and revision of them in accordance with comments received.
6. Field trials to apply and test the guidelines in work establishments so as to evaluate their merits.

This project has reached the stage where a set of guidelines now exists that reflects reactions from the advisory panel. Their nature will be described in this report. Copies of the guidelines themselves are available from NIOSH at the address indicated. One purpose of this presentation is to make the guidelines known to potential users and to invite them to consider cooperative work with NIOSH in trial applications to their informational programs and materials. This would constitute the last step in this project undertaking.

Nature and Organization of Guidelines

A set of 14 guidelines emerged from the process just described. These guidelines are listed in Table 1, arranged

by category with respect to their subject matter. The first two guidelines offer some orientation and perspective to the role of health risk messages in fulfilling occupational health and safety needs. Guideline 1 addresses the issue of the workers' right to know workplace hazards and the employer's duty to disclose such information. Suggestions to inform workers commensurate with the state of evidence available about real or suspect hazards are also mentioned. Communicating job risk information to workers at the point of job entry or even prior to the job assignment is emphasized but complicating factors are noted in this regard.

Guideline 2 recognizes that these informational efforts, however effective, can only complement but not substitute for other prescribed health and safety measures such as engineering controls, environmental monitoring, inspections, and record-keeping. Moreover, health risk messages need to be woven together with other communication activities such as hazard labeling, use of posters, and training to realize mutual reinforcing effects.

For health risk communications to be maximally effective, they must be tailored to the informational needs and characteristics of the target audience. This is the essential theme of the three guidelines in the category of background preparation. It is recognized that, before any message is prepared for a group of workers at risk, efforts should be made to determine (*a*) their existing level of knowledge (or misinformation) about the workplace hazards in question, (*b*) their perception of the hazard in terms of the everyday performance of their jobs and the benefits of protective measures to reduce the risk, and (c) factors such as level of education, age, and length of job service that could affect their understanding or acceptance of the message to be developed.

The seven guidelines in the content/structure category deal with the composition of the message once the preparatory work has been done. These guidelines consider topics of (*a*) the credibility of the message source and the perceived expertise and trustworthiness of persons and organizations involved with the health hazard concerns, (*b*) the giving of particularity to job operations, workplace locations, and exposure factors presenting the greatest hazard, (c) the use of imaginable, meaningful terms to describe the nature of the hazard and risk estimates, , (*d*) the effective use of fear/arousal in messages to motivate interest and action, and (e) ways for organizing the message and choice of language expected to increase understanding.

In the delivery category, the first guideline stresses the use of multiple messages at intermittent intervals rather than mass single-dose transmissions for more effective reception. The second recommends that all available channels in the information network be exploited to reach the target worker group. Worker-directed messages reinforced by similar communications delivered through persons in complementary or supportive roles (e.g., foreman, union representative, and higher management), including the family, are considered among the more potent options.

Evaluation guidelines emphasize that efforts intended to inform workers about workplace hazards and to promote protective actions must include some form of assessment to determine if the communication is having its desired effect. Before-after comparisons of worker reactions to such information, their knowledge of the hazards, and their conformance with safe work practices could dictate needs for messages, changes, or other strategies to attain a more successful result. Indicators suggested for evaluation include scores achieved on a quiz, the number of requests for added information, and behavior sampling for specific work practices or use of personal protective equipment. Less obtrusive measures are also noted in verifying the impact of a communications program. For example, in addition to monitoring respirator wear in specified situations through behavioral observations, one could look at the frequency of filter replacements or check purchase

Table 1 — Listing of Health Risk Message Guidelines by Category

Orientation and Perspective	
Guideline 1:	Acknowledging workers' right to know workplace hazards and risks and needs to disclose such information
Guideline 2:	Integrating health risk messages with other informational/educational activities aimed at promoting workplace health and safety
Background Preparation	
Guideline 3:	Establishing target work group's level of knowledge about workplace hazards
Guideline 4:	Ascertaining target group's perceptions of hazards in everyday operations and appreciation of protective measures to reduce risks
Guideline 5:	Fitting messages to the demographic make-up of the target audience
Message Content/Structure	
Guideline 6:	Designating credible sources information
Guideline 7:	Identifying high-risk jobs, operations, or work conditions with particularity
Guideline 8:	Balancing fear arousal in hazard messages with actions that can control risk
Guideline 9:	Making delayed, insidious health threats more imaginable
Guideline 10:	Enhancing the meaning of quantitative measures of health risk
Guideline 11:	Structuring messages to stress main points and using expressions familiar to the target group
Delivery	
Guideline 12:	Using multiple messages, varying in form and presented intermittently rather than mass single-dose communications
Guideline 13:	Directing messages through as many channels of the existing social/communications network as is feasible
Evaluation	
Guideline 14:	Providing means for evaluating the effect of the message in meeting its intended goals

records for such items. If workers are, in fact, wearing their respirators more often as a result of a health risk message, an increase in filter usage would be expected.

