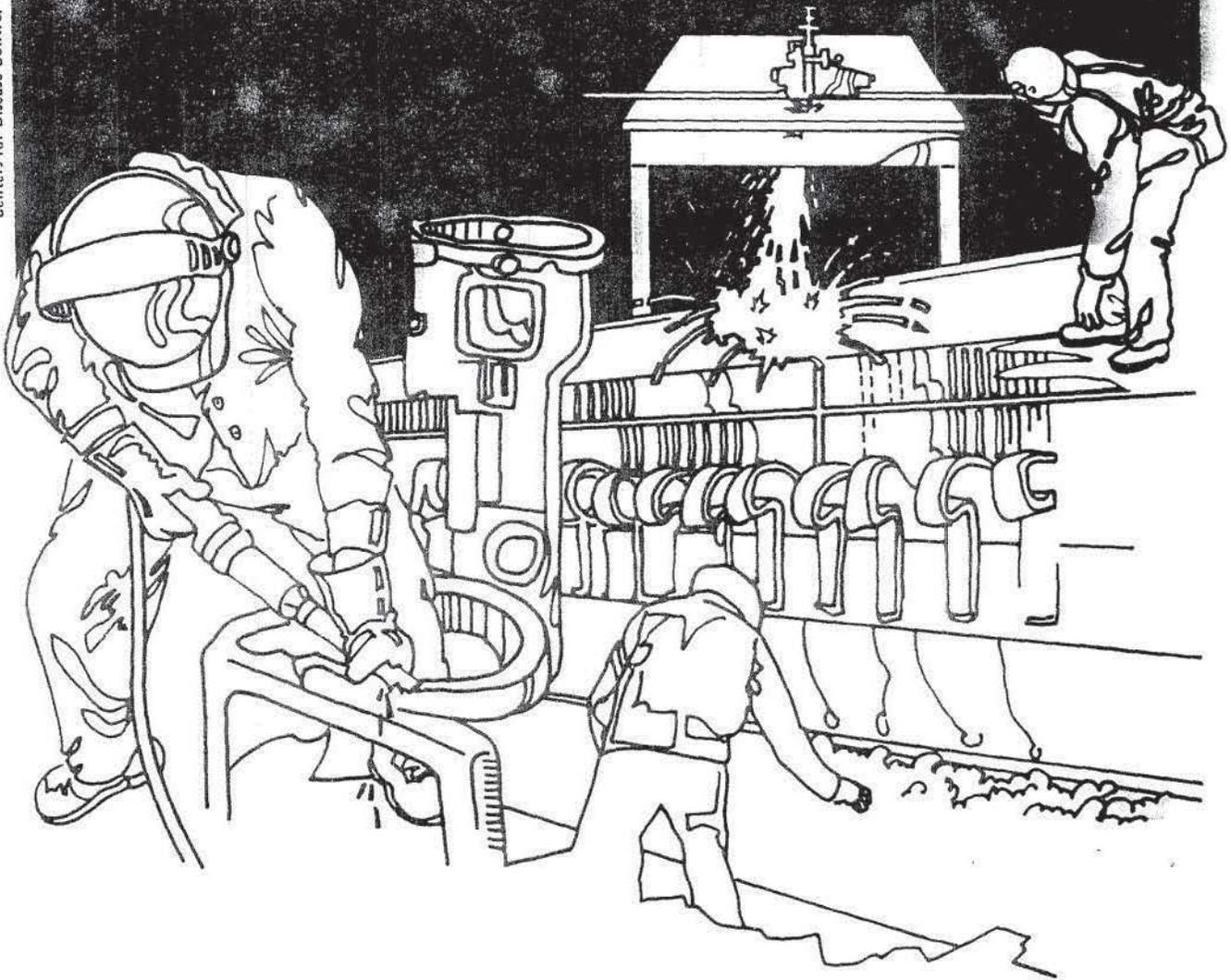


U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

80-233-793

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 699(a)(6), which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HE 80-233 -793
JANUARY 1981
DAVIS BESSIE NUCLEAR POWER STATION
TOLEDO EDISON COMPANY
UNITED ENGINEERS & CONTRACTORS COMPANY (UE&C)
OAK HARBOR, OHIO

NIOSH INVESTIGATORS:
JAMES CONE, MD
RICK HARTLE, IH

I. SUMMARY

In September 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from an authorized representative of employees at Davis Bessie Nuclear Power Station in Oak Harbor, Ohio. The request was prompted by a report of folliculitis of the scalp in one nuclear guard and numerous complaints of scalp and skin irritation among construction workers, working in areas where Kao-wool (a ceramic, non-asbestos, wool fiber used as an insulation material) was installed.

