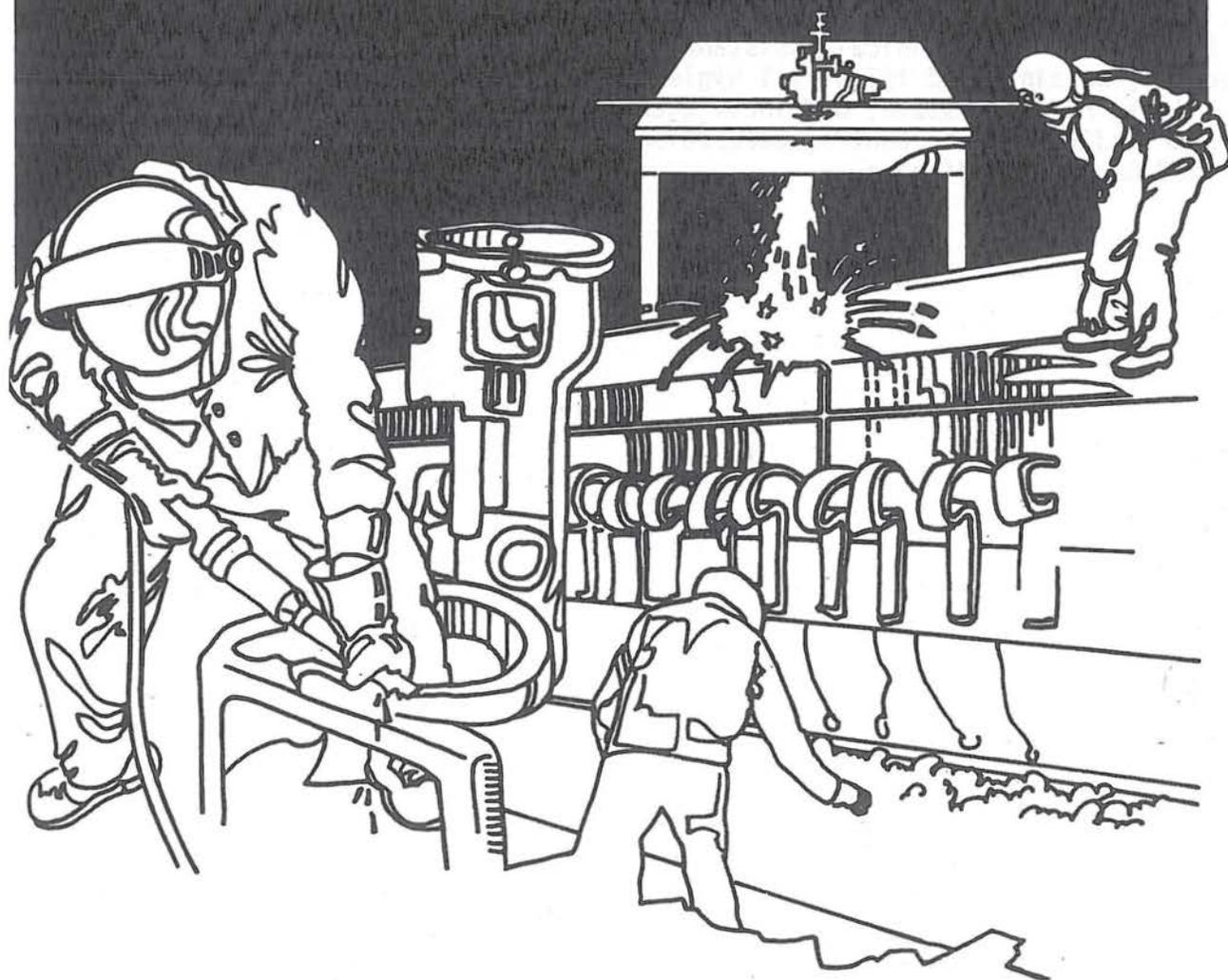


NIOSH



Health Hazard Evaluation Report

HETA 81-146-1162
RALSTON PURINA COMPANY
MECHANICSBURG, PENNSYLVANIA

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. 669(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.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

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

HETA 81-146-1162
August 1982
Ralston Purina Company
Mechanicsburg, Pennsylvania

NIOSH INVESTIGATOR:
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I. SUMMARY

In February, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from workers at Ralston Purina Company, Mechanicsburg, Pennsylvania to evaluate reports of skin rash and possible respiratory impairment among workers involved in production of dry pet food.

