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TYSON FOODS
MONETT, MISSOURI**

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I. SUMMARY

On January 11-12 and February 17-19, 1993, investigators from the National Institute for Occupational Safety and Health (NIOSH) conducted a Health Hazard Evaluation (HHE) at Tyson Foods in Monett, Missouri. The investigation was performed in response to a management request regarding reported symptoms potentially related to work in the evisceration area of a poultry processing plant. Reported symptoms mentioned in the HHE request included burning and watery eyes, dry throat, and sinus problems. Reported potential exposures included chlorine and sanitation chemicals.

After conducting a walkthrough survey of the facility, NIOSH industrial hygienists evaluated the heating, ventilating, and air conditioning (HVAC) system and collected water samples and general area air and personal breathing zone (PBZ) air samples. A NIOSH physician reviewed Occupational Safety and Health Administration (OSHA) Injury and Illness logs (Form 200), discussed the recorded conditions with the plant health and safety personnel, conducted a medical symptom questionnaire survey, and was available for confidential medical interviews with affected employees.

One-hundred-eleven of the 120 (93%) Tyson employees and seven of the nine (78%) USDA employees completed the symptom questionnaire. Employees reported mucous membrane irritative symptoms as the most frequently experienced symptoms on the day of the survey and during the four weeks prior to the survey. The most commonly reported symptoms were runny nose or sinus congestion, cough, sore or dry throat, and dry or irritated eyes.

Industrial hygiene sampling data revealed low levels of chlorine in both the area and PBZ air samples. Water samples, however, revealed elevated peak concentrations of chlorine during work breaks. This problem was attributed to the chlorinator and may have caused the periodic irritative symptoms experienced by the employees. Chloramines were not detected in any of the water samples. Additionally, the HVAC system was found to inadequately distribute and exhaust air from the work area.

During this investigation, NIOSH investigators found mucous membrane irritative symptoms in employees working in the evisceration area of this plant. Chlorine was the only potential causative exposure identified. Recommendations for engineering controls, administrative controls, and medical management are contained in this report.

KEYWORDS: SIC 2015 (Poultry: slaughtering and dressing), poultry processing, chlorine, ammonia, chloramines, irritative symptoms.

II. INTRODUCTION

On October 30, 1992, a National Institute for Occupational Safety and Health (NIOSH) health hazard evaluation (HHE) was requested by the management of the Tyson Foods poultry processing plant in Monett, Missouri. NIOSH was asked to evaluate workers' exposures to chlorine or sanitation chemicals used during the processes. Symptoms listed on the HHE request include burning and watery eyes, dry throat, and sinus problems.

Site visits involving a medical and industrial hygiene team were performed on January 11-12, and February 17-19, 1993. An opening conference was conducted by NIOSH investigators to present an overview of the HHE program and discuss plans for the investigation. Immediately following the opening conference, a walkthrough survey was conducted in the plant. Following the walkthrough, medical and industrial hygiene surveys were conducted. The medical evaluation consisted of reviews of the Occupational Safety and Health Administration (OSHA) Injury and Illness logs (Form 200), discussions with the plant health and safety personnel, administration of a medical symptom questionnaire, and the opportunity for employees to have confidential medical interviews with the NIOSH physician. The environmental survey included a review of work practices, an assessment of the industrial hygiene and safety conditions, analysis of the ventilation system, and collection of water and air samples for chlorine and analysis of water samples for levels of free-available chlorine.

III. BACKGROUND

Facility Description

There are three major work areas in the plant: 1) live-receiving, 2) evisceration and inspection, and 3) final processing. Walls physically separate the three areas, each having separate ventilation systems to prevent cross-contamination from initial stages of processing to the final product. Live chickens are delivered to the plant by truck, suspended on shackles on a conveyor system, and mechanically killed and defeathered in the live-receiving area. The chickens are then dropped from the shackles onto a conveyor belt which delivers the birds to the evisceration area.