The process of installation of Kao-wool involved the laying of pure Kao-wool blankets on top of trays containing electrical wiring in "cable spread rooms". This process began in February 1980, and was largely completed by the time of the NIOSH evaluation. A total of 150 production and 250 maintenance workers, as well as a large but varying number of construction workers were potentially exposed. NIOSH responded to this request by conducting a preliminary survey on September 24 - 25, 1980. A followup survey was performed on October 16, 1980. The medical evaluation included a medical questionnaire and skin examination of 52 Toledo Edison and UE&C employees. In addition, scalp cultures were performed on 43 workers to detect possible bacterial contamination. The environmental evaluation consisted of three personal breathing zone samples for airborne Kao-wool. In addition, bulk samples were obtained for fiber diameter sizing.

The personal breathing zone samples taken after the installation process had been largely completed revealed no gravimetrically detectable accumulation of particulates. Diameter sizing showed fibers to be largely non-respirable, ranging between <1 and 125 microns.

Thirty-seven workers have a history suggestive of irritant dermatitis of the scalp following exposure to Kao-wool, and 24 workers had physical examination findings consistent with this diagnosis. One worker had a history of severe folliculitis of the scalp, and one worker had physical findings of chronic foreign-body granuloma of the skin. Positive bacterial skin cultures were found in 18 workers, with an unusual distribution of flora of the gut, respiratory tract and common skin contaminants.

Based on the environmental sample results, employee interviews, physical examinations and skin cultures, NIOSH determined that a potential health hazard exists as a result of employees' exposure to Kao-wool. Dermatitis of the scalp, folliculitis of the scalp and chronic granuloma of the skin may, in part, be attributable to current and past exposures of workers at Davis Bessie. Recommendations for reducing exposures are made in Section VII.

KEYWORDS: SIC 4911 (Electric power generation) Ceramic wool fibers, irritant dermatitis, folliculitis of the scalp

II. INTRODUCTION

On September 1, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation from a union representative of employees of the United Engineers and Contractors (UE&C) site at the Davis Bessie Nuclear Power Station in Oak Harbor, OH. A second confidential request for a Health Hazard Evaluation was received on September 6, 1980 from a union representative of Toledo Edison Company employees working at the Davis Bessie Nuclear Power Station. The investigation was requested in both cases to evaluate skin problems possibly resulting from exposure to Kao-wool, a ceramic wool fiber used as an insulating material in the cable tray spread room and other areas of the plant.

III. BACKGROUND

The Davis Bessie Nuclear Power Station, designed and built by Babcock and Wilcox beginning in 1971, began power production in 1977. Kao-wool was first used in the summer of 1978, in the cable spread room. In February 1980, the power station was taken off line for refueling and Nuclear Regulatory Commission-required retrofitting of fire protection sprinkler systems, security systems and further insulation with Kao-wool. This process was 99% completed at the time of the NIOSH study and the Power Station was scheduled to be back on line by October 15.

On September 24, 1980, NIOSH personnel, management and union representatives conducted a walk-through survey of the power station, including the entrance areas of the cable spread room, and other sites that nuclear guards were required to patrol. Also inspected were lunchroom facilities and trailers where clothing changes and hard hats were stored. Excluded from the inspection were containment areas (except for the clothing change area outside the containment area). On September 25, with management and employee representatives of United Engineers and Contractors, NIOSH conducted a second walk-through of areas where hard hats were stored by UE&C personnel.

IV. ENVIRONMENTAL EVALUATION

A visual inspection of the work areas revealed that large quantities of Kao-wool had been installed for fire protection purposes throughout the facility. This process however, had been largely completed more than a week prior to the walk-through. During the walk-through no airborne fibers were observed, and inspection of ledges, rafters and other relatively inaccessible areas showed no visible accumulation. Environmental air samples were collected via attachment of personal sampling devices to three guards and samples were collected for the duration of the guard's security tour. The samples were analyzed gravimetrically, and showed no detectable accumulation of any particulates. Because of the association between relatively larger fiber diameters and dermatitis, bulk samples of the Kao-wool material were obtained for fiber diameter sizing. Sizes ranged from <1 micrometer to approximately 125 micrometers, generally above respirable size.

While construction was underway, Kao-wool blankets were applied to wiring trays in positive-pressure rooms. Guards were positioned outside these areas and fiber-laden air was forced past them when construction workers entered or exited.

Another potential source of airborne fibers exists when guards physically search or "frisk" individuals prior to facility entrance. Construction workers, in particular, may enter and exit the facility numerous times per day, and fiber accumulations on their clothes may be liberated in the guardhouse where searches take place. Construction workers may be exposed to falling Kao-wool fibers while traveling under cable trays.