The NIOSH survey on March 3-4, 1981 was directed to obtaining process information and employee medical interviews. A walk-through evaluation was performed during regular operation of the plant, and 50 workers were interviewed. Procedures for shut-down, start-up, and maintenance of the production process were not observed. Information about food coloring agents and cleaning agents was obtained through the Ralston Purina corporate office.

Five workers were found to have dermatitis, but this could not be attributed to specific exposures. Interview data suggested that some workers may have experienced direct skin irritation from food ingredients or cleaning agents used in the plant. One worker with dermatitis was found to be sensitive to paraphenylenediamine (PPDA), which suggested the possibility that reexposure to PPDA in lubricant or oils in the plant and/or cross-sensitivity reactions to azo dyes or other substances present in the plant might have caused the skin lesions.

Based on the results of this survey, NIOSH concludes that some workers were experiencing dermatitis at the time of the survey, but these findings could not be attributed to specific exposures. Some dermatitis may have been caused by allergic contact sensitivity or cross-sensitivity reactions. Recommendations are included concerning protection of skin from potentially irritating cleaning agents and grain dust.

KEYWORDS: SIC 2047 (dog, cat, and other pet food), allergic dermatitis, cross-sensitivity reactions, paraphenylenediamine, azo dyes, food dyes, grain dust.

II. INTRODUCTION

In February, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from an authorized representative of workers at Ralston Purina Company, Mechanicsburg, Pennsylvania to evaluate reports of skin rash and possible respiratory impairment among plant workers involved in production of dry pet food.

III. BACKGROUND

This facility produces dry dog food and cat food. It has been in operation for 12 years, during which time it has produced only dry pet foods composed of grains, meat meals, powdered milk, other animal-derived ingredients, vitamin supplements, mineral supplements, preservatives, and coloring agents. The company employs approximately 280 workers, of whom about 200 are hourly employees. The plant operates 3 shifts/day for 5 days/week.

The plant is mostly a single-floor facility consisting of a main production area, a storage area for finished products, separate storage areas for food ingredients and biologically inert constituents, an adjoining garage-like unloading area for bulk ingredients, and an extended platform at the level of the orifices into the mixing/process vessels. The orifices at this level are covered by semi-enclosing exhaust hoods. This platform level has a table with an enclosing exhaust hood for measurement of certain small ingredients, such as coloring agents.

Bulk grain ingredients of pet food are introduced into a mixing vessel via an automated transport/storage system. Other ingredients are handled typically in powdered or pellet form and are introduced into the mixing vessel through the orifices at the elevated platform level. The ingredients are combined to form a mixed meal that is cooked by a heat/pressure process, extruded into characteristic pet food shapes, and dried in an automated enclosed production sequence. The resulting product is packaged in a partially automated process.

The processing unit is shut down each Saturday morning and is restarted the following Monday. In this process, meal-mix in the mixing vessels is saturated with EP Liquid (a proprietary organic acid bacteriocide) and the vessel is sealed. Exterior surfaces of the vessels are cleaned with a liquid detergent solution. The conveyor system for the drying unit is cleaned with KS-30 (a proprietary caustic cleaning product) that drains into an open-top moveable tank for disposal. At start-up, the bacteriocide-saturated meal is run through the cooking unit. This meal and the first portion of regular meal-mix that follows are emptied into an open-top tank and are discarded. Workers reportedly wear face shields and rubber protective clothing during the shut-down and start-up processes to protect from skin and eye exposure to acid, alkali, and detergent solutions.

Procedures for handling, storage, and processing of food components, selection of other constituents, plant sanitation, and personal hygiene procedures are intended to be in accordance with the United States Department of Agriculture standards for food-grade production.¹

Make-up air for the processing and packaging areas is filtered in an effort to maintain a zero-dust environment.