In evisceration, the birds are rehung on shackles which carry them to one of three evisceration lines. Evisceration machines spray the birds with superchlorinated water and remove the entrails of the bird which the USDA inspectors examine for defects or signs of disease. If birds are condemned by the inspector, they are removed from the processing line, and if a bird has a minor imperfection or is contaminated with fecal material, it is sent to the salvage area for reprocessing. After the birds are inspected, the liver and gizzards of the chickens are harvested, and the birds pass through additional machines which detach the entrails, necks and tails, and wash out the insides of the carcass. The birds are then chilled in large

tanks and packaged as either whole birds or as chicken parts. Figure 1 is a lay-out of the evisceration area where the NIOSH investigation was conducted (not to scale).

Three processing lines operate from Sunday night through Thursday night (9 p.m. to 6 a.m.), with a day shift (6 a.m. to 3 p.m.) followed by a clean-up shift (3 p.m. to 9 p.m.). There are two USDA inspectors and eight Tyson employees on each evisceration line during both shifts. Approximately 10 employees work in the salvage area, and approximately 5 employees work in the rehang area. Chickens are processed at a rate of 200,000 birds per day, with the evisceration lines running at 70 birds per minute.

Employees are given two 30-minute breaks during a shift, at which time the machines and work areas are sprayed with high-pressure hoses to remove poultry-waste products from the surfaces.

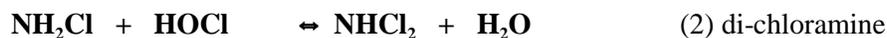
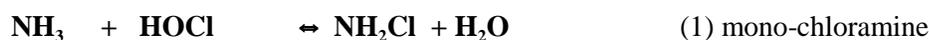
During the clean-up shift, an alkaline solution is prepared and mixed with water in a 55-gallon drum and dispensed into buckets, where it is mixed with a 5% sodium hypochlorite solution. The equipment is sprayed with high pressure hoses, foamed with the cleaning solution, hand scrubbed, rinsed, and inspected. A concentrated quaternary ammonium compound is applied to the equipment as a sanitizer, but not rinsed off. The clean-up shift for the adjacent deboning area is scheduled during the day shift of the evisceration area.

Initially, symptoms among the USDA inspectors were thought to be caused by the cleaning compounds used in the deboning area which drained through the evisceration area; however, remedial actions did not eliminate the complaints. Before the NIOSH investigation, Tyson hired a ventilation engineer to evaluate problems associated with excessive condensation throughout the facility. The engineer recommended installing a new ventilation system to control the problem.

Area air samples and personal breathing zone samples had been collected for chlorine by a Tyson area safety manager on two separate occasions before the NIOSH survey. All air sample results were found to be well below the OSHA permissible exposure limit for chlorine. Water samples were found to have a pH of 7; trichloramines are typically not formed at a pH of 7.

Formation of Chloramines

The USDA requires that spray water on evisceration machines, and in salvage or reprocessing areas, be superchlorinated to at least 20 ppm chlorine in order to kill bacteria caused by fecal contamination.¹ Additionally, the water in the chiller tanks may be superchlorinated to 20 ppm chlorine to prevent bacterial cross contamination of the carcasses. At the Tyson plant, water is superchlorinated by injecting chlorine gas into the water to form hypochlorous acid (HOCl). In order for chloramines to form, nitrogen compounds, such as ammonia or amines, must be present.² HOCl reacts with such compounds as the degradation products of organic nitrogenous matter to form three chloramine compounds: mono-chloramine (NH₂Cl), di-chloramine (NHCl₂), and tri-chloramine, also known as nitrogen trichloride (NCl₃). The reactions of chlorine and ammonia in water are as follows:



The species of chloramine formed and the concentrations of each are affected by the concentrations of chlorine and ammonia as well as pH and temperature.³ The lower the pH and the higher the chlorine:ammonia ratio, the greater the tendency to produce tri-chloramine. If ammonia or mono-chloramine were present in the water, the high chlorine concentrations introduced into the water by the superchlorination process would tend to lower the pH and promote the production of tri-chloramine. Tri-chloramine, unlike mono- or di-chloramine, has low solubility in water and readily off-gases upon agitation.⁴

IV. METHODS

Environmental

Water Samples

Water samples of the superchlorinated water were collected and analyzed for free available chlorine and inorganic chloramines by use of a common water test-kit method. This method

depends on a color reaction between N,N-diethyl-p-phenylenediamine (DPD) and free available chlorine in the water sample; the colored solution is then titrated rapidly with ferric ammonium sulfate to detect the presence of chloramines.⁵ The portable water test kit used by the USDA only measures for free and combined chlorine. Because trichloramine is unstable and readily escapes from water, the test method was performed immediately after sample collection. Break periods were sampled more extensively once a pattern was established for peak chlorine concentrations. The pH of the water was also recorded.