Guideline Format

Each guideline is written as a prescriptive statement, defining a factor or element believed to be important in preparing effective health risk messages and noting how it could be implemented. There follows a digest of relevant research findings or other rationale in support of the guideline and a list of key references. The supporting material acknowledges studies involving informational approaches to gaining audience responses to a variety of subjects, many not related to occupational hazards or worker health risks. Reactions to different forms of advertisements, understanding of packet inserts in medicines, reactions to antismoking messages and those intended to promote automobile seat belt use, and participation in vaccination programs reflect the diverse nature of the literature consulted for this purpose. Panel members decided which factors are applicable to health risk formulations for the workplace.

For purposes of illustration, guideline 5, from the background preparation category, reads as follows:

> *Guideline #5: Describe the general sociodemographic make-up of the target worker group in order to design a message which they can read and understand easily. Among the important factors to be considered would be educational level, job experience, sex and age characteristics, hazard exposure history. Information on these factors could be gathered through examination of company records, personnel statistics, questionnaire surveys and interviews.*

The supporting statement for this guideline acknowledges that receiver or audience factors can significantly influence the interpretation and acceptance of a message. For example, long-range health problems or premature death may not be very threatening to young workers but may be a concern to older ones. Similarly, workers with previous knowledge of or experience in working in a hazardous environment might hold beliefs different from those of new workers and have different informational needs about health risks.

As noted in the guideline statement, data about the sociodemographic characteristics of the target work force could be gathered in a number of ways, including questionnaires, examinations of personnel data, or meetings with workers. With regard to the latter approach, involving workers in the preparation of a message has the advantage of enhancing their responsiveness to its later issuance.

Fig. 1 presents guideline 6, including the prescriptive statement, supporting material, and reference list. The other guidelines were similar in style of presentation.

Select Guidelines and Applications

Capsule summaries of several other guidelines and illustrations of their application, in evaluating sample messages being used for informing workers about workplace health hazards and risks, are described in this section. (The sample exhibits presented in this section are in-

GUIDELINE #6 *Sources of health hazard and risk data used in constructing the messages must be credible to the target group of exposed workers. Expertise and trustworthiness are critical to this perception. Credible sources may include Governmental agencies charged with protecting worker health and safety, recognized national and international bodies of health researchers and industrial hygienists. Within the work establishment, credible sources may include health and safety committees or company and union health professionals. Local conditions may dictate other forms of attribution or need for endorsements.*

Supporting Material

Research in the attitude change literature, in general, and that focussed on health risk issues, in particular, indicates that source credibility can be an important factor in shaping audience response to persuasive messages (McGuire, 1969, 1980; Eagly and Himmelfarb, 1968; Cialdini, et. al., 1981). Experiments testing the effects of such factors as source knowledge, experience and/or objectivity towards the information were found to alter the opinions and learning of the audience. The thrust of these findings was that the sources perceived as having more expertise and less to gain from the audience being persuaded caused the most response shifts in the direction of the message's appeal. Information stemming from research scientists and health professionals in governmental programs directed to occupational health and safety concerns would appear to embody these elements though public confidence may not necessarily be high in government officials in general. The company as the composer or originator of material identifying hazards in working conditions can have difficulty in assuring credibility. As they are not a disinterested party to the intent of the message, their communications raise questions about full, factual disclosures. Health risk information representing joint communications from company management and worker interest groups may ease this doubt. For a detailed summary and analysis of source credibility factors in communicating information, see McGuire (1969; 1980). Health risk messages to workers could use issuances, directives, bulletins from the Occupational Safety and Health Administration, National Institute for Occupational Safety and Health, National Toxicology Program, the International Agency for Research on Cancer, the American Conference of Governmental Industrial Hygienists as the basis for defining particular hazards found in their work environs. Joint company/union composed literature referencing the above could serve this purpose within the work establishment.