Kao-wool exposure may also occur when guards brush against cable trays during security tours.

V. MEDICAL EVALUATION

A. Methods

On September 24, 1980 NIOSH conducted a medical survey of the Toledo Edison employees. Two groups of employees were selected for a cross-sectional study: nuclear guards, the group of primary concern, and instrument and control personnel (primarily involved in calibration and maintenance of the instruments and gauges in the power station).

On September 25, NIOSH conducted a similar study of UE&C employees, including a sample selected by union representatives from workers who had earlier responded to a questionnaire circulated by one of the union stewards concerning possible skin problems at Davis Bessie. These included electricians, carpenters, asbestos workers, wiremen, sprinkler fitters, laborers, and pipefitters.

The medical survey included a questionnaire, a brief physical examination of the skin and scalp, cotton swab cultures of affected areas of the scalp or skin, and skin scrapings on 3 cases (preserved on a slide with 10% KOH in water). Three NIOSH investigators also had scalp cultures performed.

A total of 52 workers, including 24 nuclear guards, 4 instrument and control workers, 8 electricians, 2 wiremen, 1 welder, 2 pipefitters, 1 maintenance worker, 2 asbestos workers, 4 carpenters, 2 laborers, 1 clerk, and 2 operators agreed to participate. Among the 28 nuclear guards present on the day of the study, the participation rate was 85%. Unfortunately, however, the week prior to our visit, all but a small percentage of the UE&C workers were laid off because of the completion of the process of retrofitting insulation and fire protection equipment. Therefore, only a small number of these workers were able to participate.

The purpose of the questionnaire was to obtain the following information:

- a. Prevalence of dermatological or other problems, including allergies, prior to work at Davis Bessie.
- b. Prevalence of dermatological problems and history of skin disease while working at Davis Bessie.
- c. History of cigarette smoking habits and work history, with a focus on prior dust exposure.
- d. Use of gloves, and hard hat use, cleaning and storage.

A worker was designated as having an irritant dermatitis due to workplace exposure if the following conditions were met:

- a. There was a history of itching of the scalp, accompanied by scaling or rash.
- b. There was a history of beginning work at Davis Bessie prior to the onset of the problem.

Following the cross-sectional study of Toledo Edison and UE&C employees, a case-control study was performed to determine the degree of association of the following risk factors with irritant dermatitis of the scalp among Davis Bessie workers:

- a. History of allergies or family history of skin problems
- b. Shampoo use
- c. Length of employment
- d. Glove use
- e. Hard hat type, storage and cleaning
- f. Prior exposure to fiberglass-type material
- g. Shift worked
- h. Dust exposure level
- i. Positive skin cultures

B. FINDINGS

1. Cross-sectional study

A total of 37 workers (15 UE&C, and 22 Toledo Edison) were found to have had a history suggestive of an irritant dermatitis of the scalp. Of these, 24 had physical examination findings compatible with this diagnosis. Workers described the onset of scalp irritation in the region of the headband of their hard hats beginning several days to weeks after beginning work in an area with

Kao-wool exposure, it progressed to moderate to severe itching, scaling and in some cases, to a pustular eruption of the scalp, scab formation and chronic scaling. In the most severe cases, it progressed to a frank folliculitis of the scalp, with local and regional lymph node enlargement provoking the workers to consult a physician. Treatment in these cases involved topical and systemic antibiotics and/or steroids in addition to removal from Kao-wool-exposed areas and prohibition against hard hat wearing. In one case, skin changes consistent with foreign-body granuloma were present on the back of the worker's neck.

Date of onset was the summer of 1978 for 5 cases, and summer 1980 for 27 other cases. A few sporadic cases occurred in between those two periods. (See Figure 1).

The prevalence of cases was similar in all occupations studied except that no cases were found among a small sample of operators and clerical workers. (See Table I).

Skin scrapings of three workers (forearm) showed one slide with Kao-wool-like fibers present.

Of the 43 skin cultures, 25 showed "no growth", the other 18 had one or more of the following:

Organism	# reported	% of total of 18
<u>Serratia marcesens</u>	5	28%
<u>Staphylococcus epidermidis</u>	5	28%
<u>Streptococcus viridans</u>	4	22%
<u>Escherichia coli</u>	2	11%
<u>Staphylococcus aureus</u>	1	6%
<u>Klebsiella pneumoniae</u>	1	6%
<u>Acinetobacter anitratus</u>	1	6%
<u>Acinetobacter lwoffii</u>	1	6%

All three NIOSH personnel cultured were negative. A blank control was also negative. In only two cases was more than one organism identified. Most of the organisms are flora of the human gut, perineum, skin or respiratory tract. The distribution of organisms is unusual, and may suggest fecal or oral contamination of the skin.

