

Regulating Forklift Safety

Strategies to Prevent Injury & Improve Compliance

By Christopher A. Janicak and Tracey L. Cekada

A powered industrial truck is a mobile power propelled truck used to carry, push, pull, lift, stack or tier materials (OSHA, 2015a). They are used across all industries in the U.S., most often in manufacturing and warehouse facilities. Types include stand-up rider trucks, sit-down rider trucks, low-lift platform trucks and high-lift trucks. Some trucks can be designed

for use on compacted improved surfaces, while others are designed for use on unimproved natural terrains and disturbed terrains found on construction sites. The industrial vehicles can be manned or they can be automatic guided vehicles.

Use of powered industrial trucks in the workplace can pose many hazards to truck operators and those working near the vehicles. For operators, hazards include rollovers and tip-overs, and falling loads. Hazards for employees working near operating forklifts include being struck by the vehicle and falling loads. Still other hazards could involve fall hazards to personnel being lifted with the truck forks, and fires and burn hazards for those engaged in refueling operations.

Bureau of Labor Statistics (BLS, 2013a) data identify approximately 6,820 occupational injuries involving forklifts that resulted in days away from work. Of these injuries, 4,320 occurred in the manufacturing industry. The same year, 4,585 total deaths occurred, of which 70 were due to forklifts (BLS, 2013b).

The following case studies demonstrate the seriousness of workplace forklift incidents.

IN BRIEF

- **Powered industrial trucks continue to be one of OSHA's top 10 most frequently cited standards. Thousands of occupational injuries resulting in days away from work still occur each year from them.**
- **OSH professionals must be familiar with consensus standards, letters of interpretation and compliance directives as they relate to powered industrial trucks.**
- **This article discusses how powered industrial trucks are regulated, OSHA's approach to powered industrial truck enforcement, the major hazards involved with powered industrial trucks, and strategies employers can use to prevent injuries and improve compliance with OSHA standards.**
- **Recent technological advances are mentioned in an effort to identify efforts by manufacturers to control hazards related to forklift operation.**

Case Study: Forklift Overturn

On Dec. 26, 2003, a 17-year-old warehouse worker (the victim) was fatally injured when the sit-down type forklift he was operating outside the warehouse tipped over and crushed him. The youth was employed by an agricultural cooperative through a work-based learning program in his high school. At approximately 2:00 p.m., the victim had apparently lost control of the forklift, which was not carrying a load, as he was making a right turn toward the ramp leading to the warehouse entrance. The forklift tipped over 90° onto its left side. A customer heard a loud noise and saw the victim trapped under the forklift. He ran to get help. While the customer and the victim's coworker ran back to assist the victim, another coworker ran into the company's store to call 9-1-1. The customer and coworker were unable to lift the forklift manually. As coworkers lifted the forklift off the victim using a front-end loader, the customer pulled the victim clear. The victim was conscious but was having difficulty breathing. Police and fire department personnel responded at 2:00 p.m. and provided emergency assistance. The victim was transported by an emergency medical services (EMS) ambulance toward a meeting point with a medical

Christopher A. Janicak, Ph.D., CSP, CEA, ARM, is professor of safety sciences and doctoral program coordinator at Indiana University of Pennsylvania (IUP), Department of Safety Sciences. He holds a Ph.D. in Research Methodology from Loyola University; an M.S. in Industrial Technology/Industrial Safety Concentration from Illinois State University; and a B.S. in Health and Safety Studies (Occupational Safety and Health Education Concentration) from University of Illinois at Urbana-Champaign.

Tracey L. Cekada, D.Sc., CSP, CHSP, is associate professor of safety sciences at IUP, Department of Safety Sciences. She holds a D.Sc. in Information Systems and Communications from Robert Morris University; an M.S. in Environmental Science and Policy from The Johns Hopkins University; and a B.S. in Occupational Safety and Health from Slippery Rock University. Cekada is a professional member of ASSE's Western Pennsylvania Chapter and serves as the faculty advisor for the Society's IUP Student Section.

helicopter, but en route the victim's condition deteriorated. EMS personnel transported the victim to a local hospital where he was pronounced dead at 3:16 p.m. in the hospital's emergency room. (NIOSH, 2004)

