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Lloyd D. Stephens and Rosemary Barrett

May 1978

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A BRIEF HISTORY OF A "20th CENTURY DANGER SIGN"

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Lawrence Berkeley Laboratory
Berkeley, California 94720

May 30, 1978

An earnest request for a brief history of the development of a "20th Century Danger Sign" was penned by a free-lance writer some 25 years ago. This request was among the first such requests by a lay person striving to understand the beginnings of a relatively young and vital scientific discipline.

The request was sent to Mr. Nels Garden, then the Head of the Health Chemistry Group at the Radiation Laboratory of the Univeristy of California, Berkeley.

His response to her was in the form of a short letter of historical nature (NBG-369-52). In his letter he states that the history of the symbol began in the latter part of 1946, when it was developed at the Laboratory for its own use, a warning of this new form of danger from nuclear radiation.

Many people in the Health Chemistry Group helped to "doodle" out a symbol which in Mr. Garden's own words, ". . . would best symbolize the degree of hazard, type of activity, etc., but which was simple in design." Some of the various samples are shown in Figs. 1 and 2.

In March 1948, Dr. Donald Cooksey received a letter from J.H.B. Kuper, (1) of Brookhaven National Laboratory, stating that they were in the process of setting up their radiation safety program and found the idea of a standardized symbol with standardized colors very desirable. In his letter he also mentions the UCRL standard as, "three 60° arcs of an annulus equally spaced around a central circular spot, using magenta for the distinctive color." He also states, "other installations are using a red on white background." Brookhaven people tended to think this a poor combination, easily confused with fire fighting color combinations. They at that time considered orange. Dr. Kuper suggested that during an upcoming information meeting, to be held 26 to 28 April 1948, those interested in such things spend time discussing symbols and colors for radiation warnings.

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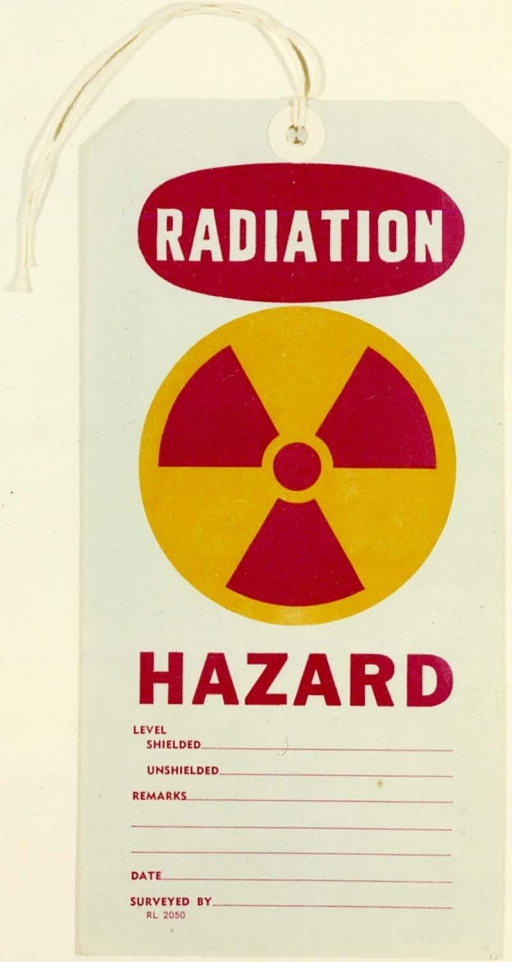
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Dr. Cooksey (2) agreed in an answer to Dr. Kuper. Mr. Nelson Garden attended that meeting for UCRL. Dr. Cooksey also included some sample stickers routinely used in Berkeley for identifying any radioactivity or contamination in or on flasks, beakers, etc. (Fig. 3).

The Information Meeting was held as scheduled. The minutes of that meeting, with representatives from many AEC installations are quite complete (3). Dr. Kuper opened the meeting with the statement of purpose, "to consider the desirability of adopting a uniform color and symbol for marking radiation hazards within research laboratories." He continued, that there would be a need for a color and symbol code well recognized, and as thoroughly understood as red is for fire hazards."