Air Samples

General area air sampling for chlorine was conducted during the day (6 a.m. to 3 p.m.) and night (9 p.m. to 6 a.m.) shifts on February 18th, and during the night shift on February 19th, 1993, (See Figure 1 for sample locations). Three personal breathing zone samples were collected from two inspector's helpers on evisceration lines 1 and 2, and from an employee working in the salvage area during the night shift on February 18th. All samples were collected over the entire shift excluding samples taken during the cleaning shifts. Samples were collected and analyzed according to U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) method ID-101 for chlorine in workplace atmospheres.⁶ Sample air was drawn through a 25-milliliter (mL) midget fritted-glass bubbler containing 10-15 mL of a 0.1% sulfamic acid solution at a flow rate of 1 liter per minute (LPM) using battery-powered personal sampling pumps. Samples were analyzed using a residual chlorine ion-specific electrode. The minimum detectable concentration for this sample set was 0.01 ppm, based upon an analytical limit of detection of 20 micrograms per sample, and a maximum sample volume of 514 L.

Ventilation

On February 20, 1993, a Roscoe® Fog Machine (model number 1500) was used in the live-receiving and evisceration areas to observe airflow mixing patterns. The plant was not processing chickens, but all processing machinery and ventilation equipment were operating. Smoke was released into the evisceration area and observed as it flowed into the room supply air, room exhaust air, and ceiling-mounted auxiliary fans located on the evisceration lines. Additionally, smoke was released at the doors of surrounding areas such as the chemical room, deboning or secondary processing area, and the scalding and picking area to verify pressure and windflow relationships between the spaces.

Medical

A NIOSH occupational medicine physician reviewed the OSHA 200 Injury and Illness logs for the plant from 1991 through the site visit date in 1993. The plant health and safety personnel were consulted regarding conditions in the plant and any questions arising from the review of the OSHA 200 logs. Additionally, Department of Labor CA-1 forms for the USDA employees were reviewed. Although the USDA and Tyson workers are located in the same facility, they are administratively distinct and operate under separate employee health systems and personnel guidelines. Confidential medical interviews with the occupational physician were conducted with self-selected Tyson and USDA employees during both site visits. Results of a health survey form conducted by Tyson health and safety personnel for their employees was also reviewed.

During the February site visit, a medical symptom questionnaire was administered to all volunteering Tyson and USDA first and third shift evisceration area employees. These are the two shifts during which chickens are actually processed (the second shift is for cleaning purposes only). Medical interviews conducted during the initial site visit (January 11-12, 1993) assisted in the development of the questionnaire. The questionnaire asked if the employee had experienced, while at work on the day of the survey, any of the 14 symptoms (irritation, nasal congestion, headaches, etc.) previously reported by employees of this and other poultry processing plants.⁷ The questionnaire also asked about the frequency of occurrence of these 14 symptoms at work in the building during the four weeks preceding the survey, and whether these symptoms tended to

get worse, stay the same, or get better away from work. The final section of the questionnaire asked about environmental comfort (too hot, too cold, unusual odors, etc.) experienced while the employees were working in the building during the four weeks preceding the questionnaire administration.

V. EVALUATION CRITERIA

General Guidelines

To assess the hazards posed by workplace exposures, NIOSH investigators use a variety of environmental evaluation criteria. These criteria suggest exposure levels which most workers may be exposed for a working lifetime without experiencing adverse health effects. It is important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these occupational health exposure criteria. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, previous exposures, and/or an allergy to a specific product(s). In addition, some hazardous substances may act in combination with other workplace exposures, or with medications or personal habits of the worker (such as smoking, etc.) to produce health effects even if the occupational exposures are controlled to the limit set by the evaluation criterion. These combined effects are often not considered by the chemical specific evaluation criteria.