Case Study: Worker Struck by Forklift

A 58-year-old Hispanic lumberyard worker died on March 30, 2012, from crushing injuries received when a forklift driven by a coworker struck him. The lumberyard laborer was walking from his work area to the employee lunchroom. At the same time and in the same area, a coworker was operating a forklift that was loaded with lumber. The forklift operator's field of vision was limited because he was transporting the lumber "load-forward" and the load partially obscured his view. He did not see the laborer but stopped when he felt the forklift roll over something. He exited the cab and found the laborer unresponsive, lying near the left side of the forklift. The laborer was pronounced dead at the scene. The medical examiner identified head and thoracic injuries as the cause of death. (NIOSH, 2012)

Regulating Powered Industrial Trucks

OSHA regulates the operation of powered industrial trucks in the workplace. Several standards apply to this equipment based on the type of industry. For example, 29 CFR 1910.178 standards apply to powered industrial trucks in which the general industry standards apply. OSHA promulgated the original 29 CFR 1910.178 forklift standard by adopting the ANSI B56.1-1969 standard. The 1910.178 standard applies to trucks manufactured under ANSI/ASME B56.6, B56.7, B56.1, B56.9 and B56.5.

During 2013, approximately 2,188 violations involved OSHA's forklift standards. Table 1 (p. 40) shows the top 10 most frequently cited standards. Operator training issues accounted for six of the top 10 leading violations classifications.

Fiscal years (Oct. 1 to Sept. 30) 2013, 2014 and 2015 continue to rank powered industrial trucks as one of OSHA's most frequently cited standards (Morrison, 2013; OSHA, 2014; Smith, 2015). More specifically, powered industrial trucks were ranked sixth in 2013 and 2015, and fifth in 2014. In fact, powered industrial trucks have continuously been among the most frequently cited standards for the past 10 years.

For marine terminals, 29 CFR 1917.43, 29 CFR 1917.44 and 29 CFR 1917.50 apply. In longshoring operations, 29 CFR 1918.65 applies. For the construction industry, the construction standard is 1926.602(c) and 1926.602(d) (OSHA, 2015b). Equipment designed to move earth is not covered under these standards, even those that have been modified with forks (OSHA, 1999a). The OSHA standards address various aspects of forklift operations including refueling, equipment operation, inspections and operator training.

In addition to these standards, OSHA can also use the General Duty Clause [Section (5)(A)(1)] of the OSH Act of 1970. This clause is used when



a hazard is present for which no specific OSHA standard exists. The following set of criteria must be met to use the clause:

- a) The employer failed to keep the workplace free of a hazard to which employees of that employer were exposed;
- b) The hazard was recognized;
- c) The hazard was causing or was likely to cause death or serious physical harm; and
- d) There was a feasible and useful method to correct the hazard. (OSHA 2003)

Part of the General Duty Clause citation process involves the identification of a feasible and useful method to correct the hazard. To achieve this, OSHA relies on national consensus standards and manufacturers' recommendations. OSHA relies on five ANSI standards that apply specifically to powered industrial trucks. They are:

- 1) ANSI/ITSDF B56.1, Safety Standard for Low Lift and High Lift Trucks;
- 2) ANSI/ITSDF B56.5-2012, Safety Standard for Driverless, Automatic Guided Industrial Vehicles and Automated Functions of Manned Industrial

Table 1

Top 10 OSHA Violations Involving Forklifts, 2013

Standard	N	Percent
Employer shall ensure that employees are trained—1910.178(l)(1)(i)	317	12.0
A training evaluation shall be completed every 3 years—1910.178(l)(4)(iii)	288	10.9
Training certification—1910.178(l)(6)	275	10.4
Defective trucks taken out of service—1910.178(p)(1)	154	5.8
Successful completion of training—1910.178(l)(1)(ii)	151	5.7
Trucks examined daily or after each shift—1910.178(q)(7)	147	5.6
Operator training—1910.178(l)	138	5.2
Nameplates legible—1910.178(a)(6)	85	3.2
Modifications require manufacturer approval—1910.178(a)(4)	70	2.6
Training program implementation—1910.178(l)(2)	68	2.6
Total	1,693	64.0

Note. Data from *Top 10 Most Frequently Cited Standards for Fiscal 2014*, by OSHA, Oct. 28, 2014. Retrieved from www.osha.gov/Top_Ten_Standards.html.