At this time there was no ASA (now ANSI) standard for indication of radiation hazards. It was generally believed that use might establish one. Points of view from various AEC installations were sought since Brookhaven wanted to use a standard symbol in its radiation safety program.

Dr. Kuper introduced Mr. Nelson Garden to the representatives present, with the statement that he was from the Radiation Laboratory at Berkeley, where both a definite color and symbol are in use.

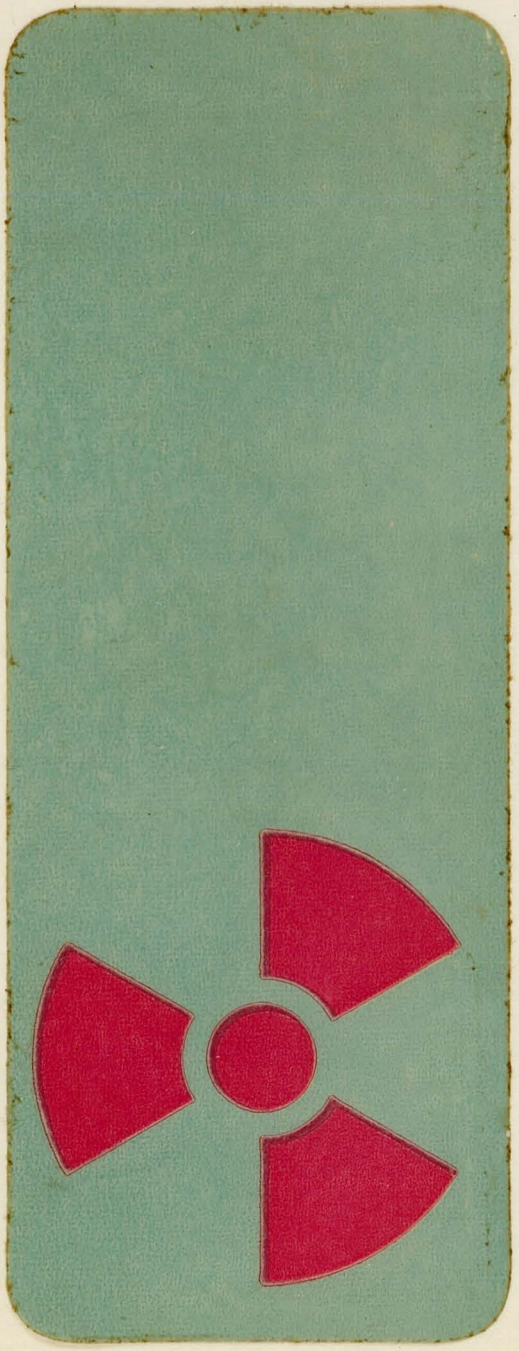
Of more concern than the symbol itself, there was a rather lengthy discussion on the choice of colors to be used. Briefly, the magenta color was readily accepted as being of unique color. The background was selected originally as a light blue, being the remaining color after eliminating colors used in engineering codes frequently used in a laboratory or shop. Eventually, the high visibility yellow was accepted by common assent.

The choice of possible symbols is shown in Fig. 4, taken directly from page 2 of the minutes of the meeting of 27 April 1948.

No definite conclusion was reached, however, Dr. Edwin G. Williams, U.S. Public Health Service, was chosen to be the receiver and distributer of suggestions and actions taken by the individual laboratories.

Dr. Edwin Williams sent a letter to Garden nearly a year after this meeting, making a strong plea for the more visible yellow background color and had added some arrows to the symbol, as seen in Fig. 5.

One expressed objection to this symbol modification was that on small stickers or lables the arrows would be too small and would only confuse the figure. In his response to Dr. Williams, Nels Garden (3) suggested a variation of stripes, as shown in Fig. 2. This was never adopted for use at UCRL, but as previously stated, was of the original suggested symbols.



