RFP--4929
CONF-950570--8

DESIGNING RADIATION PROTECTION SIGNS

Michael A. Rodriguez
University of Colorado at Boulder
EG&G Rocky Flats, Inc.
P.O. Box 464 T893B
Golden, CO 80402-0464
(303) 966-6695

Chanie L. Richey
EG&G Rocky Flats, Inc.
P.O. Box 464 T893B
Golden, CO 80402-0464
(303) 966-3442

ABSTRACT

Entry into hazardous areas without the proper protective equipment is extremely dangerous and must be prevented whenever possible. Current postings of radiological hazards at the Rocky Flats Environmental Technology Site (RFETS) do not incorporate recent findings concerning effective warning presentation. Warning information should be highly visible, transmitted quickly, and easily understood. While continuing to comply with industry standards (e.g., Department of Energy [DOE] guidelines), these findings can be incorporated into existing radiological sign design, making them more effective in terms of usability and compliance. Suggestions are provided for designing more effective postings within stated guidelines.

INTRODUCTION

Because entry into a hazardous area without the proper protective equipment is extremely dangerous, radiation protection signs, which specify the protective requirements for an area, were designed. However, warnings only safeguard users to the degree that users comply with the protective requirements. Recent reports indicate that 99% of radiological requirements violations resulted from lack of compliance to posted restrictions.[1]

THESIS

Based on a review of research on warning effectiveness and comparison of these findings to current posting design, recommendations are made that accommodate radiological posting design requirements at RFETS for Radiological Controlled Areas and Material Access Areas and are aimed at increasing user compliance. Postings based on these suggestions will decrease radiological safety violations, thereby increasing user safety.

For warnings to be effective, personnel must be aware that they are responsible for following restrictions in hazardous areas. While effective training concerning protective equipment requirements is essential, it cannot be relied upon to ensure compliance, especially when users do not enter protected areas routinely.[2]

It is imperative that radiological postings are salient and clear. To that end, the Code of Federal Regulations (CFR) and DOE directives state: (a) postings must have a yellow background, (b) the radiation symbol must be black or magenta, (c) lettering must be black or magenta, and (d) specific titles must be used to define the area to be posted (e.g., "Caution, Contamination Area")(see references 1-4). The directives also state that posting requirements may be modified.

While these directives are aimed at ensuring compliance of radiological postings, they do not utilize current research on the design of effective warnings. Research shows that people typically do not read warnings, especially when they are familiar (Godfrey & Laughery, 1984; Vaubel & Young, 1992). According to research, the most effective presentation of warnings is to display the information in a distinctive and rapidly obtainable manner (Rodriguez, 1991). Unfortunately, current radiological postings are not designed in this manner (See Figure 1). For example, all postings have black lettering on a yellow background and are printed in small text on identical slide-in tabs. Using this design, postings are likely to go unnoticed because they blend-in with other postings on the door or entryway: They are uniform rather than distinctive. Because postings look alike, the user must take the time to read each line of text, making compliance less likely.

The following suggestions not only conform to posting

[1]Fewer than 1% of the violations were due to inadequate posting of requirements (i.e., a door was left unposted).

[2]More than 66% of the radiological violations reviewed involved people who typically do not enter RCAs on a daily basis. Although such personnel may be current with their Radiological Worker training, it is only required every two years. Over a span of two years infrequent users are likely to forget much of the training.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

directives for RFETS, but incorporate research findings as well (See Figure 2):

1. Use pictures/icons of required equipment (e.g., dosimeters, respirators, safety glasses) alongside of text. Making information concerning protective requirements easily obtainable through the use of pictures/icons increases the likelihood of compliance because users do not have to read any text to understand what precautions are necessary for an area. Equally important is the fact that the use of pictures/icons accommodates those who cannot read English, cannot read well, or who cannot see well because their glasses are in their respirators.

2. Use different colors for different restrictions (e.g., red for respiratory protection, white or orange to specify what coveralls are required).

3. Make postings larger in order to accommodate pictures and larger text size. Enlarging postings also will make the signs more noticeable and easier to read.