Table 2

General Duty Clause Violations Involving Forklifts, 2013

Hazard	N	Percent
Inadequate/missing seat belts	70	49.3
Improper personnel platforms	41	28.9
Improper lifting of loads	9	6.3
Improper maintenance	9	6.3
Trailer/loading dock hazards	4	2.8
Other hazards	9	6.3
Total	142	100.0

Vehicles;

3) ANSI/ITSDF B56.6-2011, Safety Standard for Rough Terrain Forklift Trucks;

4) ANSI/ASME B56.7-1987, Operator Controlled Industrial Tow Tractors;

5) ANSI/ITSDF B56.9-2012, Safety Standard for Operator Controlled Industrial Tow Tractors.

From Jan. 1, 2013, to Dec. 31, 2013, 145 violations involving forklifts were cited using the General Duty Clause (Table 2).

The scope of each standard describes the types of vehicles to which it applies. An employer is responsible for knowing which ANSI standard applies to a particular piece of equipment. The standards are arranged such that one part applies to the user and another part applies to the manufacturer. User expectations include general safety practices, operator safety rules and practices, and maintenance. The manufacturer's part addresses design and construction aspects of the trucks.

Compliance Interpretations & Directives

To assist employers with compliance, OSHA issues letters of interpretation on its standards. These compliance interpretations are formulated by issuing letters to employers, individuals and organizations seeking clarification as to how a particular

standard is to be interpreted. OSHA formulates an official interpretation of the standard and issues a letter of interpretation that is then posted on the agency's website. These letters provide guidance as to how a particular standard or phrasing in a standard is to be interpreted, and are a great resource to employers. Numerous standard interpretations are related to powered industrial trucks ranging from controlling battery acid exposures during recharging to proper methods for lifting personnel with a truck (OSHA, 1991;

1993; 1996; 1999a, b; 2001; 2003; 2004a, b).

In addition, OSHA issues compliance directives to its compliance safety and health officers (CSHO) on many issues. These directives provide guidelines to the CSHO in determining compliance with various aspects of a standard. Employers can also use these directives to help them meet OSHA's expectations. For example, Directive No. CPL 02-01-028, Compliance Assistance for the Powered Industrial Truck Operator Training Standards, outlines the inspection guidelines, enforcement guidance, and questions and answers pertaining to different aspects of the forklift standard.

DOL Youth Employment Provisions for Nonagricultural Occupations

In addition to OSHA standards and various ANSI standards, the U.S. Department of Labor's Youth Employment Provisions for Nonagricultural Occupations also apply to the operation of forklift trucks. This law bans all minors under the age of 18 from operating, riding on or assisting in the operation of certain power-driven hoisting apparatus including forklifts (DOL, 2010). Violators of the provisions may be subject to a civil penalty of up to \$11,000 for each minor employed in violation. Penalties for violations that cause the death or serious injury of a minor may increase up to \$50,000, and those penalties may be doubled (up to \$100,000) when the violations are determined to be willful or repeated (DOL, 2010).

OSHA Approach to Powered Industrial Truck Enforcement

As could be expected, an examination of forklift violations by industry reveals that most violations occur in the manufacturing, wholesale trade, and transportation and warehousing industries (Table 3).

Incident & Injury Prevention Strategies for Powered Industrial Trucks

Both the OSHA standards and the various related ANSI standards address major hazard control strategies for safe operation of a powered industrial truck. When implemented, these strategies can

help employers both reduce incidents that involve powered industrial trucks and strengthen compliance with OSHA standards.

Seat Belts

The purpose of seat belts on forklifts is not to protect the worker from high-speed collisions, as would be the case for passenger cars, but rather to protect the employee in the event of a forklift tipover. During such an event, a forklift operator's natural urge is to jump out, which could cause the worker to be crushed. The safest place for an operator in the event of a rollover is strapped in the seat, where s/he is protected by the vehicle's rollover protective structure. According to NIOSH (2001), forklift overturns account for the highest percentage of fatalities, and many of the resulting fatalities could have been prevented had the operator been restrained.