Key References

Cialdini, R.B., Petty, R.E. and Cacioppo, J.T. Attitude and attitude change. In: *Annual Review of Psychology 32*, 1981.

Eagly, A.H. and Himmelfarb, S. Attitudes and opinion. In: *Annual Review of Psychology 29*: 517, 1978.

McGuire, W.J. Attitudes and Attitude Change. In Handbook of Social Psychology (Eds. G. Lindzey and E. Aronson) 2nd Edition, Addison-Wesley Publishing Co., Reading, Mass. 136, 1969.

McGuire, W.J. The communication-persuasion model and health risk labeling. In Product Labeling and Health Risks, (Eds. L. Morris, M. Mazis, I. Barofsky) Banbury Rept. No. 6. Cold Spring Harbor Laboratory, Cold Spring Harbor, New York, 1980.

Fig. 1 — Reproduction of guideline 6 showing format. Prescriptive statement, supporting material, and list of references followed this style for all the guidelines.

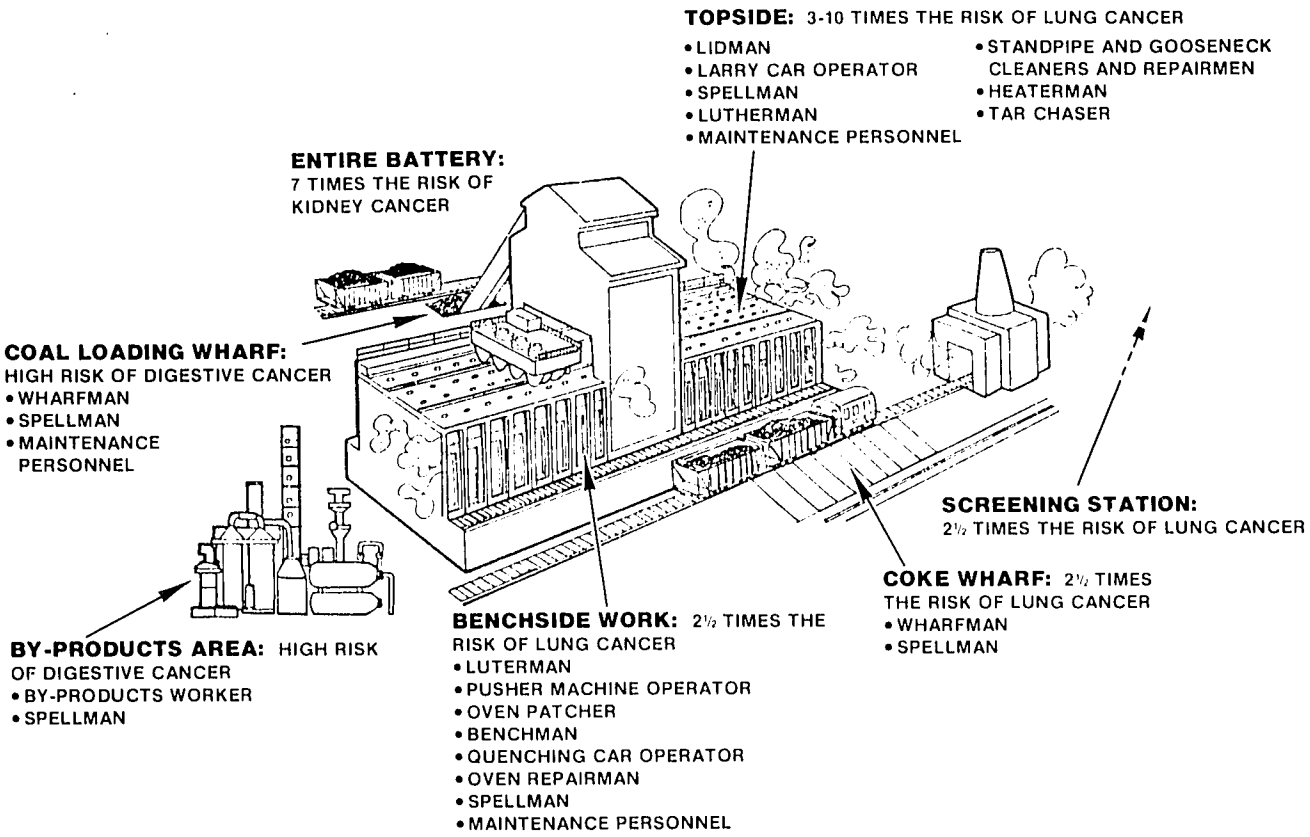


Fig. 2 — Excerpt from informational booklet on coke oven cancer hazards designed by Abt Associates.[17] Specific work locations and job functions that present different cancer risks due to exposure to coke oven emissions are identified.