Evaluation criteria for chemical substances are usually based on the average personal breathing zone exposure to the airborne substance over an entire 8- to 10-hour workday, expressed as a time-weighted average (TWA). Personal exposures are usually expressed in parts per million (ppm), milligrams per cubic meter (mg/m^3), or micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). To supplement the 8-hr TWA where there are recognized adverse effects from short-term exposures, some substances have a short-term exposure limit (STEL) for 15-minute peak periods; or a ceiling limit, which is not to be exceeded at any time. Additionally, some chemicals have a "skin" notation to indicate that the substance may be appreciably absorbed through direct contact of the material with the skin and mucous membranes. This may potentially increase the overall exposure and biologic response beyond that expected from inhalation alone.

The primary sources of evaluation criteria for the workplace are: NIOSH Criteria Documents and Recommended Exposure Limits (RELs),⁸ the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs),⁹ and the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).¹⁰ These criteria typically change over time as new information on the toxic effects of an agent become available.

The OSHA PELs reflect the economic feasibility of controlling exposures in various industries, public notice and comment, and judicial review; whereas the NIOSH RELs are based primarily on concerns related to the prevention of occupational disease. A recent Court of Appeals decision vacated the OSHA 1989 Air Contaminants Standard in *AFL-CIO v OSHA*, 965F.2d 962 (11th circuit, 1992); therefore, OSHA is now enforcing the previous 1971 standards (listed as Transitional Limits in 29 CFR 1910.1000, Table Z-1-A).¹¹ However, some states which have OSHA-approved State Plans will continue to enforce the more protective 1989 limits. NIOSH encourages employers to use the 1989 PELs or the NIOSH RELs, whichever are lower. Evaluation criteria may change over time as new information on the toxic effects of an agent become available. Thus, it is prudent for an employer to maintain worker exposures well below established occupational health criteria.

Specific Substances

Chlorine

Chlorine gas is a potent irritant of the eyes, mucous membranes, and skin, and inhalation exposure causes pulmonary irritation.¹² Mild mucous membrane irritation may occur at 0.2 to 16 ppm; eye irritation occurs at 7 to 8 ppm, throat irritation at 15 ppm, and cough at 30 ppm.¹³ Other studies have shown that some individuals develop eye irritation, headache, and cough at concentrations as low as 1 to 2 ppm.⁷

The NIOSH REL, ACGIH TLV, and OSHA PEL for chlorine are all 0.5 ppm TWA, 1 ppm STEL.³⁻⁵ Additionally, the range of reported odor thresholds for chlorine is 0.03 to 3.5 ppm; however, because of olfactory fatigue, and a TWA of 0.5 ppm, odor does not always serve as an adequate warning of over-exposure.⁸

Nitrogen Trichloride (Tri-chloramine)

Nitrogen trichloride is known as a strong irritant and lacrimator (inducer of tears), but little is known of its toxicity.¹⁴ Its odor has been described as smelling like rotting grapefruit or geraniums.³ The respiratory tract appears to be the primary site of damage in rats exposed to nitrogen trichloride. The effects from exposure to nitrogen trichloride are similar to those observed from other pulmonary irritants. Its acute inhalation toxicity is similar qualitatively and quantitatively to chlorine.⁹ The collection of air samples for laboratory analysis is not feasible, since nitrogen trichloride is unstable in air. Presently, there are no occupational exposure limits for nitrogen trichloride.

VI. MEDICAL RESULTS

One-hundred-eleven of the 120 (93%) Tyson employees and seven of the nine (78%) USDA employees completed the questionnaire. The median age range of the 50 male and 68 female respondents was thirty to thirty-nine years of age. Fifty-four currently smoked cigarettes, 16 were former smokers, and 48 had never smoked. Respondents had worked in the evisceration area for an average of 4.6 years (range 1 month to 27 years) working an average of 40 hours per week (range 8-45).