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Berkeley the Bureau of Standards was of the opinion that the symbol
recognizable at a distance. He suggested the use of a spoke or sharp-
pointed design, or perhaps skull and cross bones as is presently used by the ICC
for shipments of radioactive materials. Holaday suggested a symbol with use of
the word "danger" rather than "radiation" since people in industry are not fami-
liar with it. German was in favor of selecting a standard symbol with the color
unimportant. Dorothy Wallace of the Argonne mentioned that Dr. Rose favored
using a scotch-tape label for tags rather than the gum-back type. Following the
discussion a motion was made by Perry that this group recommend adopting a standard
symbol to mark radiation hazards, if possible. The motion was seconded and passed.

The following diagrams and ideas for possible symbols were illustrated
on the blackboard for consideration:

1. Berkeley
2. Hanford
3. Skull and Cross bones (Danger sign to indicate danger zone; red striped tags used there for labels)
4. Mushroom Cloud

Suggestions were also made for combining skull and cross bones with the
Berkeley symbol. Tribby of Los Alamos stated that a danger sign marked "radiation
hazard" is used there. Curtiss suggested that Brookhaven also design a symbol
for consideration. A question was raised as to whether the ICC would adopt any
symbol other than the skull and crossbones. It was the general opinion that the
best that could be hoped for was a standardization by research laboratories first
and that perhaps later on industry would follow.

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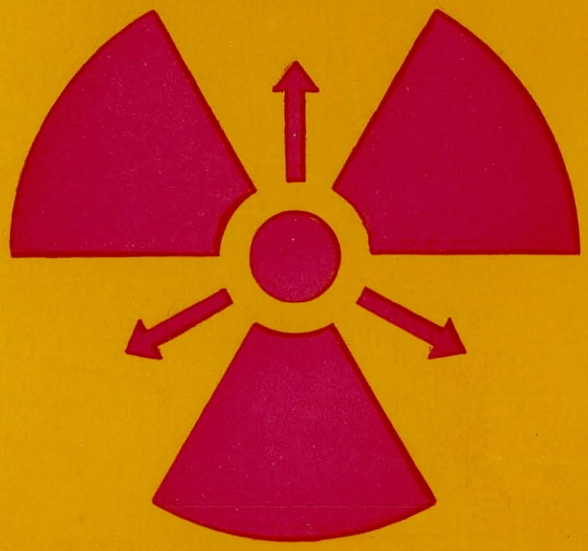

RADIATION HAZARD

PRECAUTIONS _____

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In a letter to Nels Garden, in August 1948, Dorothy Wallace (4) of Argonne National Laboratory, in Chicago, stated her desire to use the UCRL symbol in both design and color, and requested that the specifications be sent to her. Also, at this time she expressed her desire to use the high visibility yellow as a background color. In her letter she enclosed a sample of the radiation warning lables which were to be used at Argonne (Fig. 6).

Dr. Donald Cooksey, in March 1949, (7) urged that a symbol be universally adopted as soon as possible for the good of the country as a whole, and he believed it would be welcomed by everyone else, including common carriers.