tended to highlight different aspects of the guidelines. Materials are taken out of context for illustrative purposes and comments, positive or negative, do not imply endorsement or condemnation of the full document or of its source.) Guideline 7, for example, emphasizes that messages identifying the presence of agents or conditions exposing workers to health threats should be tailored to the workplaces of concern. Those particular job operations, work locations, and exposure factors likely to present the greatest health risk should be explicitly described and differentiated from those that pose little or no harm. The supporting statement to this guideline states that elaborate descriptions of hazardous conditions and warnings provide more cues for those actions aimed at minimizing danger. Moreover, information providing specific details about high-risk conditions, as opposed to general or vague statements about workplace hazards, establishes more routes for recall. (A related notion of "personalizing" the risk is contained in another guideline [9].)

The sketch shown in Fig. 2 embodies the essence of guideline 7. It gives an excellent example of information targeting specific work locations and jobs presenting different health risks. The material is taken from an information booklet for coke oven workers that addresses cancer hazards in such work.[17]

Guideline 8 states that messages emphasizing potential danger from workplace conditions need also to emphasize actions that workers can take to control or otherwise minimize such risks. High fear arousal in messages caused by vivid descriptions of the hazards can evoke desired concerns,[18] but the same message must also contain instructions for controlling the danger so as to reduce any undue anxiety that can make one feel helpless in the situation.[18-20] Related to the essential point of this guideline, Fig. 3 provides excerpts of union and industry literature concerned with toxic lead exposures in battery manufacturing. The union material addresses only the hazard and is fear-inducing. Alternatively, management's information tends to minimize the fear, emphasizing only protective actions. The guideline suggests that, for maximum effect, the two statements should be merged.

Health risks due to chemical or physical agents in the workplace are difficult to appreciate. Actual exposures may not be obvious, and the dangers less than immediate and palpable. Indeed, the exposure hazard may consist of nothing more tangible than an increase in occurrences of one or more low-probability events quite removed in time from the situation at hand. These factors, together with a tendency for persons to consider themselves as personally immune to many hazards, would suggest a tendency for

SHADES OF DIFFERENCES	
UNION LITERATURE	INDUSTRY LITERATURE
Battery Manufacturing	
Lead poisoning can be fatal. Lead can damage your reproductive capacity.	Keep your family safe.
You can poison your family by taking home contaminated work clothing.	Under no circumstances should work clothes or shoes be taken home.
The company must maintain your earnings for 18 months when you are removed from your job due to high blood lead levels.	In some parts of the plant you may be asked to wear respirators to keep the dust out of your lungs. No worker need ever experience the unpleasant symptoms of lead poisoning.

Fig. 3 — Characterizations of union and industry literature concerned with toxic lead exposures in battery manufacture. The material is excerpted from an article by Melville.[3]

workplace health risks to be seriously underestimated.[9] Guideline 9 suggests ways for enhancing the imaginability factor in communicating information about workplace hazards and risks to overcome these kinds of difficulties. The guideline calls for heightening risk perceptions through detailing the workers' routines that present exposure opportunities and relating the hazards to accounts of the onset and progression of the resultant disease and its attendant personal and social consequences. Repetition of such messages, references to particular workers who have been afflicted, portrayals of situations that identify the message receiver with the potential for adverse impact, and use of vivid, concrete language are also noted as ways of increasing the saliency of the health hazards and risks.