The questionnaire results are shown in Table I. The first column of Table I shows the percentage of the 118 respondents who reported the occurrence of symptoms while at work on the day of the survey. Nasal or sinus congestion, sneezing, cough, headache, irritated or strained eyes, and sore or dry throat are the most commonly reported symptoms. These symptoms may all be directly or indirectly related to mucous membrane irritation.

The second column shows the percentage of employees who reported experiencing the respective symptom once a week or more often while at work during the four weeks preceding the survey. With a few exceptions, these symptom prevalences are similar to those for symptoms experienced on the day of the survey.

The third column shows the percentage of employees who reported experiencing the respective symptom once a week or more often while at work during the four weeks preceding the survey and also reported that the symptom tended to get better when they were away from work. This latter criterion has, in some studies of indoor environmental quality, been used to define a "workplace-related" symptom. It is possible that a symptom which does not usually improve when away from the workplace could also be due to conditions at work.

Table II shows results of employee reports regarding environmental conditions at their workstations on the day of the survey and during the four weeks preceding the survey. Column

one shows the results for the day of the survey. It shows that 25% of the respondents felt that the work area was too cold during at least part of their workshift, 13% note chemical odors, 11% note other unpleasant odors in the work area, and 20% felt that there were tobacco smoke odors during at least part of their work day.

The second column shows the responses to the questions about environmental comfort conditions experienced in the facility during the four weeks preceding the survey. Adverse environmental conditions (too hot, too cold, odors, etc.) were considered "frequent" if they were reported to occur at work once a week or more often. Column two results are generally somewhat higher than those shown in the first column, which reports the work station environmental conditions experienced during the day of the survey. Forty-five percent of respondents perceived that the temperature was too cold, 21% reported too little air movement, 27% frequently were too hot, 22% thought the air was too humid, 20% noted frequent chemical odors and 21% noted other unpleasant odors.

Additional questionnaire results not listed in the tables include: (a) 80% of the evisceration area employees reported wearing gloves the majority of the time during their work, (b) 88% of the employees in this area feel that the workspace is reasonably or very clean, and (c) only eight percent of the employees reported wearing safety goggles during their work.

VII. ENVIRONMENTAL RESULTS

Water Samples

Water samples were collected from three locations within the evisceration and inspection area: (1) the superchlorinated water from the salvage area, (2) the superchlorinated water from the chillers, and (3) the superchlorinated water from the evisceration machines. Chloramines were not detected in any of the water samples. The free available chlorine in the superchlorinated water ranged between 19.4 to 68.0 ppm (see Figure 2), and the pH ranged between 5 to 6 during the day and night shifts on February 18.

As mentioned previously, the USDA requires that water on evisceration machines and salvage areas be superchlorinated to at least 20 ppm chlorine, and that water in the chiller tanks, although not required, may also be chlorinated to 20 ppm. The results indicate that: (1) the majority of the samples were well above 20 ppm, and (2) levels were found to be highly variable.

Free chlorine levels peaked during breaks when the water on the processing line was turned off. This variability was consistently found on the evisceration machines and the salvage area. Upon further investigation, it was determined that these two areas are on separate chlorination systems, and the system serving the evisceration machines and salvage areas was not operating properly. The chlorinator operates by injecting chlorine gas into the water based on the water flow. When water flow stops, the regulator valve on the chlorinator should close, however, this did not happen and chlorine was continuously being added to the pipes. Many workers in this area stand very close to the superchlorinated water sprays on the various machines. Therefore, elevated and variable chlorine levels in these water sprays could partially explain why workers are periodically experiencing eye and upper respiratory irritation.

Air Monitoring for Chlorine

Although chlorine in water reached relatively high levels, personal breathing zone and general area air samples for chlorine ranged from < 0.01 ppm to 0.1 ppm, well under the OSHA PEL of 0.5 ppm. Specific sampling results are found in Table 3.

All air sample results are expressed as TWAs for approximate eight-hour sampling periods. These long-term air sample results do not preclude occasional short-term peaks of chlorine

greater than 0.5 ppm. Since the high chlorine concentrations in water occurred sporadically, and apparently only during 30-minute break periods, it would have been necessary to conduct short-term sampling during the breaks to measure peak levels.

