Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

ISSN: 0972-6268	Vol. 10	No. 4	pp. 633-636	2011

Survey Based Research Paper

Study of Health Effects on Photostat Workers in Kolhapur, Maharashtra

Rajiv B. Hunashal
Post Graduate Department of Environment Management, Chh. Shahu Institute of Business Education and Research (SIBER), University Road, Kolhapur-416 004, Maharashtra, India

Nat. Env. & Poll. Tech.
Website: www.neptjournal.com

Received: 19/4/2011
Accepted: 17/6/2011

Key Words:
Photostat workers
Photocopying machines
Volatile organic compounds
Health effects

ABSTRACT

The present study of health effects on photostat workers is carried out in the selected populated educational and commercial areas in Kolhapur city. It is in the form of questionnaire survey of 150 workers working in different Xerox centres. The aim of study is to evaluate the workers of different age groups those are occupationally exposed to photocopying and Xerox machines. The toxic components of photocopiers are from their emissions, toners and extremely low frequency of electromagnetic fields, coming in the form of vapours, gases, particulates in addition to chemicals used in photo duplication equipment. This causes headache, respiratory problem, leg pain, dermatitis, irritation in eyes and nose, cough and sneezing, loss of visibility and allergies.

INTRODUCTION

In recent times, India has emerged as a fast developing nation due to rapid industrialization and urbanization. This has enhanced the level of environmental pollution manifold. Increasing the number of electronic devices has imposed a serious threat on the people. Recently, it has been realized that pollutants that are found inside the homes, shops, that is indoor pollutants, are equally dangerous. In this regard some of the electronic devices used in the commercial sector in households and shops are photocopier machines. This trend is likely to continue in future, and exposures in this environment influence health of the workers those handle these devices. Some of the case reports and a few studies have suggested that some common environment exposures, such as exposures to carbonless copy paper (CCP) (Shehade et al. 1987, Skov et al. 1989, Kanerva et al. 1993) and fumes from Xerox machines, photocopiers and printers affect the health adversely (Skov et al. 1989, Jaakkola & Jaakkola 1999, Yassi et al. 1988, Fisk et al. 1993).

Ozone and organic volatiles are emitted from laser printers and photocopiers (Tuomi et al. 2000). The volatile organic compounds (VOCs) that are emitted by these machines include isodecane, xylene, 2,2,4-trimethyloctane, alkanes, nitropyrene and phthalates, which create various health effects. The emission of the VOCs range from 0.5 to 16.4 µg/sheet of paper (Hetes et al. 1995).

The average ozone emitted from photocopying machines is 40 µg/copy (Selway et al.1980). Ozone levels can reach to dangerous level in small, poorly ventilated copying rooms, since it can cause headache and irritation in eyes, nose, throat and lungs. The essential components of the dry toners are colorants and binder resins. Toner dust may irritate the respiratory tract resulting in coughing and sneezing. Some toners contain compounds like nitropyrenes and trinitrofluorene, which have genotoxic effects in workers (Iravathy Goud et al. 2004). The chromosomal aberration in workers, occupationally exposed to photocopying machines in Sular, South India, has been reported by Mythili Balakrishnan & Ayyappa Das (2010).

The objective of this study was to asses the exposure of the workers to various health effects such as head ache, respiratory problem , loss of hearing , loss of eye visibility, leg pain, cough and sneezing and allergies, with respect to age groups. Xerox machines, photocopiers and printers are safe when used occasionally and serviced regularly. But they are bad when poorly maintained and used frequently. The proper ventilation is also essential to reduce the health hazards in the workers.

SUBSTANCES CAUSING HEALTH HAZARDS

Volatile organic compounds: The volatile organic compounds like isodecanes (carcinogenic), 1, 1, 1-trichloroethane (skin irritation), iso-octane, toluene (fatigue, eye, throat irritation) xylene (kidney damage), benzene (carcinogenic), F alkanes, 2, 2, 4-trimethyl octane, nitropyrene and phthalates are produced during wet and dry processes.

Ozone: In xerographic devices, ozone is produced primarily by the corona discharge of various corotrons. UV emission from document exposure lamps are so low that the ozone generated by this means is significant.

Particulate materials: Dust associated with copying and printing consists primarily of paper particles and fibres with smaller amount of toner particles (less than 20%). Dust is emitted from the exhausts used to extract heat from the machine interior. Paper fragments are also generated during paper handling outside the machine causing respiratory problems.

Toners: Toners are generally a mixture of plastic resins and carbon black often with other additives. Carbon black is classified as nuisance dust (mildly toxic) but will contain impurities known to be carcinogenic. Health effects of the toners are irritation in eyes, headache and itching skin.

UV light: The strong UV light is produced during the operation that reduces visibility of eyes of the workers and also affects the skin.