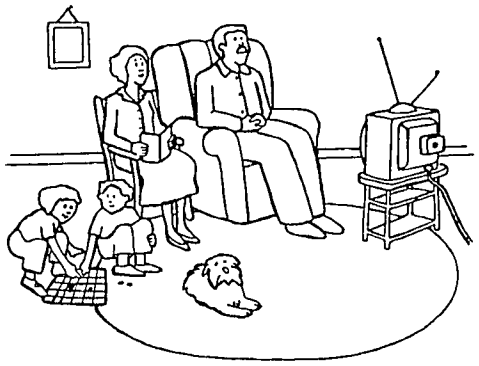
Figs. 4 and 5, from the coke oven workers' pamphlet,[17] offer some illustrations of these ideas. Fig. 4, extracted from the introductory section of the pamphlet, offers an actual case example and an element of personalization in defining the cancer risk posed by coke oven work. Fig. 5, describes the consequences of cancer affliction in terms that go beyond morbidity and mortality. Life-style changes, familiar disruption, and loss of social status noted therein are designed to increase the impact of the message on the worker. The disquieting qualities of this portrayal are

THE PROBLEM: COKE OVEN WORK CAUSES CANCER

IN 1975, ROOSEVELT JOHNS, ONE OF 50 STEELWORKERS LIKE YOURSELF, TESTIFIED AT THE U.S. DEPARTMENT OF LABOR HEARING ON COKE OVEN WORK. HE TOLD THE LABOR DEPARTMENT HOW HE GOT LUNG CANCER AS A RESULT OF TWENTY-FIVE YEARS' WORK ON A COKE OVEN BATTERY. HIS DOCTORS HAD TRIED TO OPERATE TO REMOVE THE CANCER BUT WERE UNABLE TO BECAUSE HIS HEART STOPPED DURING THE OPERATION. JOHNS WAS THEN GIVEN OVER FORTY COBALT TREATMENTS AND WENT TO THE HOSPITAL EVERY NINETY DAYS FOR A SIX-DAY STAY TO BE INJECTED WITH A NEW DRUG. HE DIED IN 1976.

Fig. 4 — Case material included in informational booklet on coke oven cancer hazards designed by Abt Associates.[17]

HOW CAN CANCER AFFECT YOUR FAMILY?



THE FINANCIAL HARDSHIPS TO A FAMILY WHEN A WORKING HUSBAND OR WIFE GETS CANCER ARE OBVIOUS — SHORTAGE OF MONEY DUE TO MEDICAL BILLS AND LOSS OF WORK. BUT CANCER ALSO CREATES FRUSTRATION AND BITTERNESS FOR MANY VICTIMS WHEN THEY CAN NO LONGER SUPPORT THEIR FAMILIES. THE PERSON WITH CANCER MAY BE CONCERNED BECAUSE HE OR SHE IS NO LONGER SEEN BY THE REST OF THE FAMILY AS THE "HEAD OF HOUSEHOLD" AND SOMEONE WHO CAN PROVIDE FOR THEM. AS A RESULT, THE PERSON MAY COME TO FEEL HELPLESS AND ASHAMED AS WELL AS FEEL CHEATED OUT OF A LIFE HE OR SHE MIGHT HAVE ENJOYED.

TENSIONS CAN ALSO BUILD UP AT HOME EVEN BETWEEN A HAPPILY MARRIED HUSBAND AND WIFE WHEN A WORKER CANNOT LEAVE THE HOUSE BECAUSE OF A DISABLING CANCER CONDITION. IN ADDITION, A SPOUSE OR OLDEST CHILD MAY HAVE TO GO TO WORK TO HELP SUPPORT THE FAMILY, OR THE FAMILY MAY BE FORCED TO GO ON WELFARE.

Fig. 5 — Excerpted passage indicating familial impacts of cancer affliction from informational booklet on coke oven cancer hazards as designed by Abt Associates.[17]

LEAVE YOUR WORK CLOTHING AT WORK

If you take your work clothes home or have your spouse wash them for you, your family may touch, breathe; or swallow coke oven particles and may become exposed to a risk of lung or skin cancer.

The Standard therefore requires that your employer provide:

- separate storage containers or lockers for your work and street clothing
- clean change rooms
- cleaning or laundering for your work clothes (jacket, pants, and gloves) at least weekly but more often if needed to keep them in good condition.