As noted, OSHA adopted ANSI B56.1-1969 when developing its original forklift standard. The ANSI standard at that time did not include the requirement for seat belts, which is why the requirement does not appear in the 1910.178 standard. However, the requirement appears in ANSI/ASME B56.1-1988 and ASME B56.1-1993. In addition, many manufacturers have instituted operator restraint retrofit programs with which employers are required to comply. OSHA (1996) would cite an employer for not taking advantage of the powered industrial manufacturer's operator restraint or seat belt retrofit program. The seat belt requirement is enforced by OSHA under the General Duty Clause. Under 1910.178(l)(3)(i), seat belt training must meet manufacturers' recommendations.

Operator Training

Operator training under the OSHA standards must be a combination of formal instruction, practical training and evaluation of performance (OSHA, 2000b). Trainers should be qualified as determined by the employer. The training requirements apply to all types of powered industrial trucks. This training also requires coverage of operator restraint systems (OSHA, 2000b). Formalized retraining under the OSHA standards is required every 3 years although more frequent retraining may be necessary if the employer determines that a need exists.

ANSI standards provide

an extensive list of areas that should be included in the training. Topic examples include:

- fundamentals of powered industrial truck operation;
- operating environment effects on truck operation;
- operation of the powered industrial truck;
- operating safety rules;
- operational training practice (ANSI/ITSDF, 2012).

The employer should retain certification records of the training for 3 years. Records should include the operator's name, training dates, evaluation date and the identity of the person(s) conducting the training and evaluation (OSHA, 2000b).

In 2000, OSHA entered into a settlement agreement with the National Maritime Safety Association and its enforcement approach to the powered industrial truck standard (OSHA, 2000a). This agreement addresses the application of 29 CFR 1910.178(l), Powered Industrial Truck Operator Training, to the longshoring and marine terminal industries (SIC 4491). The standard was issued Dec. 1, 1998, and is made applicable to marine terminals by 29 CFR 1917.1(a)(2)(xiv) and to longshoring by 29 CFR 1918.1(b)(10). The settlement agreement outlines OSHA's requirements pertaining to forklift operator training as they apply to the maritime and longshoring industries. The agreement includes provisions for the use of third parties to conduct the training, training record re-

Table 3

OSHA Powered Industrial Truck Penalties

Industry classification	Citations	Inspections	Penalty
33 / Manufacturing (part 3 of 3)	762	547	\$1,008,306
32 / Manufacturing (part 2 of 3)	505	347	\$793,289
42 / Wholesale trade	428	284	\$683,933
23 / Construction	251	217	\$304,334
49 / Transportation and warehousing (2 of 2)	249	167	\$625,178
44 / Retail trade (part 1 of 2)	171	108	\$368,532
48 / Transportation and warehousing (1 of 2)	135	91	\$342,602
31 / Manufacturing (part 1 of 3)	132	88	\$265,135
56 / Administrative and support and waste management and remediation services	110	84	\$259,248
81 / Other services (except public administration)	60	41	\$95,449
45 / Retail trade (part 2 of 2)	50	31	\$85,215
11 / Agriculture, forestry, fishing and hunting	25	14	\$30,606
21 / Mining, quarrying, and oil and gas extraction	21	15	\$48,494
54 / Professional, scientific and technical services	17	12	\$26,816
53 / Real estate, and rental and leasing	15	9	\$31,492
92 / Public administration	13	11	\$0
51 / Information	11	8	\$14,839
71 / Arts, entertainment and recreation	10	5	\$10,903
22 / Utilities	5	4	\$22,400
62 / Healthcare and social assistance	5	3	\$5,475
Total	2,975	2,086	\$5,022,246

Note. OSHA powered industrial truck penalties under 29 CFR 1910.178 by industry, October 2014 through September 2015. Data from OSHA's Data and Statistics web page. Retrieved from www.osha.gov/oshstats/index.html.

quirements and determination of powered industrial truck operator competency.

Operation

ANSI standards provide general operating safety guidelines, traveling safety guidelines and loading procedures. General operating guidelines include keeping hands and feet inside the operator's compartment, proper starting procedures and pedestrian safety (ANSI/ITSDF, 2012). OSHA (2004b) does not set specific speed limits for the safe operation of a powered industrial truck. The agency recommends that the employer consider various factors including the type of truck, manufacturer's limitations, load being carried and adequate stopping distances. National consensus standards such as ASME B56.1-2000, Safety Standard for Low Lift and High Lift Trucks, provide a stopping distance formula. Employers can then use this information, along with other factors, to calculate a maximum safe speed (OSHA, 2004b).

