PLAINTIFF'S EXHIBIT

K-2074

November 9, 1970

Mr. Patrick Meyers
Safety Director
Owens-Illinois
711 Southwood Avenue
Columbus, Ohio 43207

Dear Mr. Meyers:

Enclosed are two copies of a report on the visit made to your company on September 28, 1970.

It was a pleasure to meet with you, and the courtesy extended was very much appreciated.

If this Division can be of assistance to your company at any time on industrial hygiene or engineering problems relating to safety, please let us know.

Very truly yours,

Robert E. Barnh, P.E.
Safety Engineer

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Enc.:

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November 9, 1970

Re: Owens-Illinois
711 Southwood Avenue
Columbus, Ohio 43207

1. On September 29, 1970, a visit was made to the above named company to check conditions of the use of ultraviolet, regarding which an employee had communicated with this Division.

2. Contacted was:

Mr. Patrick Haynes, Safety Director

3. The company manufactures television tubes.

4. A Model UVS-11 Ultraviolet Products, Inc. ultraviolet lamp is a component of a system for quality control inspection of the television tubes. The laser beam is directed away from the inspector's position, and he observes light reflected back from the tube being inspected.

5. As long as people within sight of the unit are wearing safety glasses, (ordinary glass prevents out practically all UV radiation) preferably with side shields, there should be no hazard. Without the side shields, there is a possibility of injury to the un-protected eye. The glasses are particularly needed by the inspector, who is looking directly at light reflected from the lamp by the tube under inspection.

6. It was mentioned that the Corning A lens was considered for the safety glasses. We are informed by Mr. Metelsky of General Electric at Nela Park that this lens would be quite safe, but might fluoresce in the ultraviolet light and interfere with observation. It is noted, in the catalog of Ultraviolet Products, Inc., that a type known as UVO-303 contrast control safety goggles is recommended for both protection and absence of "blue haze" interference.

7. Without protection, damage to both skin and eyes can result from excess exposure to ultraviolet radiation. The effect is strongly influenced by the wave length, analogous to color, of the rays. Near ultraviolet, close to visible light, is in the range of 400 nanometers (nm) wavelength. Far ultraviolet is defined as that of 320 nm and shorter wavelengths. Below 180 nm wavelength, air is opaque.

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8. Skin erythema, reddening of the skin as in sunburn, with pain reaction, comes from exposure to certain frequency bands. The effect is negligible at 320 nm wavelength, reaches a maximum at 297 nm, and returns to a low value at 297 nm. At 260 nm, another peak is indicated but, according to some references, of lower intensity than the one at 297 nm.

9. Smallest effective exposure for skin reddening is reported as 3×10^4 micro-watt seconds per square centimeter (μW sec/cm^2). Ten times this amount was needed for the cancer retardation of white mice. No account human skin cancer from ultraviolet lamps are recorded, although some are reported from long exposure to sunlight and certain chemicals.

10. Without suitable protection, a keratitis or keratoconjunctivitis reaction is damaging to the eyes. This is described as inflammation of the cornea with punctuate lesions or ulcerations in the superficial 5-cell thick epithelial layer. This is the outermost layer of the eye. Symptoms after several hours are pain, sensitivity to light, tears, and spasms inducing closing of the eyes.

11. Threshold dose for keratitis reaction of the eye is given as 1.5×10^4 μW sec/cm^2 at 288 nm wave length. The relation of wavelength to effect is reported as follows:

Wavelength, nm	Keratitis Effect
310	None
288	Maximum
280	Minimum
254	From 33% to 100% of maximum as reported by various sources

12. In the case of the ultraviolet source, Model UVS-11 of Ultraviolet Products, Inc., data was:

Input: 115 volts, 0.12 amps
Principal wavelength: 254 nm
Output without filter: 320 $\mu W/cm^2$ at 6" distance

13. Converting from 6" to 1' radius:

$$\frac{320 \times (6")^2}{(1')^2} = \frac{320}{4r^2} = \frac{80}{r^2} \quad \frac{\mu W/cm^2}{ft^2}$$

or micro-watts per square centimeter divided by square of distance in feet from source, where r = distance from source.

14. This assumes that other frequencies than the primary output wavelength of 253.7 nm are negligible in effect.

Correcting for transmission loss of filter, curves in their catalog indicate transmission of 30% of the primary 253.7 nm wavelength when filtered.

$$\frac{60}{r^2} \times .3 = \frac{24}{r^2} \frac{uW/cm^2}{ft^2}$$

To compute time for threshold exposure,

$$T = \frac{1.5 \times 10^4 \text{ uW sec/cm}^2}{24/r^2 \text{ uW/cm}^2} = 625 \text{ sec}/r^2 r$$

$$\text{or } 625 \text{ sec}/r^2 \times \frac{\text{minutes}}{60 \text{ sec}}$$

$$= 10.4 \text{ minutes}/r^2,$$

r, feet	r^2	T, Minutes for Threshold Exposure
10	100	1040
5	25	260
2.5	6.25	65
1	1	10.4

These represent minutes of threshold exposure at various distances from the source, for the un-protected eye. As mentioned above, glasses worn by the operator would provide protection.

15. This survey was made in accordance with IC-5, Specific Safety Requirements of The Industrial Commission of Ohio Relating to All Workshops and Factories.

16. No recommendations are made at this time. Suggestions for lessening exposure are contained in the body of the report.

Respectfully submitted,

Robert W. Hursh, P.E.
Safety Engineer

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