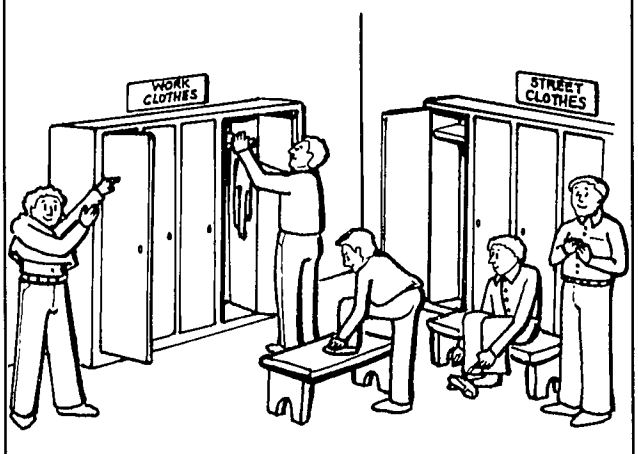


Fig. 6 — Excerpted material indicating one measure for reducing exposure or contact with coke oven particles posing risk of cancer as found in informational booklet designed by Abt Associates.[17]

TABLE A

Estimated Loss of Life Expectancy from Health Risks[a]

Health Risk	Estimates of Days of Life Expectancy Lost, Average
Smoking 20 cigarettes/day	2,370 (6.5 years)
Overweight (by 20%)	985 (2.7 years)
All accidents combined	435 (1.2 years)
Auto accidents	200
Alcohol consumption (U.S. average)	130
Home accidents	95
Drowning	41
Natural background radiation, calculated	8
Medical diagnostic x-ray (U.S. average), calculated	6
All catastrophes (earthquake, etc.)	3.5
1 rem occupational radiation dose, calculated (industry average for the higher-dose job categories is 0.65 rem/yr)	1
1 rem/yr for 30 years, calculated	30

TABLE B

Estimated Loss of Life Expectancy from Industrial Hazards[a]

Industry Type	Estimates of Days of Life Expectancy Lost, Average
All industry	74
Trade	30
Manufacturing	43
Service	47
Government	55
Transportation and utilities	164
Agriculture	277
Construction	302
Mining and quarrying	328
Radiation accidents, death from exposure	<1
Radiation dose of 0.65 rem/yr (industry average) for 30 years, calculated	20
Radiation dose of 5 rms/yr for 50 years	250
Industrial accidents at nuclear facilities (nonradiation)	58

Fig. 7 — Reproduction of two tables from instructional information booklet of U.S. Nuclear Regulatory Commission[21] comparing health risks from occupational radiation exposure with those due to other causes.

Protect Your Skin

If your work involves the risk of skin or eye contact with acrylonitrile, your employer must provide you with impermeable protective clothing and equipment such as safety goggles and gloves, and shoe covers that will prevent acrylonitrile from seeping through the leather of your shoes. Your employer must have your protective clothing cleaned whenever it is contaminated or as needed to maintain its effectiveness. If your protective clothing gets wet with liquid acrylonitrile, you must remove it promptly and shower immediately to prevent blistering. Leather shoes or clothing that have become wet with acrylonitrile must be replaced and not worn again, because it is not possible to completely remove acrylonitrile from leather. Even if you don't think you have spilled acrylonitrile on your skin, you must shower at the end of your workshift to prevent skin irritation, contamination of your street clothes, and accidental exposure of your family or friends.

ORIGINAL

Protect Your Skin

If your work involves the risk of skin or eye contact with acrylonitrile, your employer must provide you with impermeable protective clothing and equipment such as safety goggles and gloves, and shoe covers that will prevent acrylonitrile from seeping through the leather of your shoes.

- Protective clothing must be cleaned whenever contaminated or as needed.
- Remove contaminated clothing and shower immediately.
- Wet leather shoes and clothing cannot be worn again once contaminated with acrylonitrile. Acrylonitrile cannot be removed from leather.
- Shower at the end of every workshift even if you do not think you have become contaminated. You may accidently expose your children, your spouse, your friends and neighbors.

REVISED

Fig. 8 — Original text indicating protective measures for reducing contact with acrylonitrile as found in U.S. Department of Labor worker health alert document[23] and suggested revision to give increased salience to the actions recommended.