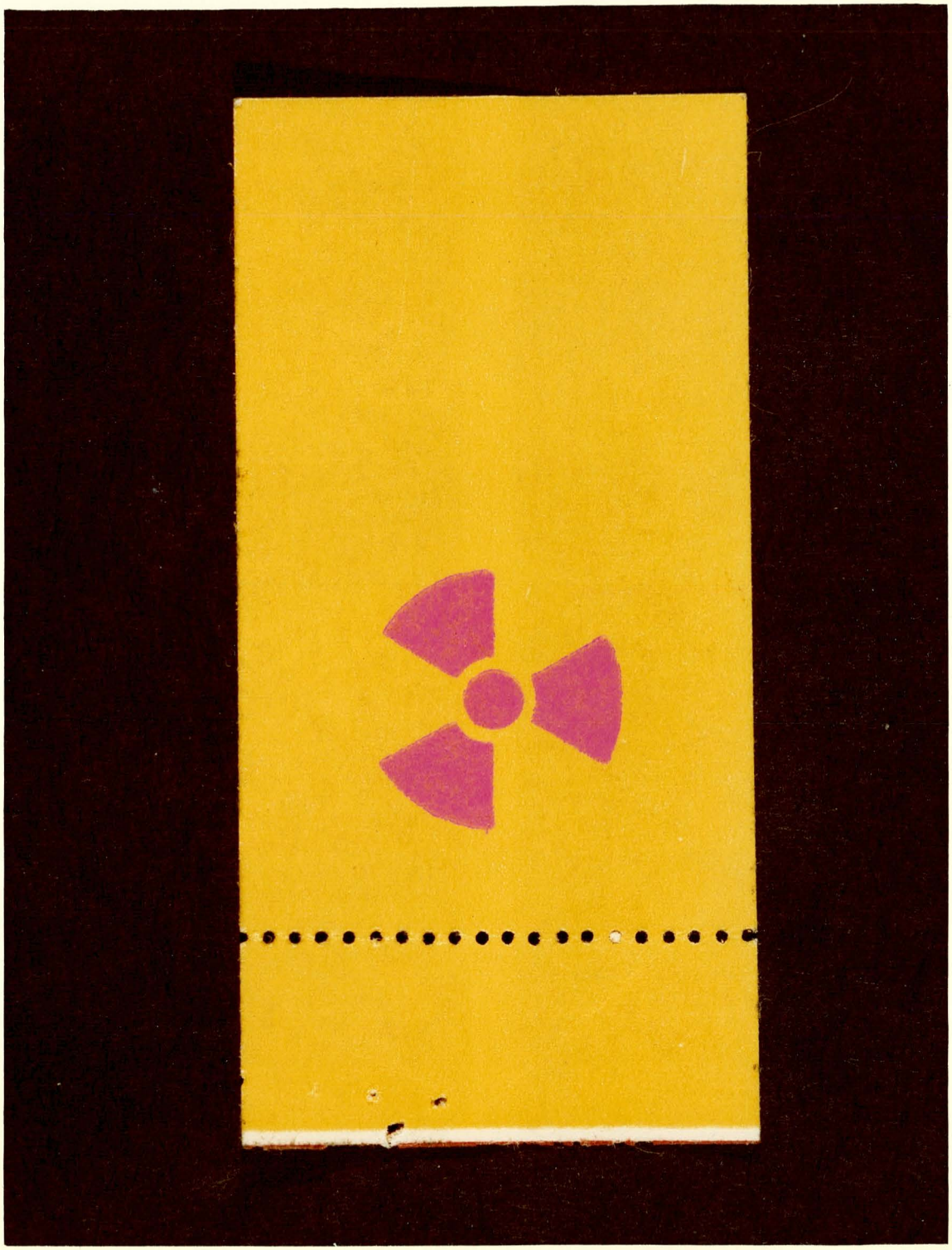
In a letter, dated 6 April 1949, (10) to Dr. Lauriston S. Taylor, at the National Bureau of Standards, Dr. Paul Aebersold, Chief of the Isotopes Division, Oak Ridge Operations, considered the desirability of a standardized symbol, "inasmuch as there are now some 500 groups using radioisotopes outside of Commission facilities, it would be desirable for these groups also to adopt a standard symbol for radiation." Dr. Aebersold also suggested that the standardized symbol should also be used at cyclotron and nuclear physics laboratories.

He felt that the symbol should have more life and meaning than the presently used one. To this end he proposed the symbol shown in Fig. 7. Dr. Aebersold states that, "one of the men had made this design which is bold, active, and unique, yet not frightening." No further communications are available on this symbol.

In March 1949, Nels Garden received a letter from Dorothy E. Wallace, Health Physics Division, Argonne National Laboratory. In this letter Miss Wallace quotes from her letter to Dr. E.G. Williams, of the U.S. Public Health Service. She states that Argonne Laboratory has adopted the symbol presented by Mr. Garden, of the Radiation Laboratory, with the only exception being the change of the blue background to yellow for better visibility.

She stated that, " We favor the adoption of Mr. Garden's symbol and the magenta color for the connotation for radioactive materials . . . We believe, as stated previously, that it would be advisable for all AEC installations to adopt a standard practice for labelling radioactive materials." The tag which she enclosed with this letter is shown in Fig. 8.