The nuclear guards had a significantly increased proportion of positive skin cultures (13/22, compared with only 4 of the 15 other workers, $p < 0.05$).

2. Case-control Study

No significant differences were found between cases and controls with respect to the following:

1. Sex
2. Age
3. Race/Ethnic background
4. History of Allergy
5. Shampoo use
6. Length of employment at Davis Bessie
7. Glove use
8. Hard hat type, storage location or cleaning practices
9. Symptoms other than itching scalp or skin rash
10. Previous exposure to fiberglass-like materials

Significant differences were found between cases and controls with respect to the following risk factors however:

- a. Twelve out of fourteen nuclear guards working the day shift (7:00 a.m. to 7:00 p.m.) had irritant dermatitis of the scalp compared with only three out of nine working the night shift (7:00 p.m. to 7:00 a.m.) ($p < 0.009$).
- b. Cases reported significantly higher present mean dust exposure levels (3.6) compared with controls (2.6). ($t=2.29$, $d.f.=48$, $p < 0.01$) (Workers were asked to rate current and prior levels of dust exposure on a scale of 1-5, with 5 being the worst dust level they had ever experienced.)

VI. DISCUSSION

Fibrous glass exposure has been frequently reported in association with irritant dermatitis. (1) Ceramic wool fibers (Kao-wool) have been similarly associated in the past with irritant dermatitis of the skin (2) Irritant dermatitis of the scalp has not been previously reported, however. The high incidence of this problem found among nuclear guards as well as construction workers at Davis Bessie Nuclear Power Station may represent the combined effect of several contributing factors, including:

- a. Widespread use of the Kao-wool blankets without encasement in fiberglass-aluminum sheets.
- b. Mandatory hard hat use by virtually all employees in areas with possible Kao-wool exposure.

c. Exposure to extremely high temperature environments during strenuous jobs, resulting in profuse sweating among workers wearing hard hats.

d. Long shifts (12 hr./day) for nuclear guards during the period of Kao-wool installation.

The reported complication of the irritant dermatitis by folliculitis may be the result of puncture of skin by Kao-wool, followed by contamination and infection due to inadequate provision for hand washing and/or gloves.

VII. RECOMMENDATIONS

Two closing conferences were held on September 25, 1980 with management, union and NIOSH representatives at the respective sites. Recommendations were made to improve the working conditions in the plant and are summarized here.

a. Environmental:

1. Kao-wool should be installed with impermeable covering to prevent liberation of fibers both during installation and in future during maintenance.
2. Adequate hand-washing facilities should be made available both for nuclear guards and any construction workers on site.

b. Personal Protection

1. Gloves should be worn by nuclear guards during personal searches.
2. Hard hats should be worn only when necessary to prevent head injury, and removed at other times, such as while in guard houses.
3. Hard hats should be cleaned frequently and stored in such a way as to prevent contamination.

VIII. AUTHORSHIP AND ACKNOWLEDGMENTS

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Acknowledgements

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Report Typed by:	Dorothy Chandler Medical Section

For the purpose of informing the "affected employees", the employer shall promptly "post" the determination report for a period of 30 days in a prominent place where exposed employees work.

Copies of this report are currently available, upon request, from NIOSH, Division of Technical Services, Publications Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through National Technical Information Service, (NTIS), Springfield, Virginia 22161.

Copies of the report have been sent to:

- A. Vice President, Toledo Edison Company
- B. IBEW Local 1413
- C. Electrician's Local UE&C, Davis Bessie
- D. United Electricians & Contractors,