Table 2 — A Checklist in Gauging the Merits of Health Risk Informational Materials for Increasing Worker Understanding of Workplace Hazards and Responsivness to Preventive Actions

1. Do the information materials as developed show good faith efforts by the employer to inform workers of known suspected health hazards in their work environment?
2. Where uncertainties exist about possible health risks, is such information still disclosed to workers who may be affected? Are efforts made to update worker information about such risks as it becomes available?
3. Are the critical points, terms, or expressions found in health risk informational messages consistent with those used in job safety training and on labels or other communications that workers are apt to receive in regard to the recognition and control of workplace hazards?
4. Is the informational material in language and content appropriate for the intended worker group in terms of their educational/reading level, age, and length of job service?
5. Have workers or worker representatives been involved or consulted with regards to developing the informational materials?
6. Are the sources to whom data about workplace hazards and risks are attributed in informational messages considered credible to the affected worker groups?
7. Does the informational material distinguish between high- and low-risk job conditions? Are high-risk job operations, locations, and exposure factors appropriately detailed to be appreciated by new workers?
8. Do the messages informing workers at risk to known or suspect workplace hazards contain elements that address the risk as well as preventive or control actions?
9. Do the informational materials attempt to portray workplace hazards and health risks in various ways such as to make them more imaginable and meaningful to the target groups of concern?
10. Are the health risk messages to workers organized in ways that highlight main points and display a writing style that invites interest and easy reading?
11. Are initial health risk messages to workers followed up by subsequent communications that serve to reinforce or amplify critical points in hazard recognition and control?
12. Are a variety of paths used for delivering the informational material to the target worker groups to ensure its being received and read?
13. Do the activities for composing and delivering health risk messages to workers also include a plan for evaluating their impact in terms of worker responsiveness to the information and the attainment of certain goals?
14. Do follow-up communications take account of shortcomings in worker response to the original material?

matched in the pamphlet by equally elaborate explanations of control measures (Fig. 6) available to the worker to avoid undue risks. This balance of fear and fear control elements is in accord with guideline 8, as mentioned.

Guideline 10, also dealing with problems of risk perception, suggests that cross comparison of the health risk from hazards found in the workplace in question with those arising from other sources could aid understanding. One admonishment is that the target and comparison hazards should be relatable in terms of controllability, extent of potential loss, and immediacy of consequences.[9] Fig. 7, from a guide instructing workers about risks from occupational radiation exposures,[21] offers two tabular illustrations. One could argue that some of the risks listed in both tables are not comparable in terms of the above-mentioned factors. For example, the risk of premature death from occupational exposure to radiation in a nuclear power plant and from motor vehicle accidents may be so dissimilar with regard to extent of personal control, amount of potential loss, and latency of occurrence as to render comparisons between the two as meaningless. Yet, the different tabled sources of hazards and risks offer a perspective that, together with other considerations, can influence an individual's concerns and actions.

The length of the message, its organization, and writing style are important considerations in gaining sought-after response to its content. In this regard, guideline 11 asserts that messages that explain the apparent dangers and ways that they can be minimized have advantages over those consisting of unelaborated "do's and don'ts."[22] Increased message length as a deterrent to reader motivation and comprehension may be eased by effective organization of the material. Meaningful ordering of facts in a general-specific, top-down fashion was seen as beneficial, as was the use of highlighted summaries in an extended text to help the reader focus on major points even if only skimming. Choice of words and sentence constructions least likely to give the target group difficulty in readability and

understanding were also noted as primary considerations. Reflecting this guideline, Fig. 8 is a passage in an acrylonitrile worker health alert[23] that contains a number of important protective actions that are lost in the text. In the same figure is a restructuring of the text, giving prominence to these measures, through underlining certain points and casting important actions in "bullet-type" expressions. A set of guidelines to deal with strictly textual issues (sentence construction and typographic and graphic principles) in document design is available from other sources.[24]

Summary

Viewing the guidelines as a whole, an emphasis on certain factors is seen in shaping health risk messages from a psychological viewpoint. These factors are as follows:

- Concreteness (as opposed to abstract content)
- Particularity (as opposed to general, vague references)
- Personability (as opposed to detached, impersonal concerns)
- Intelligibility or Understandability
- Expressiveness

These factors and the guidelines suggest a set of questions that could serve as a checklist for defining those message qualities needed to enhance worker understanding of health risks posed by their jobs and to increase their responsiveness to safe work practices as may be explained therein. These are shown in Table 2.

The fact that differences in the way health risk messages are presented can have marked effects on how they are perceived suggests that people who inform others bear an important responsibility in conducting risk-information programs. The guidelines as an end-product of this project are intended to aid decision-making in this regard.

The merits of the guidelines as currently written will be determined by field trials involving their application and evaluation. For this purpose, cooperative work with employers is envisioned in accordance with the following type of plan.