Ventilation

The ventilation system brings in filtered air from the roof and distributes it to the evisceration area through five supply diffusers located at the ceiling (approximately 15 feet above floor level). The system is designed to deliver a total of 50,000 cubic feet per minute (CFM), however, the system had not been balanced since being installed, and one of the air intakes on the roof was found to be blocked by cardboard. Air is exhausted from this large room through nine exhaust grilles located in the picking and scalding room. There were several suspended ceiling fans located throughout the area which were pointed in various directions to provide additional cooling to the workers. Depending on air supply demand, the ventilation system is reportedly shut down over the weekend and generally started on Sunday afternoon, a few hours before employees report for work. Several employees reported that they have noticed stronger chlorine odors on the Sunday night shift which may be attributed to the shut down of the ventilation system over the weekend thus allowing for air contaminants to buildup.

Temperature and relative humidity measurements were typically around 70 degrees Fahrenheit and 70 percent, respectively. Results of the smoke released in the room showed that the general air flow pattern in the evisceration area was for air to move slowly from the evisceration machines, down the processing lines where the majority of workers are located, and into the northeast corner of the room by the sizing area (see Figure 1). Thus the primary airflow was moving in the opposite direction of the intended exhaust flow. On the evisceration lines, the ceiling-mounted auxiliary fans caused very turbulent air flow patterns. A portion of the smoke released at floor level by the evisceration lines drifted toward the ceiling where the supply diffusers were located. These diffusers seemed to be supplying very little, if any, air to the work areas, since the smoke became very stagnant. Another area where there was little air movement was in the southeast corner. The wash-out section of evisceration lines one and two is located in this area. It aerosolizes a large amount of superchlorinated water (this area happened to have the highest air concentration for chlorine). The only air (smoke) which was observed being exhausted from the evisceration and inspection area was that in the immediate vicinity of the picking and scalding room, where the exhaust fans are located. The location and the operational status of the exhaust fans were found to be inadequate for the removal of air from the adjacent evisceration and inspection area. Additional problems which make proper ventilation difficult in this area is the amount of turbulence created by auxiliary fans, employees and equipment, and the thermal gradients which are created by the use of both heated and chilled water in close proximity to one another.

Very little air movement was found in the chemical storage room. A small exhaust fan is located in the southwest corner of the room; however, due to the small size of the fan and its location, sufficient exhaust was not being provided for the space. The chemical mixing room was found to be under positive pressure, thereby allowing air to leak into the salvage area where the drain is located. This room had two exhaust fans; one fan was located in the ceiling and the other fan was located in the south wall. Neither of the fans were operational, and both had cardboard taped over them.

Other Observations

Several employees on the clean-up shifts were not wearing safety goggles. Additionally, employees were observed smoking in the deboning area during clean-up, although smoking is supposedly prohibited.

VIII. CONCLUSIONS

During this investigation, NIOSH investigators found mucous membrane irritative symptoms in employees working in the evisceration area of this plant. Chlorine was the only potential causative exposure identified. Elevated chlorine levels detected in the water sprays may partially explain these irritative symptoms. Recommendations for engineering controls, administrative controls, and medical management are presented below.