In 1980, NIOSH conducted a health hazard evaluation² of a similar Ralston Purina facility in Cincinnati, Ohio in response to concerns about exposure to EP Liquid. Extruder operators reported mild mucous membrane irritation, cough, lightheadedness, and noxious odor during shut-down/start-up procedures and developed burns if skin contact occurred. NIOSH measurements revealed low level evolution from EP liquid of ethylene oxide and formaldehyde, neither of which was intended to be a component of EP Liquid. NIOSH recommended engineering and work practice changes that might reduce worker exposures to EP Liquid.

IV. METHODS

The NIOSH survey on March 3-4, 1981 was directed to obtaining process information and employee medical interviews. A walk-through evaluation was performed during regular operation of the plant, and 50 workers were interviewed. Procedures for shut-down, start-up, and maintenance of the production process were not observed. Information about food coloring agents and cleaning agents was obtained through the Ralston Purina corporate office.

V. EVALUATION CRITERIA

Allergic Skin Sensitization

Skin contact with a chemical substance can evoke allergic skin sensitivity if the substance or a metabolite stimulates the immunological system. Such sensitization may arise in only a small fraction of those who are exposed. Once someone has become sensitized to a substance, repeat exposure to the substance can elicit a skin reaction whose appearance may closely resemble dermatitis from other causes.

An individual who is sensitized to a given substance may show sensitivity to additional substances, either because they are chemically similar to the first substance or because metabolism results in production of a common chemical metabolite that is the sensitizing agent. Some substances are not capable of causing primary sensitization but can cause cross-reactions in individuals who have been sensitized to another substance.

Paraphenylenediamine

Paraphenylenediamine (PPDA) and related compounds are used in hair and fur dyeing, photographic developing, dye synthesis, and as antioxidants in petroleum and rubber products.³ In the context of this plant, PPDA might be present in lubricating or hydraulic oils present in production machinery.

PPDA is recognized to be a potent skin sensitizer and has been banned in some countries from use as a human hair coloring agent because of the dermatitis it can cause.⁴ The mechanism of action involves oxidation to quinone diimine, which can combine with body proteins to give some of the strongest known sensitizing agents.⁵ Individuals who are sensitized to PPDA may show cross-sensitivity reactions to aniline, sulfonamide medications, some antihistamines, some local anesthetics, para-amino benzoic acid (PABA), or azo dyes used in foods, cosmetics, clothing, and furs because these substances may also be metabolized in the skin to quinone diimines.^{4,6,7} However, individuals sensitized to PPDA show differing patterns of cross-sensitivity to these compounds.⁷ In some cases, dermatitis from sensitivity to PPDA can be reactivated by ingestion of substances chemically related to the skin sensitizing agent.⁸

Allergic sensitization to PPDA is long-lasting. A sensitized individual may react to it or to cross-reacting substances even if he/she has not been exposed to any such substance for years. Documentation of the source of initial sensitization to PPDA may be difficult, since it has been used as an additive in various industrial and commercial products. Since patterns of cross-reactivity vary from individual to individual, documentation of cross-sensitivity would require specific testing of the worker.⁷

VI. RESULTS

The medical officer interviewed 50 hourly workers who were involved in the handling of raw materials and production of finished product. Reported medical concerns fell broadly into the categories of skin problems and mucous membrane/upper airway irritation.

1. Workers who performed cleaning and/or disinfection duties reported eye, nose, and throat irritation, cough, and skin burns or skin irritation if exposed to KS-30 or EP Liquid without adequate personal protection. Some individuals reported throat irritation and breathing difficulty when working near mists of these acid or alkaline solutions even when wearing the disposable masks provided by the company. Skin irritation was reported by some workers in association with use of detergent solution.

