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OSHA Compliance Issues

Employee Exposure to High-Level Radio Frequency Radiation

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The Sears Tower in Chicago, Illinois, stands 110 floors, or 1,454 feet, above ground level. Its antenna towers add an additional 253 feet, for a total height of 1,707 feet. In 1998, local media reported that a painter painting one of the antennas suffered burns from radio waves. Exposure to high-level radio frequency (RF) radiation can result in burns, cataracts, temporary sterility, and even death.

Following guidance contained in the Occupational Safety and Health Administration's (OSHA's) Field Inspection Reference Manual (FIRM), the Agency elected to inspect the workplace.[1] At the time of the OSHA inspection, 21 major broadcasters were broadcasting from the two antennas.

Background

In 1998, a contractor was hired to paint and weatherproof the two antenna towers; the project began in May, and was to be completed by October. The incident initiating this OSHA inspection occurred during the final week of the project.

The "painters' ring" (Figure 1) is located approximately 50 feet above the roof of the Sears Tower. The area below the painters' ring, including the roof of the Sears Tower building, represents a safe work zone where employees can work without exposure to high RF. When work above the painters' ring occurs, the radio and television broadcasting stations are required to either shut down or switch to an alternate antenna.

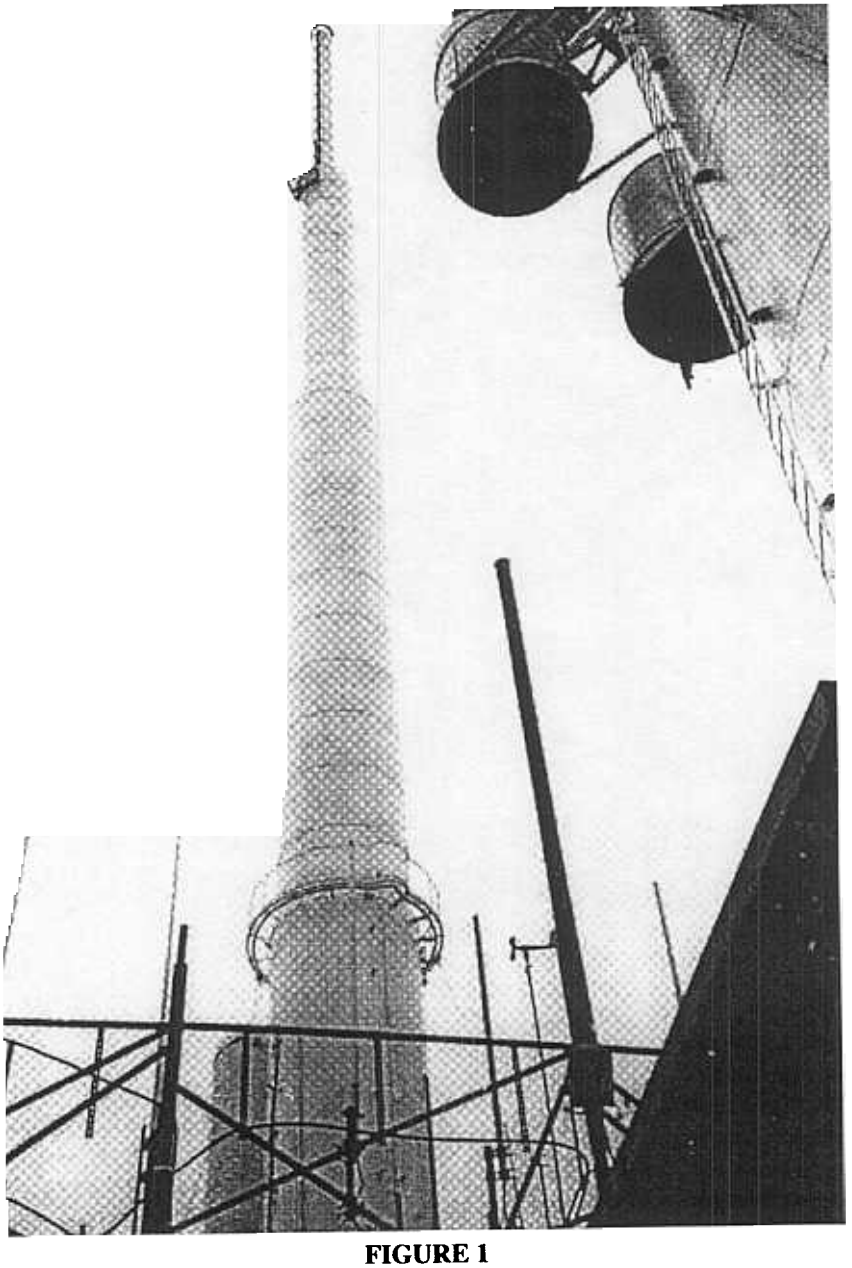

FIGURE 1
Painters' ring, located approximately 50 feet above the roof of the Sears Tower.