Carbon monoxide: It is produced when toner (containing carbon black) is heated in an inadequate air supply. In poorly ventilated conditions, its effects include headache, drowsiness and increased pulse rate.

Nitrogen oxide: It may be produce when there is a spark in electrostatic photocopiers. Symptoms are similar as that of carbon monoxide.

Noise: The noise of about 68 dB(A) is produced during ordinary copiers. It affects the hearing capacity of workers.

Selenium and cadmium sulphide: Some copiers use a drum impregnated with selenium or cadmium sulphide. The gas emitted from these materials, especially when hot, can cause throat irritation. The short term exposure to high level of selenium by ingestion causes nausea, vomiting, skin rashes and rhinitis.

Liquid and solid inks: In some imaging applications liquid and solid inks are used. These inks are generally based on paraffinic solvents, various colorants and dispersing agents. Black inks contain special grade carbon blacks, while coloured inks contain dyes or pigments. The workers exposed to these pigments and dyes will suffer from carcinogenic effects.

Naphthalene: It is a chemical commonly used in older photocopiers. It is a hazardous substance, passes through skin as well as enters the body through inhalation. The exposure to large amount of naphthalene may damage red blood cells, causes fatigue, lack of appetite, restless, pale skin, nausea, vomiting and diarrhoea, and also affects unborn children.

MATERIALS AND METHODS

Study Area: The present study was carried out in Kolhapur. The aim of the study is to evaluate the hidden health effects on the workers exposed to photocopiers and Xerox machines.

The criteria of study is based on survey. At the time of survey, workers were informed to reply to the questionnaire. All the questions in the questionnaire are subdivided into age of the worker, years of exposure to photocopying machine, type of machine used, hours of working in a day, salary, health effects, and precaution and safety measures to minimize the health effects.

RESULTS AND DISCUSSION

The personal information of the respondents like age group, year of working, etc. is given in Table 1. It shows that the maximum workers were of the age group 15-20 years (58) followed by 21-25 years (26), 26-30 years (24) and 41-45 years (10).

The total number of respondents suffering from respiratory problems due to emission of volatile organic compounds (VOCs) and dust from the toners were 54, distributed in the age groups as 15(41-45 yrs), 13(36-40 yrs), 12(31-35 yrs), 7(26-30 yrs), 5(21-25 yrs) and 2(15-20 yrs) as indicated in Table 2.

The respondents, suffered from headache due to emission of carbon monoxide (CO) and ozone, were 30 with 8(41-45 yrs), 7(36-40 yrs), 6(31-35 yrs), 4(26-30 yrs), 2(21-25 yrs) and 3(15-20 yrs) age groups.

The workers facing leg pain problems due to continuous working with standing were 25 out of which 10 were of 41-45 yrs age group, 7 of 36-40 yrs, 5 of 31-35 yrs and 3 of 26-30 yrs.

The exposures caused loss of hearing ability due to continuous noise emitted from photocopying machines in about 18 people. Of these 7 belonged to 41-45 yrs age group, 4 to 36-40 yrs, 3 to 31-35 yrs, 2 to 26-30 yrs, 1 to 21-25 yrs and 1 to 15-20 yrs. There was also the loss of visibility due to strong radiations emitted from machines in 17 people, out of which 9 belonged to 41-45 yrs age group, 5 to 36-40 yrs and 3 to 31-35 yrs age group.

Percentage of respondents affected with various health implications is indicated in Table 3 and Fig. 1. It depicts

Table 1: Personal details of the respondents.

Sr. No.	Age Group	Years of Working	Number of Respondents
1	15-20	3-4	58
2	21-25	4-6	26
3	26-30	4-7	24
4	31-35	6-8	17
5	36-40	7-10	15
6	41-45	8-10	10
		Total	150

Table 2: Details of the respondents affected with various health effects with respect to age groups.

Sr.No	Various health effects	Different age groups (yrs)						Total No. of Respondents
		15-20	21-25	26-30	31-35	36-40	41-45	
1	Headache	3	2	4	6	7	8	30
2	Respiratory effects	2	5	7	12	13	15	54
3	Loss of hearing	1	1	2	3	4	7	18
4	Loss of eye visibility	-	-	-	3	5	9	17
5	Leg pain	-	-	3	5	7	10	25
6	Cough, sneezing	-	-	-	1	-	1	2
7	Allergies	-	-	-	1	-	1	2
8	Others (skin, nausea)	-	1	-	-	-	1	2
		6	9	16	31	36	52	150

Table 3: Percentage of respondents affected with various health effects.