The rest of the story of a "20th Century Danger Sign" is well known. A warning symbol for a few employees of a small laboratory dedicated to a



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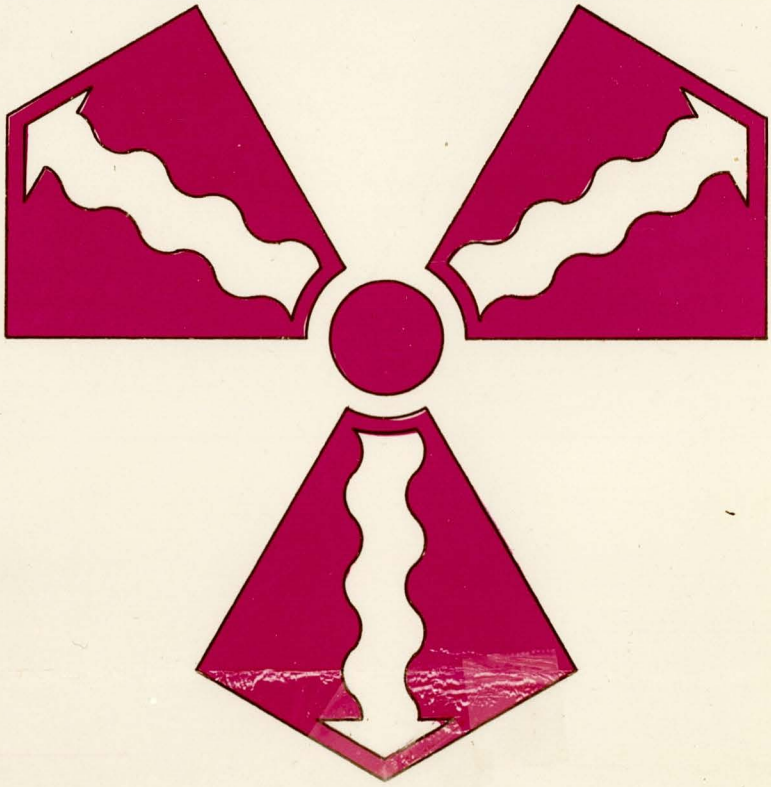

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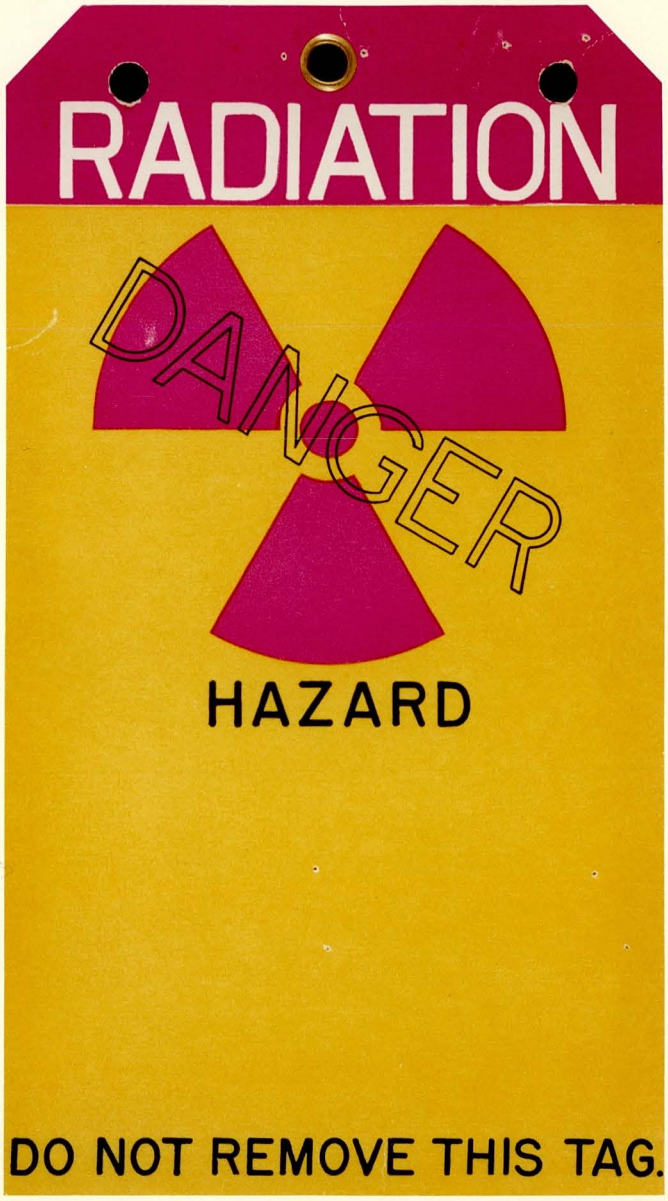
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new science has become a universal danger symbol in an industry now matured. This symbol is now formalized in the Federal Regulations Title 10, Part 20 (Fig. 9). It has been carried to the farthest reaches of earth, onto our nearest celestial neighbor, the moon, and even today is travelling on a cosmic journey into the unknowns of the universe. Truly, here is a "20th Century Danger Sign."

