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A Letter from Wordie H. Parr, Ph.D, Chief of Physical Agents Effects Branch of National Insttitute for Occupational Safety and Health Work Flow of Documents - background NIOSH VDT / CRT radiation questions

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Notes

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July 21, 1978

Mr. Lawrence H. Slaughter
Director, EDP & Information Systems
United Nations
42nd and 1st Avenue
New York, New York

Dear Mr. Slaughter:

Background

Employees in the Department of Conference Services from several countries had voiced concern about potential radiation hazards associated with the use of Video Display Terminals (VDTs) although no specific medical complaints were registered. As a result, the employees resisted using the terminals until an independent evaluation had been conducted by a NIOSH team.

Work Flow Does

The Department of Conference Services is responsible for transcribing the proceedings of the General Assembly and other meetings and for the preparation of all UN documents and publications. This totals approximately 55-60,000 pages of translated material per year.

Each manuscript is reproduced in the six official languages of the UN: English, Spanish, French, Russian, Chinese, Arabic. There are, therefore, six typing units composed of individuals fluent in one of the six languages. These typists are 85% female and are hired either in their native countries or locally.

Typically, the flow of work moves from the translators who dictate the original material on to tapes. The taped translations are forwarded to the six typing units for transcription. A draft typed copy is checked by the translator and reviewed by a senior translator for final grammatical edit and approval. The final draft is typed on stencils and proofread within the typing unit and then sent out for reproduction and distribution. When the General Assembly is in session, the speeches and related materials must be processed overnight for distribution to the delegates prior to the start of the session the following day. This requires tremendous speed and accuracy on the part of the typists. According to the typists, it is not uncommon for them to work 14-16 hour days, six days a week for months at a time.

The team that arrived at the UN on June 21, 1978, included Dr. Messite, Dr. Colligan, Mr. Moss, Mr. Murray, and Dr. Parr. At the UN the NIOSH team met with Dr. Peter Gatenby, Medical Director; Mr. Robert Chittenden, Chairman, Staff Council; Mr. R. Webb, Director, Personnel Administration; Mr. L. Slaughter, Computer Specialist; Mr. Daniel Rutledge, Deputy to Under-Secretary General; and representatives from the English, Spanish, and French units, and outlined the objectives of the investigation as follows:

1. To measure the ionizing and nonionizing radiations emitted by the VDT.

2. To examine the man-machine interactions for human factors and ergonomic problems.

3. To address the issue of current work practices.

4. To reduce any undue concern by the workers regarding the possible health hazards of the VDTs.

NIOSH Investigation

Following the meeting between the NIOSH team and UN representatives, Bill Murray and Gene Moss began their evaluation of the radiation emissions from the Wang machines. The protocol for measuring the radiation emissions from the VDT addressed both ionizing and nonionizing radiation. For ionizing emissions a Stoms meter was used to detect the presence of very low energy (less than 15 kilovolts) x-rays. A Victoreen Model 440RF/C ionization chamber, designed to measure low-level x-ray emissions from color television receivers, was used to accurately determine the exposure rate in milliroetgens/hour (mR/hr). Optical (ultraviolet, visible and infrared) radiation was measured with an EG&G Model 555 spectroradiometer. This instrument was used to determine spectral irradiance in terms of watts per square centimeter per nanometer ($W \cdot cm^{-2} \cdot nm^{-1}$) emitted by the cathode ray tube in the wavelength range 300-800 nm. In addition, the brightness or luminance of the screenface was evaluated with a Spectra Mini-Spot meter which reads out in footlamberts (fL). Three instruments were employed to measure radiofrequency (RF) radiation in the range of 10-500 megahertz (MHz), the frequency generated by the VDT. A Hewlett Packard Model 5303B Frequency Counter was used to determine the frequency of any RF radiation emitted by the terminal. The electric field component was measured in volts per meter (V/m) with the Electric Energy Density Meter Model EDM-2 and the magnetic component in amperes per meter (A/M) with a Narda Model 8607.

Two of the 27 terminals investigated were selected from the French and Spanish units for detailed optical radiation measurements with the EG&G. Other measurements were done on all 27 VDTs. All units were surveyed at maximum brightness conditions as close to the surface of the terminal as possible to maximize the measured radiation levels.

Drs. Messite, Colligan, and Parr interviewed a number of typists from the Spanish, English, and French units. The pattern of these interviews was fairly consistent. The potential hazards of radiation from various sources were carefully explained and the women were assured that according to design specifications, the Wang word processors were incapable of producing hazardous radiation levels. At this point, the employees tended to express more diverse concerns about general work practices such as the work-rest schedules, working hours, time pressures, etc. These factors, coupled with the burden of learning a new system was extremely threatening to many of the women. The interviewees were told that these matters would be discussed at a general meeting with UN management and staff the following day.

Results and Conclusions

Individual measurements made on VDTs in the different typing units are shown in Appendix A. The maximum levels measured are presented in Table I and compared with appropriate occupational exposure guidelines. The measured UV radiation is a factor of 10 million below the standard recommended in the NIOSH criteria document. The luminance (visible) values are less than 10% of the Threshold Limit Value (TLV) proposed by the American Conference of Governmental Industrial Hygienists. The electric field component is approximately one-third of the standard of the American National Standards Institute. This value was measured at 5 cm from the terminal and decreased to zero at approximately 15 cm. The RF-magnetic component, infrared and x-ray levels were too low to be measured and, thus, were at least a factor of 100 below the appropriate standard. These measurements were made at a distance of less than 15 cm from the terminal. Because radiation intensity decreases with increasing distance from the source, the levels to which an employee is exposed, at the normal working distance of 30-40 cm from the video screen, would be lower than the measured levels in all cases except for luminance.