4. Post the restrictions for a hazardous area only at the point of entry (e.g., at the step-off pad). Because individuals inside a protected area already should be in compliance with general restrictions (as opposed to additional restrictions required to enter specific modules, for example), reposting general restrictions is unnecessary. Posting protective requirements only where personnel first enter an area reduces redundancy and decreases the amount of information to which users must pay attention.

Effective postings concerning hazardous areas and required protective equipment are essential to ensuring compliance with radiological controls and worker safety. Based on research on the design of warnings, information should be rapidly obtainable and easily understood. Current postings can be redesigned to improve the presentation of information while staying within the guidelines of the DOE and CFR. Suggestions were made to add pictures/icons, expand the use of colors, and limit the amount of wording only to that which is necessary. Postings designed based on these suggestions will serve to increase user compliance to radiation protection requirements. Through the use of additional cues such as colors and pictures, postings will transmit more information in a shorter amount of time. In addition, users will be more likely to pay attention to warnings because the information they need will be posted at the points of entry to that area.

REFERENCES

1. Code of Federal Regulations 10-CFR-835, Occupational Radiation Protection (1994).

2. Code of Federal Regulations G-10-CFR-835/G1-Rev. 0., Implementation Guide for use with 10-CFR-835, Occupational Radiation Protection. (1993).

3. "DOE/EH-0256T-Rev. 1, Site-Specific Radiological Control Manual" U.S. Department of Energy (1994).

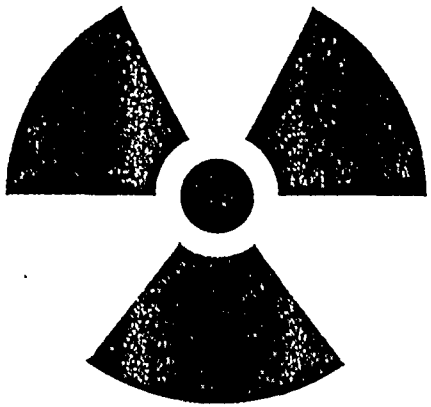
4. "DOE Order 5480.11/P, Radiation Protection for Occupational Workers," U.S. Department of Energy (1992).

5. Godfrey, S. S., & Laughery, K. R., (1984). The biasing effects of product familiarity on consumers' awareness of hazard. *In Proceedings of the Human Factors Society 28th Annual Meeting* (pp.483-486). Santa Monica, California: The Human Factors Society.

6. Rodriguez, M. A. (1991). What makes a warning label salient? *In Proceedings of the Human Factors Society 35th Annual Meeting* (pp.1029-1033). Santa Monica, California: The Human Factors Society.

7. Vaubel, K. P., & Young, S. L., (1992). Components of perceived risk for consumer products. *In Proceedings of the Human Factors Society 36th Annual Meeting* (pp.494-498). Santa Monica, California: The Human Factors Society.

CAUTION



CONTAMINATION AREA

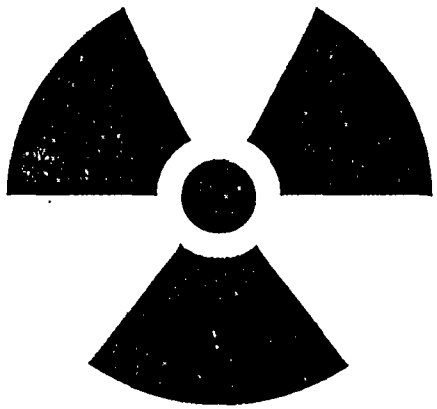
FULL-FACE WITH HEPA CARTIRDGES REQUIRED

TLD REQUIRED FOR ENTRY

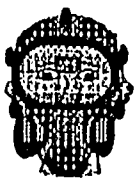
RWP REQUIRED FOR ENTRY

Figure 1

CAUTION

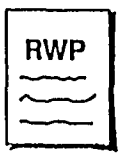


CONTAMINATION AREA



FULL-FACE WITH HEPA CARTRIDGES REQUIRED

DOSIMETER BADGE



RWP REQUIRED FOR ACCESS

Figure 2