Joint Session with Electronic and Electrical Equipment Section

OCCUPATIONAL MEDICINE IN THE ELECTRONIC AND ELECTRICAL INDUSTRY

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Probably no other industry has developed so rapidly, made greater inroads into the intricacies of science, or taxed the imagination and ingenuity of man more than the electronics industry. From the simple, humble beginnings of the crystal set radio and vacuum tube to the complicated marvels of TV microwave devices, computers, lasers, etc., electronic engineers continue to push back the barriers of the seemingly impossible to accomplish the incredible.

However, in the course of such achievements numerous safety hazards, toxicological problems and industrial hygiene difficulties have been encountered. Naturally, in any electronic operation one has to deal with a variety of solvents, gases, plating chemicals, caustics, acids, fire and explosive hazards, industrial and diagnostic x-ray, noise, toxic plant effluents, etc. I shall treat hurriedly of these common universal hazards in order to provide time for the more exotic issues in the electronics industry.

The common chemical hazards include mercury, lead, arsenic, cyanides (plating), hydrogen sulfide, molybdenum, germanium, trichloroethylene, beryllium, magnesium, phosphine (deborane), methylene chloride, photo resist (mixture of polyvinyl, alcohol, ethyl alcohol and ammonium dichromate), caustic, hydrofluoric and other acids, sulfur dioxide, ammonia, amyl acetate, amines, vanadium, yttrium, europium, barium, strontium, calcium, cadmium, zinc, manganese, nickel, the epoxy resins, polyurethane resins, radioactive materials, and phosphors.

Phosphors

With the exception of the phosphors, you undoubtedly have had experience with all of the aforementioned chemicals, both as to their degree of hazard and the safeguards necessary to control these hazards. However, to some the word phosphor may be a relatively new term, as it is primarily confined to fluorescent tube and TV tube manufacture, both monochrome and color. By definition, a phosphor is a combination of chemicals blended together to produce a new chemical structure with characteristics different from its constituents and capable of luminescence.

In the early development of luminescent phosphor chemicals, you may remember beryllium and the resultant toxicological hazards it presented before eventually being brought under control. Hard on the heels of the fluorescent lamp came a new electronic device: the television receiver. Furthermore, the development of color TV in 1954 entailed the use of new and exotic phosphors not previously employed. Looking back upon the history of beryllium phosphors, one may anticipate that new industrial hygienic problems will come with the new phosphors. Regrettably, as in the early days of beryllium use, no toxicological information of sufficient scope is available to give one a background in the approach to management of the clinical problems of workers who are exposed to these new materials in their occupations. The physician in industry, therefore, must devise an approach to determine the level of toxicity and the extent of a medical engineering control program to protect employees as well as any potential product liability. Let me outline briefly how occupational medicine might attack such a problem.

Two main issues present themselves:

1. That of exposure to the raw materials used to make the powder or phosphor covering the face of the TV tube — in this instance europium-activated yttrium orthovanadate, used to produce a superior color and brightness as compared to the older and relatively less toxic silver-activated zinc cadmium sulfide.

2. That of exposure to the finished phosphor after it has been fired and a new chemical structure formed — new in crystalline structure, solubility particle size, and new in its toxicological properties.

As the name implies, this new solid state compound europium-activated yttrium orthovandate consists of a mixture of the metallic