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No Silver Bullet

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Introduction

Despite increasing efforts by U.S. industries to prevent occupational injuries and illnesses, incidence rates remain high. The incidence rate for non-fatal occupational injuries and illnesses was 5.2 cases per 100 equivalent full-time workers in electrical equipment manufacturing (SIC 3825) versus 4.6 cases in private industry (BLS, 2005). The investigation of severe injuries and fatalities may provide only limited insight into effective and efficient prevention strategies for less severe and more numerous minor injuries and illnesses, and may also encourage under-reporting of safety infractions.

An investigation into one electrical manufacturing facility's implementation of near-miss (NM) reporting yielded not only reductions in incidence rates and workers compensation costs, but an increase in NM incidents and productivity. Changes in incident/accident reporting, data analysis, and plant safety culture were found to be effective solutions with measurable positive outcomes.

Objectives

In 2003, the newly named Chief Executive Officer defined safety as the company's primary objective. To reach this goal, two secondary objectives had to be met.

1. Describe the incidence of NM, minor, and OSHA recordable injuries over time and to evaluate any differences among the three event types by comparing respective risk factors.
2. Evaluate the utility of a NM reporting system by estimating its impact on the annual incidence of minor injuries and OSHA recordable injuries.

Methods

Executive leadership at the corporate level determined that if the plant were to be successful, a culture of safety must emerge. This new culture evolved into one that is energized by working safely, set aggressive goals to reduce recordable incident rates, and drives out waste and inefficiency caused by injuries. The following "Safety Mandates" emerged from this corporate-wide initiative:

- Safety is everyone's responsibility.
- All injuries and occupational illnesses can be prevented.
- Management has a responsibility to train all employees to work safely.
- Working safely is a condition of employment.
- Preventing safety incidents and injuries contributes to business success.

A year after the safety movement began, the plant brought on a new Safety, Health and Environmental team. The goal for this team was to continue progress toward the culture that values safety as a core part of the business.

To achieve this goal the team used a three step approach: *educate, empower and excite*.

<u>Educate</u>
Management's commitment to provide a safe workplace must provide continuous training in safe work practices to all employees (team members). Formal training sessions keep employees current on new and existing safety methods and material covered is then enforced by supervision. Employees have been taught to pay close attention to close calls and small errors at work and home that could lead to larger errors. Team members are considered "athletes" and are provided with an industrial nurse, trigger point therapist, health fair, wellness committee, and wellness/fitness center which all serve to educate team members on the benefits of personal health and wellness. Supervisors and managers are given safety observation training to teach them to observe team members and give them feedback on safe behavior and unsafe behavior. Leadership teams participate by beginning every meeting with safety topics.

Training methods include a supervisor conducting a daily team meeting to cover a 5 minute safety topic and any safety incidents that occurred in the last 24 hours; a manager conducting monthly safety training for all team members; field experts conducting specific safety training for specialized functions within the facility; and the Safety, Health and Environmental professionals. The teams utilize training to emphasize personal responsibility for the safety of everyone and to ensure all teams members safely return to their families after their shift.

Empower

Team members impact the safety of their workplace by utilizing principles taught in training programs to avoid making critical errors, holding all team members accountable, recognizing superior performance, involvement in prestart-up safety reviews and job safety analysis for new or modified equipment, management support, involvement with the safety committee, conducting weekly safety audits, and implementing 5S housekeeping - sorting, straightening, shining, standardizing, and sustaining. Team members that discover a safety issue or concern can write their concern and recommended corrective action on one of four safety recommendation boards. A cross functional team from each shift is assigned to each board to review the recommendations, implement corrective actions, and track completion. Since November 2003, over 1000 recommendations have been submitted with a 95% completion rate.

Excite

To support the concept that safety is everyone's responsibility, team members must be excited and show ownership in the safety program. Safety committees greet each team member at the plant entrance after a holiday break and provide wellness information and healthy snacks. Plant wide dinners, free vending, and family fun day celebrations for significant safety milestones motivate team members. Thank you notes from managers and supervisors, employee-of-the-month recognition, and company awareness awards are a few other motivation tactics to keep team members excited about safety.

In the fall 2008, the facility invited the Occupational Safety and Health Administration (OSHA) to evaluate the effectiveness of the safety program. Through OSHA's Voluntary Protection Program (VPP), OSHA entered into a cooperative relationship with the management and labor at the facility. It was determined that the facility met the requirements for OSHA's VPP program and was accepted as a VPP Merit site. This qualification resulted in this facility becoming the first VPP site in the community, the only active VPP Facility in the company, and part of an elite group of facilities in the United States.