Based on the results of the survey and the most current biological effects studies and radiation standards, an employee working in the vicinity of, or with, video display terminals is not exposed to a radiation hazard.

Thursday, June 22, the NIOSH team met with Mr. Bob Webb, Mr. Rutledge, Mr. Larry Slaughter, and Dr. Peter Gatenby of the UN management, Mr. Robert Chittenden and three representatives of the Spanish, French, and English typing units.

Dr. Parr opened the meeting and reviewed the findings of the radiation survey with regard to the physical hazards associated with the Wang system and pointed out that the machines emit extremely low levels of radiation, if any, and, compared with the current acceptable exposure standards, did not present either a cataract or other health hazard.

The human factors aspects of the Wang system were then discussed. The general point was made that the introduction of new work processes necessitates the re-evaluation of existing work practices to insure that the demands of the new system are compatible with the abilities and capacities of the operators for maximum productivity and worker comfort. Dr. Gatenby, at Dr. Messite's suggestions, will monitor the user's vision with periodic eye examinations. Dr. Gatenby also indicated, from a medical perspective, a concern over certain existing work practices (e.g., current work/rest ratios) and felt that the workers needed more frequent rest breaks for their own well-being.

As a result of this investigation, physical measurement, and the discussion with management and staff, the NIOSH survey team recommends the following:

1. The work-rest ratios should be re-evaluated to allow the workers to adjust to the Wang system as comfortably as possible. Previous research has indicated that a minimal 15-minute break every two hours is sufficient to alleviate stress-related problems.

2. New office equipment (already budgeted for) should be adjustable so that the desk and chairs are compatible with the individual's postural characteristics.

3. Attention should be paid to environmental lighting and potential glare problems from using the Wang system in a room of variable light conditions (due to uncovered windows, room traffic, etc.). If necessary, individual hoods should be placed on the screens to keep illumination constant.

4. Training should be initiated at a time of minimal work load to allow the users to become accustomed to the system under minimal pressure. Transient symptoms (e.g., eye strain, headaches) may result as a normal outcome of learning to use a new system. They should not be a source of concern and probably will disappear once the individual becomes comfortable and experienced with the new system.

5. Communication between management and staff is essential in ironing out the problems associated with the introduction of a new work operation. In this respect, supervisors should expect, and be sensitive to, adjustment problems likely to be encountered by workers in learning to use the system.

Sincerely yours,

Wordie H. Parr, Ph.D.
Chief
Physical Agents Effects Branch

TABLE I

Radiation Region	Maximum VDT Measured Level	Occupational Exposure Standard	Reference
Ultraviolet	$1.1 \times 10^{-10} W.cm^{-2}$	$1.1 \times 10^{-3} W.cm^{-2}$	NIOSH CD
Visible	$2.50 \times 10^{2} fL$	$2.92 \times 10^{3} fL$	ACGIH TLV
Infrared	ND*	$1.0 \times 10^{-2} W \cdot cm^{-2}$	ACGIH TLV
RF-Electric Component	$7.2 \times 10\ V \cdot m^{-1}$	$2.0 \times 10^{2} V \cdot_{m}^{-1}$	ANSI
RF-Magnetic Component	ND*	$5.0 \times 10^{-1} A \cdot m^{-1}$	ANSI
X-ray	ND*	$2.5\ mR \cdot hr^{-1}$	OSHA

Table 1. Maximum Radiation Levels Measured in Comparison to Current Occupational Exposure Standards

* Not detectable

APPENDIX A

	VDT S/N	Luminance (footlamberts)	X-Ray (mR/hr)	Radiofrequency E-field (V/m)	Radiofrequency H-field (A/m)	Ultraviolet ($W \cdot cm^{-2}$)	Infrared ($W \cdot cm^{-2}$)
Spanish Unit	6375	250	ND	50	ND	--	--
	6467	120	ND	30	ND	--	--
	6380	220	ND	48	ND	--	--
	6469	60	ND	21	ND	--	--
	6455	150	ND	37	ND	3.0×10^{-11}	ND
	6372	110	ND	37	ND	--	--
	6402	200	ND	58	ND	--	--
	6486	110	ND	30	ND	--	--
	6470	205	ND	43	ND	--	--
French Unit	7294	80	ND	30	ND	--	--
	7295	100	ND	21	ND	--	--
	7296	180	ND	40	ND	--	--
	7293	70	ND	26	ND	--	--
	6350	220	ND	58	ND	1.1×10^{-10}	ND
	7297	200	ND	26	ND	--	--
	6376	140	ND	37	ND	--	--
	7209	200	ND	58	ND	--	--
English Unit	6799	180	ND	48	ND	--	--
	6796	200	ND	48	ND	--	--
	6432	45	ND	26	ND	--	--
	6801	200	ND	72	ND	--	--
	6798	30	ND	40	ND	--	--
	6794	220	ND	48	ND	--	--
	6800	50	ND	26	ND	--	--
	6795	150	ND	34	ND	--	--

ND - Not Detectable