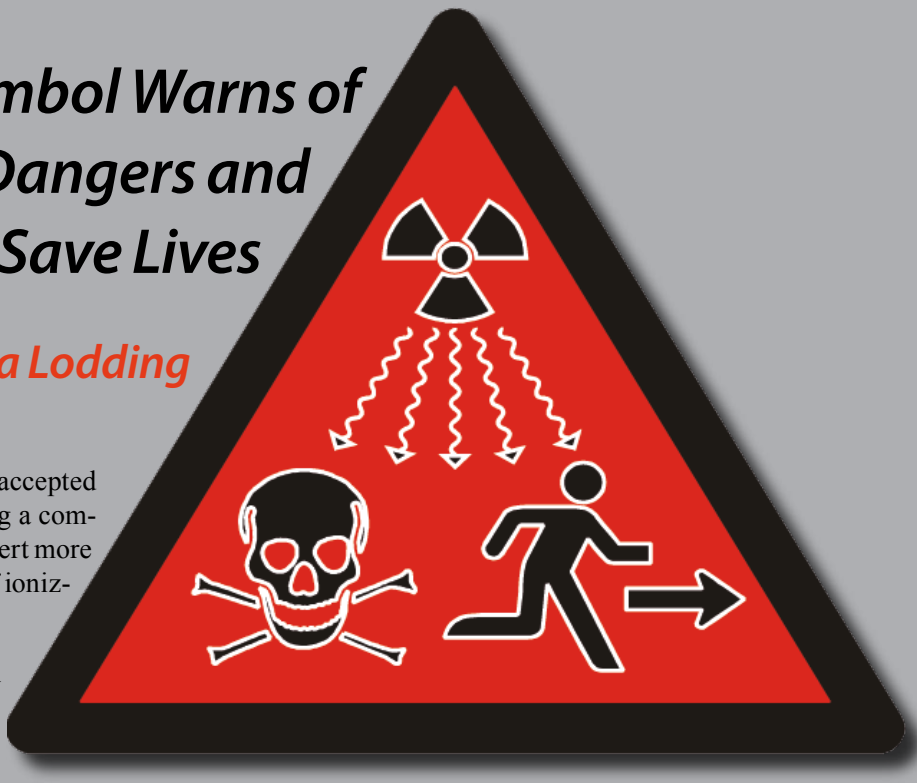
Drop it and Run!

New Symbol Warns of Radiation Dangers and Aims to Save Lives

by Linda Lodding



The black-and-yellow trefoil symbol—long the accepted label for denoting radioactive material—is getting a companion. And it's hoped that the new symbol will alert more people to the potential dangers of large sources of ionizing radiation and save lives.

Unlike some signs of danger—like the commonly used skull-and-crossbones icon that seems to scream out both "poison" and "pirates"—the trefoil symbol has little recognition beyond the nuclear community. This was learned from a five-year IAEA-led study to evaluate the best symbol to convey radiation danger.

The vast majority of respondents tested in an eleven-country survey had no idea what the symbol meant nor had any knowledge of radiation. In fact, only 6% of those questioned in India, Brazil and Kenya could recognize the trefoil symbol for what it was.

Had "Aroon", a local scrap collector in Samut Prarn, Thailand known what the symbol meant, he might be alive today. Like many in his rural community, Aroon collected scrap metal as his livelihood. When, in 2000, he came across a disused cobalt-60 teletherapy source outdoors, he only saw the metal as potentially valuable—not deadly. While the source was properly marked (but improperly secured), this made little difference to Aroon who didn't recognize the symbol. And how could he? Radiation and its dangers—as well as its many benefits—are unknown in most poor villages where orphan radiation sources potentially are found.

In search of a new symbol

The same year that Aroon died from radiation exposure, an international conference on regulating radiation safety in Buenos Aires, Argentina noted that a new radiation symbol was needed—one that would clearly warn of the presence of dangerous levels of ionizing radiation on large sealed radioactive sources.

What resulted was a recommendation to design a universal system of labelling large radioactive sources. In 2001, IAEA Member States approved the "new warning symbol project."

The assignment was daunting. How to come up with a symbol that would be universally understood regardless of education, cultural orientation or age? One that would provoke the same reaction from a 10 year-old boy in Los Barrios, Spain, a grandmother in a village in Kenya, a scrap metal collector in Samut Prarn, Thailand? How to clearly convey: 'Danger—Run Away—Do Not Touch!'

The starting point involved a wide variety of experts — human factors experts, graphic artists, sociologists, statisticians and radiation protection professionals. And, over the past five years, many people contributed to this project. The end result of the first phase was fifty potential icons representing "danger" in varying shapes and colours.

To help narrow down the possibilities, the signs were tested on school children at Vienna International School in Austria, which has students from more than 80 countries. It was reasoned that these children—many of whom were not reading yet—would guide researchers to the symbols that they intuitively responded to as indicating "danger" or "bad". Not surprisingly, many children saw the tre-

foil symbol as something as benign as a propeller and the color yellow, the background color of the trefoil symbol, as meaning "caution" but not "danger".

Based on the feedback, the scope of possible designs was further reduced to a field of five. Member States also screened the symbols for any inappropriate religious, cultural or historical associations.

Taking it to the streets

In 2004, the International Organization for Standardization (ISO) approved the project and, the following year, the Gallup Institute was brought in to test the effectiveness of five of the symbols in selected countries. Eleven countries were surveyed: Brazil, Mexico, Morocco, Kenya, Saudi Arabia, China, India, Thailand, Poland, Ukraine and the USA. All told, 1650 participants took part. With local Gallup employees conducting the surveys, the symbols were tested on different population groups—urban, rural, mixed ages, varying educational backgrounds, male, female. Researchers were judging: What were the respondents' initial reactions to the symbol? What action would they take if they saw these symbols?