Recommended traveling safety guidelines include proper ascent and descent of inclines, traveling at cross aisles and adherence to general rules of the road for forklifts being operated in a facility. Operation guidelines for loading include procedures for lifting and lowering loads with forks and attachments (ANSI/ITSDF, 2012).

Loading Docks & Chocking Trucks

In many circumstances forklift operators must load/unload tractor-trailers using a forklift. Hazards of this type of activity include the forklift truck falling through the bed of the tractor-trailer, the bridge plate moving or failing, and the truck pulling away from the loading dock. To prevent the truck trailer from being moved while loading operations are being performed, OSHA requires the use of a wheel chock or similarly effective method.

The intent of the safety regulation is to effectively prevent movement of the truck during loading operations involving powered industrial trucks (OSHA, 1991). OSHA Compliance Directive CPL 02-01-030, Chocking of Tractor-Trailer Under the Powered Industrial Truck Standard, establishes the criteria by which OSHA can cite employers under 1910.178(k)(1) and 1910.178(m)(7) for trucks and trailers.

Due to DOT brake regulations, OSHA does not cite for failure to chock trailer wheels if the vehicle is otherwise secured. DOT regulations preempt the enforcement and DOT has jurisdiction. On Oct. 30, 1978, OSHA issued Directive STD 1-11.5, which stated that 1910.178(k)(1) and 1910.178(m)(7) should not be enforced as they apply to trucks and trailers under the Motor Carrier Act (motor carriers engaged in interstate commerce) (OSHA, 1999c). If the truck is an intrastate truck, OSHA (2015c) has jurisdiction.

It is the forklift operator's responsibility to inspect the working conditions to ensure that the trailer bed can support the weight of the loaded forklift and that the dock plate is properly secured. ANSI/ITSDF (2012) standards recommend that

portable and powered dock boards be marked conspicuously with their carrying capacity and that the carrying capacity not be exceeded. They are to be secured in position, either by being anchored or by being equipped with devices that will prevent their slipping.

Platforms/Hoisting Employees

Using a forklift to lift employees can be extremely hazardous if not performed properly. Several fatalities occur each year due to this activity. At one time, an OSHA regulation addressed the use of personnel platforms under 29 CFR 1910.178. However, it was ruled that 29 CFR 1910.178(m)(12) was unenforceable by OSHA. An amendment deleted a provision of the standard covering the use of powered industrial trucks to lift personnel. It was deleted because it was invalidly promulgated from a nonmandatory provision of a national consensus standard (OSHA, 2015d).

OSHA enforces requirements pertaining to personnel platforms through the use of the General Duty Clause and recommended practices found in the various relevant ANSI standards. When elevating personnel with a forklift, employers should ensure that the platform meets the design requirements outlined in the ANSI standards and the platform is attached to the lifting carriage or forks. Personnel should be protected from falls through the use of a fall restraint system or guardrails. When personal fall restraint systems are used, they should be inspected and maintained in accordance with the schedule and requirements found in Section 6 of ANSI/ASSE Z359.1-2007, Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components (ANSI, 2012).

Battery Charging/Refueling

Powered industrial trucks operate on several different types of fuels including battery, propane, gasoline and diesel. A new growing market for forklifts is fuel cell technology. Fuel cell forklifts produce zero emissions while in operation and can operate for more than 12 hours without performance degradation. On the other hand, fuel cell material handling equipment can be refueled in a couple of minutes compared to the charging requirements of batteries, which may take several hours (Mayyas, Wei, Chan, et al., 2016).

Each fuel source presents unique hazards that must be controlled in the workplace. OSHA standards govern the storage, handling and use of these different fuels, as do various ANSI and NFPA national consensus standards. Safe handling procedures for fuels such as LPG gas, diesel fuel and gasoline include controlling heat sources that could ignite flammable vapors and gases.

Battery-powered industrial trucks pose fire hazards and chemical exposure hazards due to the use of electrolytes. Battery recharging should be performed in a designated area and precautions must be taken to ensure that facilities are provided for flushing and neutralizing spilled electrolyte, for fire protection, for protecting charging apparatus from



Hazard control strategies can help employers both reduce incidents that involve powered industrial trucks and strengthen compliance with OSHA standards.

damage by trucks, and for adequate ventilation for dispersal of fumes from gassing batteries (29 CFR 1910.178). An OSHA (1978) directive stipulates that in battery-charging areas where powered industrial trucks are only charged (i.e., no maintenance is performed, batteries are not removed from the truck, no electrolyte is present in the area), these areas are not subject to the requirements of 29 CFR 1910.178(g)(2).