Data Gathering

Systematic recording of minor injuries and NM incidents at this manufacturing plant was implemented in 1999. Using these records, injury data was gathered and entered into a Safety Corrective Action Report (SCAR) database using a structured format. An investigation team consisting of supervisory and non-supervisory personnel investigated each minor, OSHA recordable, and NM incident to identify causal factor and determine necessary corrective action. Corrective actions were implemented, audited, and follow-up performed with the employee involved.

Results

Workers in the database were on average 49.6 yrs of age (SD 8.7) and had worked in the plant for 23.5 yrs (S.D. 8.9) (Table I).

Table I - Demographic and occupational characteristics of NM, minor, and OSHA recordable injury reporters in the electrical manufacturing.

Characteristic	Near-miss events	Minor injuries	OSHA recordable injuries
Number of events, n*	261	1205	205
Year, n (%)			
2002	13 (7.6)	162 (28.6)	77 (38.3)
2003	32 (18.7)	143 (25.3)	70 (34.8)
2004	62 (36.3)	143 (25.3)	31 (15.4)
2005	64 (37.4)	118 (20.9)	23 (11.4)
Age, mean (SD), (years)	48.6 (9.1)	49.6 (8.7)	50.8 (8.0)
Duration of employment, mean (SD), (years)	23.0 (8.9)	23.4 (9.0)	25.2 (8.3)

* Totals do not sum to 261, 1205, and 205 due to missing data

Operations are conducted over seven shift schedules. Most of the incident reports were from three eight-hour shifts with the distribution as follows: first shift (546, 40%), followed by second (296, 21%), and third (151, 11%) shifts. The others group of employees (387, 28%) worked in shifts with changing bi-weekly schedules. This schedule included three consecutive 12-hour days and an additional 12-hour day on non-consecutive weeks.

The production area breakdown of the incident reports was (831, 52%) assembly areas, (552, 35%) components manufacturing, molding, plating, and brazing, and (208, 13%) tool room, maintenance, shipping and receiving.

There were 1690 events reported between 1999 and 2006 (Figure I) including 261 NM, 1205 minor injuries, and 205 OSHA recordable injuries. Seventy-six of the OSHA recordable injuries were associated with lost days (mean 42.1, S.D. 52.5, range 2-180 days).