1. Access copies of informational materials being used by the employer to inform workers about known job hazards, health risks, and control measures.
2. Critique these materials in light of guidelines and offer modifications to improve the message construction and/or delivery.
3. Implement the modified message plan with a suitable evaluation strategy to determine its effectiveness relative to the effectiveness of those formerly used.
4. Obtain data reflecting impact of the messages.

Such field trials are expected to provide an empirical basis indicating the utility of the guidelines and their potential for wider use.

References

1. Occupational Safety and Health Act, Public Law 91-596, 91st Congress, Dec. 29, 1970.
2. Occupational Health and Safety Administration: Hazard communication. *Federal Register* **48**(228):43280–53348, 1983.
3. Melville M: Risks on the job-workers right to know. *Environment* **23**:12–46, 1981.
4. Richter EF: The workers right to know: Obstacles, ambiguities and loopholes. *J Health Politics Policy Law* **6**:339–346, 1981.
5. Baram ME: The right to know and the duty to disclose hazard information. *Am J Public Health* **74**:385–390, 1984.
6. Baram ME: Charting the future course for corporate management of health risks. *Am J Public Health* **74**:1163–1166, 1984.
7. McElveen JC Jr: Despite pre-emption threat-local right to know laws increase. *Occup Safety Health* **54**:20–26, 1985.
8. National Academy of Science: Informing Workers and Employers About Occupational Cancer, U.S. Dept. of Labor contract J-9-F-5-0122. Washington, D.C.: National Academy of Sciences, 1977.
9. Slovic P, Fischoff B, Lichtenstein S: Informing people about risk, in Morris LA, Mazis MB, Barofsky I (Eds.): Product Labeling and Health Risks, Banbury Report 6. Cold Spring, N.Y.: Cold Spring Harbor Laboratory, 1980, pp 165–181.
10. Tversky A, Kahneman D: Judgment under uncertainty: Heuristics and biases. *Science* **185**:1124–1131, 1974.
11. Manning D: Writing readable health messages. *Public Health Reports* **96**:464–465, 1981.
12. Nelkin D, Brown MS: Workers at Risk: Voices From the Workplace. Chicago: University of Chicago Press, 1984, chap. 5.
13. McGuire WJ: The communication-persuasion model and health risk labeling in Morris LA, Mazis MB, Barofsky I (Eds.): Product Labeling and Health Risks, Banbury Report 6. Cold Spring, N.Y.: Cold Spring Harbor Laboratory, 1980, pp 99–122.
14. Corn M: Public health approaches to chronic disease in the workplace and the environment: The role of environmental control technologies. *Arch Environ Health* **39**:235–240, 1984.
15. Patty F: General Principles: Industrial Hygiene and Toxicology. New York: Wiley Interscience, 1958, pp 45–46.
16. Tepper, LB: The right to know; the duty to inform. *J Occup Med* **22**:433–437, 1980.
17. Coke Oven Work and Cancer, U.S. Dept. of Labor contract report J-9-F-6-0125. Cambridge, Mass.: Abt Associates, 1977.
18. Leventhal H, Watts JC, Pagano F: Effects of fear and instructions on how to cope with danger. *J Personality Social Psychol* **6**:313–321, 1967.
19. Leventhal H: Findings and theory in the study of fear communications, in Berkowitz L (Ed.): Advances in Social Psychology. New York: Academic Press Inc, 1970, chap. 5.
20. Leventhal H, Safer MA, Panagis DM: The impact of communications of the self-regulation of health beliefs, decisions and behavior. *Health Educ Q* **10**:3–29, 1983.
21. U.S. Nuclear Regulatory Commission: Instructions Concerning Risks From Occupational Radiation Exposure, regulatory guide 8.29. Washington, D.C.: Office of Nuclear Regulatory Research, 1981.
22. Kanouse DE, Hayes-Roth B: Informing people about risk, in Morris LA, Mazis MB, Barofsky I (Eds.): Product Labeling and Health Risks, Banbury report 6. Cold Spring, N.Y.: Cold Spring Harbor Laboratory, 1980, pp 147–164.
23. Occupational Safety and Health Administration: Acrylonitrile: Worker Health Alert, OSHA 3059. Washington, D.C.: U.S. Dept. of Labor, 1980.
24. Felker DB, Pickering F, Charrow VR, et al: Guidelines for Document Designers. Washington, D.C.: American Institutes for Research, 1978.