IX. RECOMMENDATIONS

1. To reduce employee exposure to chlorine, the variability of the chlorine concentration in the superchlorinated water spray should be reduced. The chlorine concentration should be closely monitored and concentrations should remain close to 20 ppm.
2. If problems should continue to occur with the operation of the chlorinator, another chlorination method should be considered. One method frequently used at other poultry plants is a drip system for hypochlorite. Symptoms were greatly reduced at one particular plant when they switched to this system from a chlorine injection system. Chlorine levels were hard to control and levels were found to be too high with the chlorine injection system.⁷
3. Source containment could be achieved around the evisceration machines in order to reduce the amount of water spray entering the work environment. This control measure was used in one plant where a clear, plastic curtain was placed around the machine and local exhaust ventilation was installed. This allowed the machine's operation to be observed; however, maintenance activities were restricted.¹⁵
4. The cardboard covering the air intake should be removed in order to provide fresh air to the evaluated area. Additionally, the cardboard covering the exhaust fans in the chemical mixing room should be removed, and the fans should be brought to operational status.
5. A mechanical engineering firm should be consulted to determine the type of ventilation system needed to (1) remove condensate from the area, and (2) provide a sufficient number of air changes per hour and proper airflow mixing. Presently, air is inadequately distributed and exhausted from the work area, thereby preventing efficient dilution and removal of air contaminants. All ceiling-mounted auxiliary fans should be pointed in the same direction to facilitate air flow movement towards the exhaust and to decrease turbulent air flows. Ventilation systems, which have proven to be effective at other plants, should be investigated.
6. A written preventive maintenance schedule should be implemented in consultation with the manufacturers of the ventilation equipment. All preventive maintenance activities should be documented for the air handling units.
7. The mixing and application of cleaners should be monitored by management. Cleaning solutions should be thoroughly rinsed off surfaces to prevent the buildup of residues on the machinery. Since the components of the cleaning agents are eye irritants, safety goggles should be worn by all employees during the mixing and application of the chemicals.
8. The drain in the chemical room should be separated from the drains on the process line, as was done in the deboning area.

9. Employees on the clean-up crew should be trained regarding the use of ammonia-based compounds in conjunction with sodium hypochlorite. Although these two compounds are not purposely mixed together, if a spill were to occur, or waste cleaning compounds were mixed together, chloramines could be produced. Several cases have been documented when solutions of ammonia and sodium hypochlorite were mixed and chloramines were formed which, when inhaled, resulted in acute toxic pneumonitis.^{16,17}

10. NIOSH recommends that the use of tobacco products be curtailed in situations where employees may be exposed to chemical substances which may interact with tobacco products and where non-smoking workers may be exposed to side-stream cigarette smoke. The best method for controlling worker exposure to tobacco smoke is to eliminate smoking from the workplace. Until this is achieved, smoking should be restricted to areas outside of the plant or to a designated smoking room which is not used for other purposes and which has additional dedicated ventilation. The air from this smoking area should be exhausted directly to the outside and not recirculated within the building.¹⁸

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Evaluations, and Field Studies

XII. DISTRIBUTION AND AVAILABILITY OF REPORT

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Copies of this report have been sent to:

1. Tyson Foods, Incorporated
2. USDA Supervisory Veterinary Medical Officer
3. OSHA, Region VI

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Table I
Symptoms Experienced At Work
Tyson Foods
Monett, Missouri
HETA 93-0230

Symptoms Of 118 Workers	Experienced on Days of Survey While at Work	Frequently Experienced Last 4 Weeks While at Work	Have Frequent Symptoms That Improve When Away from Work
Dry, itching, or irritated eyes	21%	19%	28%
Wheezing	6%	7%	10%
Headache	21%	19%	26%
Sore throat or dry throat	21%	18%	24%
Unusual tiredness, fatigue, or drowsiness	13%	20%	14%
Chest tightness	7%	6%	10%
Stuffy or runny nose, or sinus congestion	43%	36%	30%
Cough	23%	23%	19%
Tired or strained eyes	21%	22%	19%
Difficulty remembering things or concentrating	5%	8%	7%
Sneezing	19%	27%	32%
Dizziness or lightheadedness	2%	4%	9%
Shortness of breath	3%	4%	7%
Hoarseness or loss of voice	6%	8%	8%

Table II
Description Of Workplace Conditions
Tyson Foods
Monett, Missouri
HETA 93-0230

Environmental Conditions	Experienced at Work During Days of the Survey 118 Workers	Frequently Experienced While at Work During Previous 4 Weeks 118 Workers
Too much air movement	11%	14%
Too little air movement	10%	21%
Temperature too hot	11%	27%
Temperature too cold	25%	45%
Air too humid	10%	22%
Air too dry	3%	8%
Tobacco smoke odors	20%	21%
Chemical odors (e.g., chlorine, cleaning fluids, ammonia,)	13%	20%
Other unpleasant odors (e.g., body odor, food odor, animal odor)	11%	21%

FIGURE 1
Facility Lay-Out and Process Flow
Tyson Foods
Monett, Missouri
HETA 93-0230