The correspondence referenced in this document is but a portion of the total material preserved by one of us (RJB) for use "at some future time", such as now.

The other author (LDS) of this brief historical document wishes to express his thanks to Ron Kathren, Portland General Electric Company and to Charles E. Haynes, Oak Ridge National Laboratory with further documentation relating to and substantiating the history of this symbol.

PART 20 - STANDARDS FOR PROTECTION AGAINST RADIATION

§ 20.103 Orders requiring furnishing of bio-assay services.

Where necessary or desirable in order to aid in determining the extent of an individual's exposure to concentrations of radioactive material, the Commission may incorporate appropriate provisions in any license, directing the licensee to make available to the individual appropriate bio-assay services and to furnish a copy of the reports of such services to the Commission.

PRECAUTIONARY PROCEDURES

§ 20.201 Surveys.

(a) As used in the regulations in this part, "survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.

(b) Each licensee shall make or cause to be made such surveys as may be necessary for him to comply with the regulations in this part.

§ 20.202 Personnel monitoring.

(a) Each licensee shall supply appropriate personnel monitoring equipment to, and shall require the use of such equipment by:

(1) Each individual who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in paragraph (a) of § 20.101.

(2) Each individual under 18 years of age who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 5 percent of the applicable value specified in paragraph (a) of § 20.101.

(3) Each individual who en... radiation area.

(b) As used in ...

(1) "Per... mea-

25 FR 10914

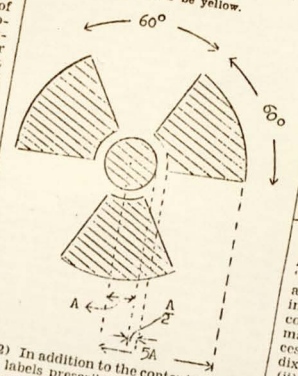
25 FR 9037

§ 20.203 Caution signs, labels, signals, and controls.

(a) *General.* (1) Except as otherwise authorized by the Commission, symbols prescribed by this section shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol prescribed by this section is the conventional three-bladed design:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.



(2) In addition to the contents of signs and labels prescribed in this section, licensees may provide on or near ... signs and labels any additional ... tion which may be appro... individuals to mini... ation or to ...

(b) ...

(iii) Maintained locked except during periods when access to the area is required, with positive control over each individual entry.

(3) The controls required by subparagraph (2) of this paragraph shall be established in such a way that no individual will be prevented from leaving a high radiation area.

(4) In the case of a high radiation area established for a period of 30 days or less, direct surveillance to prevent unauthorized entry may be substituted for the controls required by subparagraph (2) of this paragraph.

(5) Any licensee, or applicant for a license, may apply to the Commission for approval of methods not included in subparagraphs (2) and (4) of this paragraph for controlling access to high radiation areas. The Commission will approve the proposed alternatives if the licensee or applicant demonstrates that the alternative methods of control will prevent unauthorized entry into a high radiation area, and that the requirement of subparagraph (3) of this paragraph is met.

(d) *Airborne radioactivity areas.* (1) As used in the regulations in this part, "airborne radioactivity area" means (i) any room, enclosure, or operating area in which airborne radioactive materials, composed wholly or partly of licen... material, exist in concentration... cess of the amounts speci... dix B, Table I, Colu...

(ii) any roo... area in ...

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