Sr. No.	Various health effects	% of respondents affected
1	Headache	20
2	Respiratory effects	36
3	Loss of hearing	12
4	Loss of eye visibility	11.333
5	Leg pain	16.667
6	Cough, sneezing	1.3333
7	Allergies	1.3333
8	Others (skin, nausea)	1.3333

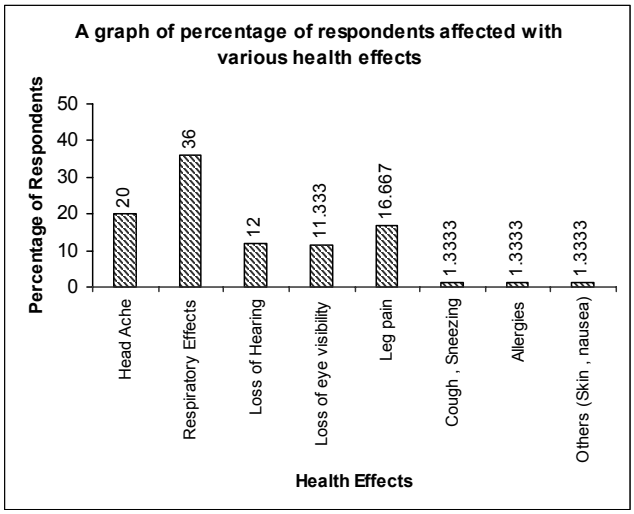

Fig. 1: A graph of percentage of respondents affected with various health effects.

that about 36 % of the total respondents suffered from respiratory problems, 20% from headache, 16.67% from leg pain, 12% from loss of hearing, 11.333% from loss of visibility.

It can be concluded that the respondents of age group 41-45 yrs suffer more from health effects such as respiratory problem, headache, leg pain, loss of hearing and loss of visibility as compared to other age groups due to hazardous emissions of Xerox and photocopying machines.

SUGGESTIONS

1. Choose low emission copiers.
2. Use of ozone filters.
3. Use of proper ventilation system.
4. Proper maintenance of photocopier machines.
5. Schedule regular breaks for working.
6. Proper disposal of waste materials.
7. Use of personal protective equipment.
8. Create awareness in the workers.
9. Proper training and guidance to the workers.

ACKNOWLEDGEMENT

The author is indebted to Late Dr. A. D. Shinde, President and Managing Trustee, Dr. R. A. Shinde, Secretary, Prof. Dr. R. V. Kulkarni, Director and Prof. Dr. A. R. Kulkarni, Head, Dept. of Environment Management, SIBER, Kolhapur, for providing the necessary materials and encouragement.

REFERENCES

Fisk, W. J., Mendell, M. J. and Daisey, J. M. 1993. Phase 1 of the California healthy building study: A Summary. Indoor Air, 3: 246-254.

Hetes, R., Moore, M. and Northelm, C. 1995. Office Equipment: Design, Indoor Air Emissions, and Pollution Prevention Opportunities. U.S. EPA Project Summary, EPA/600/SR-95/045, Research Triangle Park, North Carolina.

Iravathy Goud K., Hasan, Q., Balakrishnac, N., Prabhakar Rao, K. and Ahuja Y.R. 2004. Genotoxicity evaluation of individuals working with photocopying machines. Mut. Res., 563: 151-158.

Jaakkola, M.S. and Jaakkola, J.J.K. 1999. Office equipment and supplies: A modern occupational health concern. Am. J. Epidemiol., 150: 1223-1228.

Kanerva, L., Estlander, T. and Jolanki, R. 1993. Occupational allergic contact dermatitis caused by diethylenetri-amine in carbonless copy paper. Contact Dermatitis, 29: 147-151.

Mythili Balakrishnan and Ayyappa Das 2010. Chromosomal aberration of workers occupationally exposed to photocopying machines in Sular, South India. Int. Journal of Pharma and Biosciences, 1(4): B303-B 307.

Saritha, V., Ch. Bhavannarayana, K. Anil Kumar and Jyothi, V. S. 2010. Xerox workers: Hidden health hazards in Visakhapatnam. Nat. Env. Poll. Tech., 9(1): 39-42.

Selway, M.D., Allen, R.J. and Wadden, R.A. 1980. Ozone production from photocopying machines. Ann. Ind. Hyg. Assoc., 41: 455-459.
Shehade, S.A., Beck, S.A. and Chalmers, R.J.G. 1987. Allergic contact dermatitis to crystal violet in carbonless copy paper. Contact Dermatitis, 17: 310-326.
Skov, P., Valbjorn, O. and Pedersen, B.V. 1989. Influence of personal characteristics, job related factors and psychosocial factors on the sick building syndrome. Scand. J . Work Environ. Health., 15: 286-295.
Tuomi, B., Engstrom, R., Niemela, J., Svinhufvud, K., Reijula 2000. Emission of ozone and organic volatiles from a selection of laser printers and photocopiers. Appl. Occup. Environ. Hyg., 15: 629-634.
Yassi, A., Warrington, R.J. 1988. Allergic eye reaction to photocopier chemicals. J. Occup. Med., 30: 457-458.