Inspections

The 1910.178(q)(7) standard requires employers to inspect forklifts daily or after each shift if the trucks are used around the clock. While ANSI standards provide more detailed procedures for inspecting forklifts, they have not been adopted by OSHA (1999b).

Examples of preshift inspection items recommended in the ANSI (2012) standards include:

- a) condition of tires;
- b) inflation pressure (if pneumatic tires);
- c) warning and safety devices;
- d) lights;
- e) battery;
- f) controls lift and tilt systems;
- g) load-engaging means;
- h) chains and cables;
- i) limit switches;
- j) brakes;
- k) steering mechanisms;
- l) fuel systems;
- m) additional attachments and items stipulated by the manufacturer.

Forklift Truck Modifications

Written approval from the manufacturer of a powered industrial truck is required for modifications or additions if they affect the capacity and safe operation of the truck. However, OSHA (2004a) would consider the lack of manufacturer's approval to be a de minimis violation if the employer has obtained written approval from a qualified registered professional engineer after receiving no response or a negative response from the powered industrial truck manufacturer.

Beyond Compliance

While utilizing compliance-related resources to better manage a forklift safety program is critical in reducing citations and penalties, one should not overlook the importance of creating a culture of forklift safety that can result in a measureable reduction in forklift incidents. Today, advances in forklift-based technologies, such as fleet and operator management systems, can help to make critical information readily available. Finding ways to change the behavior of the forklift operator can also improve overall safety (Gaskell, 2016).

For example, technology can help enhance the overall safety culture by conveying the message that safety matters. Technologies exist that can manage inspections, operator certifications and equipment access. Some technologies, for example, can prevent a forklift operator from simply going through

the motions during preinspection by tracking the time it takes to complete the inspection. If a forklift does not pass inspection, technology exists to make it unable to start. Other technologies require login before the operator can use the equipment. A forklift can also be retrofitted with a device that will not allow the unit to turn on until the seat belt is buckled.

These simple actions can help to keep operators accountable and help employers to better track both forklift and operator actions and activities. This can send a strong message that the organization takes safety seriously and can be a step in the right direction toward continuous improvement (Gaskell, 2016).

Manufacturers have taken additional steps to help control typical hazards of forklift operation. For example, keyless access controls can ensure that only authorized operators who hold training credentials can operate the forklift. Customized safety checklists can be presented on an LCD display module on a forklift. It can generate work orders and lockout vehicles until repairs are made. Infrared communications technology provides an invisible beam of light around the vehicle while it is in operation and will activate warning systems for the driver. Microwave motion sensors can detect traffic in the area to alert pedestrians and other operators of potential collisions (Lawrence, 2007). These are just a few of the efforts manufacturers have put in place to control forklift hazards.

Conclusion

Hazards involving forklifts are prevalent in the U.S. workplace. The manufacturing, wholesale trade, and transportation and warehousing industries are most frequently cited by OSHA, and these violations result in more than \$5 million in penalties each year. The number of violations and fines could be due to the increased use of forklift trucks in these industries. Additionally, powered industrial trucks have been named one of OSHA's most frequently cited standards for more than a decade. Employers should use this list to help them evaluate their own workplaces and to ensure compliance with 1910.178 and applicable consensus standards.

Federal OSHA standards are most often used to cite shortcomings in employee training. Employers are commonly cited for issues such as lack of forklift operator training, use of noncertified training and training evaluations not being completed every 3 years.

In addition to the OSHA standards that apply to forklift trucks, employers must be aware of the various national consensus standards that OSHA applies when citing employers using the General Duty Clause. Examples of forklift violations cited under using these standards include seat-belt-related hazards and personnel platform hazards. Furthermore, federal regulations ban workers under age 18 from operating forklifts.

Employers should make use of compliance-related resources such as the OSHA standards, national consensus standards, letters of interpre-

tation and OSHA compliance directives. Each resource provides employers invaluable information that can help them with compliance and help them make the workplace safer for those who operate and work near forklifts. **PS**

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