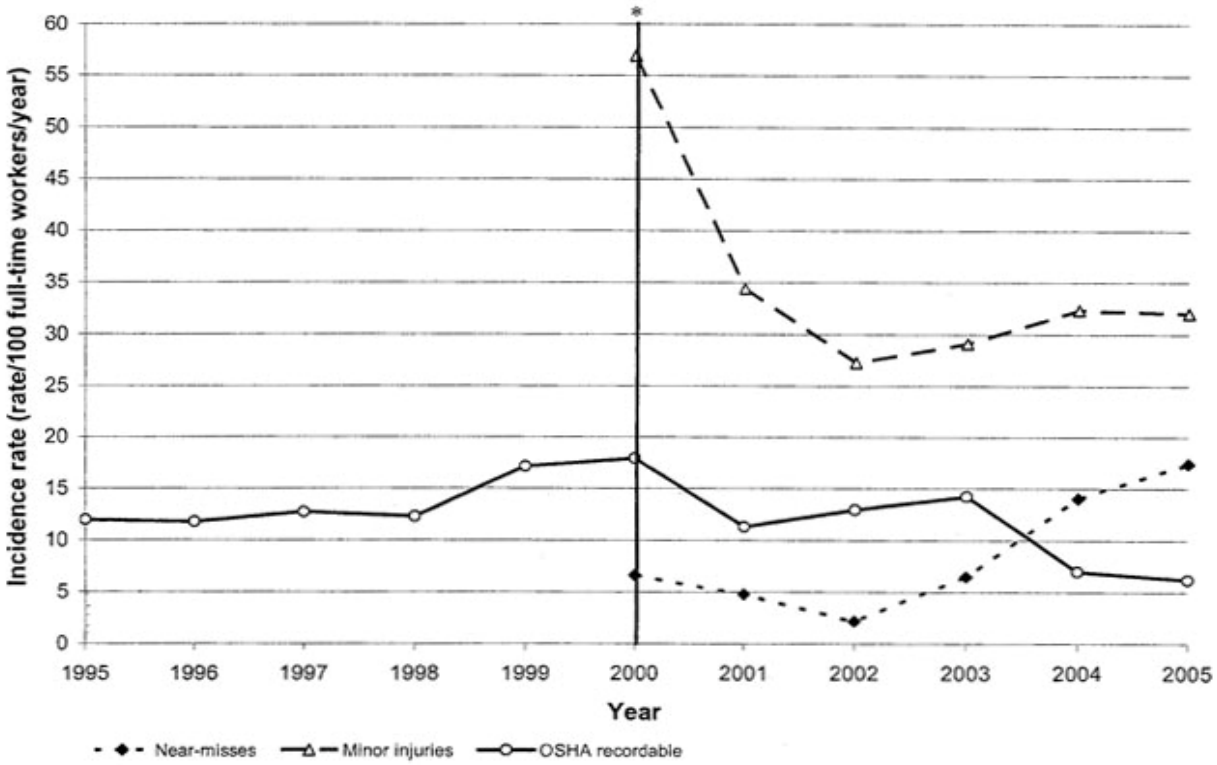

Figure I - Distribution of 1690 events by year among manufacturing facility workers, 1995-2005.

The majority of events reported were discomfort or pain (558, 39%), strain (150, 10%), laceration (115, 8%), struck by an object (98, 7%), and bruise (70, 5%).

The body locations reported were neck or shoulders (224, 16%), finger (225, 16%), hand or wrist (201, 14%), arm or elbow (189, 13%), and back (165, 12%).

A logistic regression analysis of the effects of time (year), age, and employment duration on event type (NM, minor, OSHA recordable) is presented in Table II. Compared to NM, the odds ratios (ORs) of minor and OSHA recordable injuries decreased over time (2002-2005).

Table II - Odds ratio for minor and OSHA recordable injuries by year at the manufacturing facility, 2002-2005.

Variable evaluated using logistic regression	OR (95% CI) Minor injury vs. Near-miss	OR (95% CI) OSHA recordable vs. Near-miss
Year		
2002	1.00	1.00
2003	0.36 (0.18, 0.71)	0.37 (0.18, 0.76)
2004	0.19 (0.10, 0.35)	0.08 (0.04, 0.18)
2005	0.15 (0.08, 0.28)	0.06 (0.03, 0.13)
Age	1.02 (1.00, 1.04)	1.03 (1.00, 1.05)
Employment Duration	1.00 (0.98, 1.02)	1.02 (0.99, 1.04)

A trend proportion of minor and OSHA recordable injuries compared to NM between 2002 and 2005 was evaluated using the Cochran-Armitage test for trend revealing that the trend for decreasing proportion of minor injuries compared to NM was significant ($z = -6.77$, p-value < 0.001). Likewise, the decreasing trend was significant for the proportion of OSHA recordable injuries compared to NM ($z = -9.08$, p-value < 0.001).

Older workers experienced events of higher severity. Compared to NM, the odds ratio of minor injuries appeared to increase with increasing age. Compared to NM, the odds of a minor injury were 1.02 times higher for each year increase in age (95% CI: 1.00, 1.04). Likewise, the odds of an OSHA recordable injury increased by 1.03 for every year increase in age compared to NM (95% CI: 1.00, 1.05).

Duration of employment was not significantly associated with the rate of minor or OSHA recordable injuries. The odds of a minor injury were 1.0 (95% CI: 0.98, 1.02) compared to the odds of NM with increased duration of employment (per year). The odds of an OSHA recordable injury was 1.02 times the odds of NM with increased duration of employment (95% CI: 0.99, 1.04).

The annual OSHA incidence rate was 12.0 injuries/100 full-time workers between 1995 and 1998. In 1999 the incidence rate increased to 17.2 when the NM reporting system was implemented and the rate remained high at the start of 2000 (17.2) before it decreased to 11.3 at the end of 2000, eventually falling to 6.3 injuries/100 full-time workers in 2005. Incidence rate ratio analysis revealed that the expected rate of OSHA recordable injuries decreased by 0.84 (95% CI: 0.73 – 0.97) (deviance (χ^2) = 3.24, df=7, p-value ≤ 0.46).

Conclusions

1. The NM reporting system in this study appeared to be an effective way to identify and evaluate exposures that may be associated with injuries.

2. The data analysis in this study supports the implementation of a NM reporting system as an effective injury prevention intervention.
3. NM reporting systems can be strengthened by effective evaluation of reported events and implemented corrective actions.