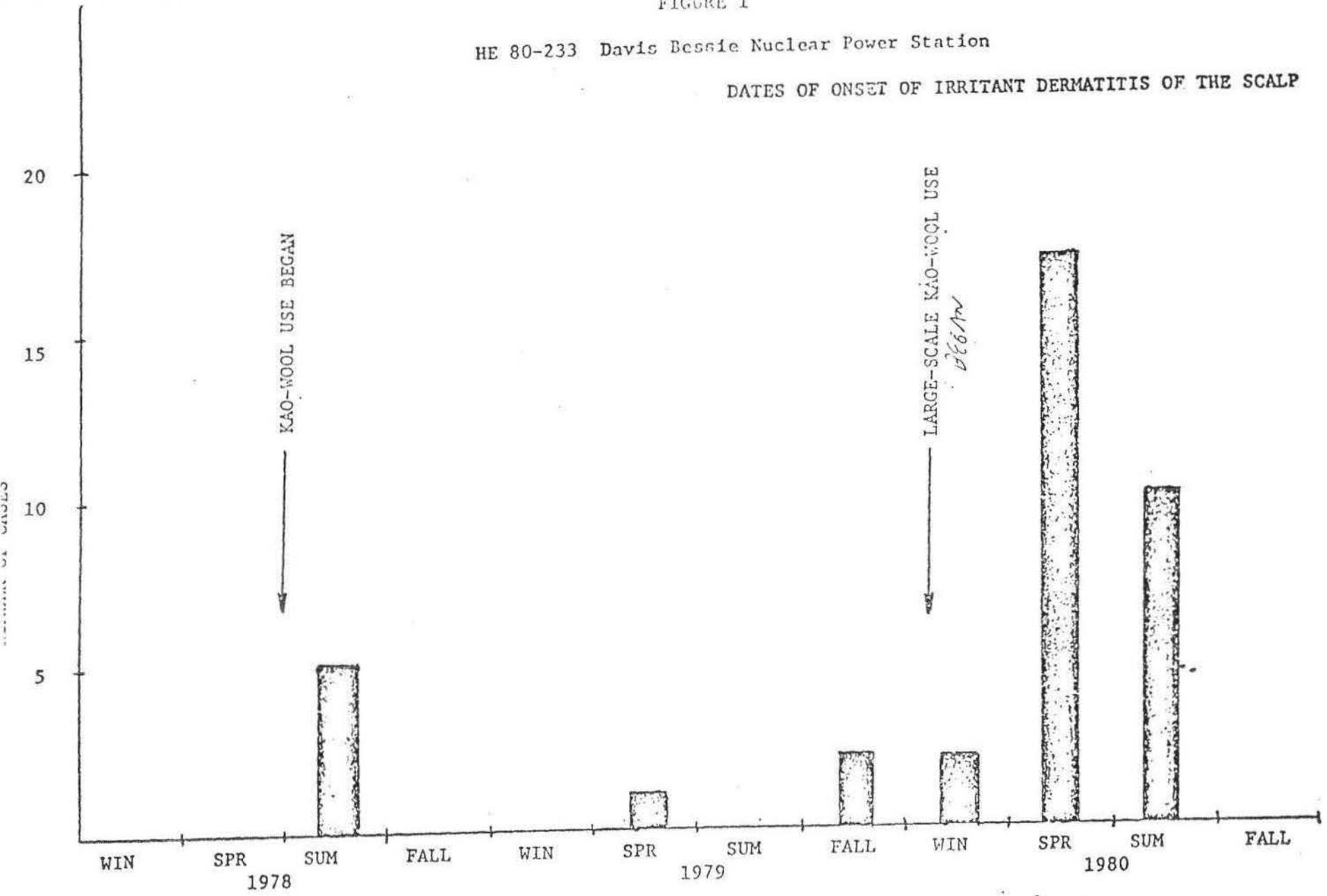
IX. REFERENCES

1. NIOSH, Criteria for a Recommended Standard... Occupational Exposure to Fibrous Glass (NIOSH 77-152).
2. Personal Communication, Richard Moore, Industrial Hygienist, Babcock and Wilcox.
3. NIOSH, Industrial Hygiene Surveys of Occupational Exposure to Mineral Wool, (NIOSH 80-135).

FIGURE 1

HE 80-233 Davis Bessie Nuclear Power Station

DATES OF ONSET OF IRRITANT DERMATITIS OF THE SCALP



Season of onset of cases of irritant dermatitis of the scalp

TABLE I

DAVIS BESSIE NUCLEAR POWER STATION
HE 80-233PREVALENCE OF CASES OF IRRITANT DERMATITIS OF THE SCALP
AMONG WORKERS

<u>JOB TITLE</u>	<u># of CASES</u>	<u># of NON-CASES</u>	<u>TOTAL #</u>	<u>% (CASES X 100)</u> <u>TOTAL</u>
NUCLEAR GUARDS	16	8	24	67%
INSTRUMENT AND CONTROL	4	0	4	100%
ELECTRICIANS	6	2	8	75%
WIREMEN	1	1	2	50%
PIPEFITTERS	2	0	2	100%
MAINTENANCE	1	0	1	100%
ASBESTOS-WORKERS	2	0	2	100%
CARPENTERS	3	1	4	75%
LABORERS	1	1	2	50%
CLERKS	0	1	1	0%
OPERATORS	0	2	2	0%
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	36	16	52	69%

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