"It was an eye-opening experience," says Carolyn MacKenzie, an IAEA radiation source specialist, of her trips to the field to witness the testing. "Initial interpretations of the symbols were that something bad could happen and caution was needed—but the source of that threat wasn't understood. Many thought it was a warning of AIDS, electricity, toxins or even a road hazard."

While all the symbols were interpreted as conveying the message of 'caution', only the symbol with the skull icon relayed the strongest message of 'danger of death.'

When end results were tabulated, the "winning" design was identified as a triangular shape with three icons: the trefoil emitting radiation, a skull and man running away. The background colour is red. These images, taken together, did the best job in eliciting the right reaction. Fortunately, the test results from all eleven countries didn't show significant differences in culture, gender, age, education or community size. This across-the-board acceptance made the selection of the final symbol easy.

Where should it go?

What hasn't been so easy is convincing the industry of the necessity of the radiation symbol. Many, initially, saw the new symbol as alarmist and worried that the symbol would have negative consequences on the public's acceptance of all things radioactive. However, once Ms. MacKenzie explains that the new symbol is only to be placed on large and potentially dangerous sources — does the initial resistance fade.

Participants in 11 countries helped zero-in on the most effective symbol to convey "danger". Here, a Kenyan woman ponders the graphic options presented to her by Gallup pollsters.

As she clarifies, "the new symbol does not replace the trefoil symbol, but is in *addition* to it. It should be placed on the radioactive source or shielding or under the device cover. In many cases, it won't be visible under normal use but only visible to someone attempting to dismantle the radioactive source." Furthermore, the symbol won't be located on the external surfaces of transport packages, freight containers, conveyances or building access doors.

The IAEA has recommended that the symbol be used on IAEA category 1, 2 and 3 sealed radiation sources (dangerous sources that can cause death or serious injury).

The symbol was published in February 2007 by the ISO as "Supplementary Ionizing Radiation Warning Symbol" (ISO 21482). The next challenge will be to publicize the new symbol within the industry and to obtain consistent implementation on large radioactive source.

"I can't teach the world about radiation," Ms. MacKenzie says in reflecting on this project, "but I can warn people about dangerous sources for the price of a sticker."

"a propeller? a windmill? a flower?"

A Symbolic History

Has the trefoil symbol failed us? 'Not at all," says Carolyn MacKenzie, a radiation source specialist at the IAEA. "There's even some debate as to whether it was ever intended as a warning sign at all." In fact, there is evidence to suggest that the trefoil symbol was never intended to alert the general public of the dangers of large ionizing radiation.

In the beginning, radioactive material was used in a relatively small number of controlled environments, such as national laboratories, where people who had access to the material could be trained as to the meaning of the trefoil symbol. Over the years the great success of radioactive material has resulted in its use in such open and remote areas as the deserts of Africa and the jungles of South America, as well as the concrete jungles of our inner cities. This means that there is now the potential for the untrained, the uneducated and the illiterate to come across large radioactive sources.

The three-bladed radiation symbol as we currently know it (except for the colors used) was 'doodled' out at the University of California Radiation Laboratory in Berkeley in 1946. This event was later described in a letter written in 1952 by Nels Garden, Head of the Health Chemistry Group at the Radiation Laboratory: "A number of people in the group took an interest in suggesting different motifs, and the one arousing the most interest was a design which was supposed to represent activity radiating from an atom."

Mr. Garden and his team printed up the trefoil symbol—originally a magenta image on a blue ground—and use of the design spread around the country. In choosing magenta as the image colour, Mr. Garden explained:

"It was distinctive and did not conflict with any colour code that we were familiar with. Another factor was its cost…the high cost will deter others from using this colour promiscuously." As for the blue ground, he commented that the blue was selected because there was very little blue colour used in most of the areas where radioactive work is carried out.

It was soon recognized that blue, as a background, was a poor choice since blue was not a colour associated with "warning" and it tended to fade, especially outdoors. The use of yellow as a background colour is thought to have been standardized by Oak Ridge National Lab in early 1948. Modifications to the Berkeley design were suggested and implemented locally into the early 1950s – for example, the addition of straight or wavy arrows between or inside the propeller blades but an ANSI standard (American National Standard Institute) and federal regulations finalized the current version by the mid 1950s.

Why did the originators at Berkeley Laboratory choose the trefoil as the symbol denoting radiation? There's only speculation.

One thought is that this symbol was used at a naval base dry dock near Berkeley to warn of spinning propellers. Others imagine that the central circle is a radiation source and that the three blades represent radiation, perhaps one blade each for alpha, beta and gamma. Some recall that it has a striking similarity to a commercially available radiation warning sign used before 1947 at some labs that consisted of a small red dot with four or five red lightening bolts radiating outwards. The latter design was very similar to that on electrical hazard warning signs. Another idea is that this design, created one year after WWII, has some resemblance to the Japanese battle flag (rays streaming out of a rising sun) which would have been familiar at the time.

Whatever the origin, it's clear that the history for this symbol continues to be written.

Reference: "A Brief History of a 20th Century Danger Sign" by Stephens and Barrett, Health Physics Vol. 36 (May) pp. 565-571; "Radiation Warning Symbol (Trefoil)" by Paul Frame, Oak Ridge Associated Universities.