2. Several workers reported itching without visible lesions after working with or near grain dusts, especially if they wore short sleeves or if they did not wash promptly after such work. Other workers reported itching without visible lesions in association with specific pet food ingredients, such as beet pulp, fish by-product, yeast, or trace mineral constituents. Eye and/or nose irritation were reported by some workers in association with exposure to ground corn, soy dust, yeast, trace minerals, and certain coloring agents.
3. Five workers had skin lesions at the time of the medical interview. One had vesicles, open lesions with clear discharge, and areas of confluent redness with scaling; these findings appeared to represent various stages of a single process. Four had thickened areas with scaling, of whom one had red punctate lesions and one had a nubbly non-inflamed rash in the same area.
4. For some individuals, interview and examination data were consistent with allergic sensitization. One such individual has received subsequent medical evaluation that has identified sensitivity to PPDA. Potentially cross-reacting substances, including PABA and azo dyes (tartrazine (yellow), FD&C Red No. 40, and sunset yellow FCF) are used in the plant.
5. Workers who complained of respiratory irritation, cough, or shortness of breath after respiratory exposure to dusts or mists generally reported that these symptoms resolved when exposure ceased.

Some workers reported that KS-30 was added to the detergent solution in order to improve its cleaning capacity, while other workers either denied that this was done or were unaware that strong alkali might be present in what they thought was a mild detergent solution. Some workers indicated that KS-30 solution was used occasionally as a general purpose cleaning agent by maintenance personnel. Since these were not identified as intended uses for KS-30, the possibility exists that some workers may be using it without adequate protection and may not be aware of its potential risks.

Some workers reported that KS-30 was not always diluted adequately prior to use.

VII. DISCUSSION

In a setting where there are several recognized potential sources of skin irritation, it is difficult to identify specific causes for the skin lesions of individual workers. In this plant, direct acid burns, alkali burns, or irritant effects from grain dusts, other food ingredients, or cleaning agents could arise if deficiencies of work practices, personal protection, or process design result in exposure to these agents. Skin problems caused by to infestation of food ingredients with insects or mites may occur, although such situations should be episodic and easily identified. Finally, an individual may become sensitized to a substance that does not affect most workers; such an individual may then develop severe skin problems if further exposed to the sensitizing agent or to cross reacting substances.

For a worker with PPDA sensitivity, the pertinent follow-up questions relate to the possibility of recurrent exposure to PPDA or cross-reacting substances. In this workplace, such exposure could arise from azo dyes, PABA, or PPDA or related additives in lubricants, greases, or oils used in the plant in the past several years that may be present in the plant. Skin testing for sensitivity can be a difficult and imperfect process even under expert supervision, especially when the substance tested is an environmental sample rather than a commercially-prepared skin test preparation. In evaluation of the worker with known PPDA sensitivity, initial evaluation has not given conclusive results. Separate tests of the pet food product gave 1 positive result and 1 negative result. Initial testing of food coloring agents used in the plant did not reveal sensitivity, although these tests were performed at the same time as the negative test for sensitivity to pet food.

Screening questions did not suggest a high prevalence of chronic respiratory symptoms. None of the 50 workers reported having current or past history of asthma. However, the 50 workers interviewed had a mean age of 32 and included only 3 workers over age 45. It is unlikely that enough chronic respiratory impairment would be manifest in this young workforce to be detectable by epidemiological methods were a cause of work-related respiratory impairment to be present.

VIII. RECOMMENDATIONS

1. The use of KS-30 should be controlled. The reported use of KS-30 outside of currently prescribed limits suggests the possible need for review of in-plant cleaning solution needs. Workers should be aware of the potential hazards of such cleaning solutions and should be protected appropriately.
2. The use of protective sleeves (either disposable sleeves or long-sleeved garments) should be encouraged to minimize skin exposure to food constituents.

3. Workers and company personnel should be aware that food coloring agents, while not considered to be potent skin sensitizers, may cause severe skin cross reactions in workers who are sensitive to certain other chemical substances, including PPDA. Furthermore, it is possible that petroleum products in use in the plant, such as lubricants or hydraulic fluids, may contain PPDA or related additives.
4. Insofar as cleaning and maintenance procedures were not observed during this investigation, specific recommendations are not made for handling of cleaning agents. The recommendations made in HHE 80-181-909, Ralston Purina Company, Cincinnati, Ohio should be reviewed for possible applicability to the Mechanicsburg plant.²

IX. REFERENCES

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2. Ralston Purina Company
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3. AFL-CIO, American Federation of Grain Millers, Local Number 368,
Mechanicsburg, Pennsylvania.
4. OSHA, Region III.
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