The daily work procedures for the painting contractors included the following:

- Painters were provided daily with personal electromagnetic radiation monitors.
- Each night, an on-site engineering contractor informed the painters when the tower ascent could begin (after all the stations had ceased broadcasting or switched to an alternate antenna).
- The painters were allowed to work only between 1:00 am and 5:00 am, weather permitting (winds less than 15 miles per hour).

The painters used "spider units" (Figure 2) for all their painting above the painters' ring. The spider units rode cables from the top of the building to the top of the antenna. There were two single-person aluminum spider units on site, which employees would operate in unison, riding up and down their respective cables simultaneously.

OSHA Findings

OSHA's initial investigation found the following:

- An on-site engineering contractor was monitoring RF safety.
- At the time of the incident, no radio or television stations were supposed to be broadcasting from the east tower.
- Each worker was evaluated daily with personal RF monitors.
- There had been no other incidents since the project began.
- Although two employees were exposed to high-level RF at the same time (one employee in each spider unit), only one worker was injured.

On the night of the incident, the following occurred:

- The engineering firm failed to contact one of the radio stations to confirm that it had switched its broadcasting to an alternate antenna. (Because work had been cancelled earlier in the week due to high winds, the radio station believed that work would not occur that night and, therefore, did not switch to an alternate antenna.)
- The workers' personal RF monitoring devices failed to adequately warn them of the high level of RF. (Prior to the incident, questions had arisen regarding the suitability of the RF monitors.)

According to the monitor manufacturer, the painting contractor was using the monitors outside the scope of their intended purpose. The manufacturer stated, and the painters verified, that due to excessive residual RF from nearby antennas, the monitors would be constantly beeping. The workers were not able to distinguish between danger and error when they entered the RF field and heard the beeping. The engineering firm stated that the monitor sales representative had given assurance that the monitors would meet its needs.

OSHA also found that the employer had not performed a proper hazard assessment to determine what personal protective equipment (PPE) the workers needed to use. The uninjured worker wore regular hiking or construction-type boots (not steel-toed), while the injured worker wore steel-toed safety shoes. Both workers were exposed (from the waist down) to the same high-level

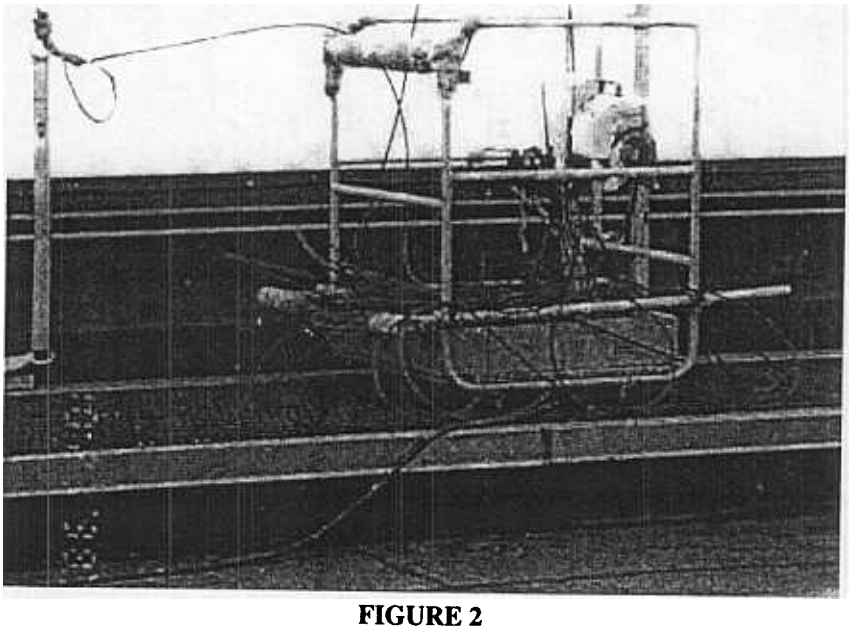

FIGURE 2
"Spider unit" used by painters for all their painting above the painters' ring.

RF. During the exposure, both workers momentarily became a living part, or extension, of the antenna through a phenomenon referred to as "induced current." As the RF exited the workers' bodies, primarily through the legs near the ankles, the steel in the injured worker's shoes caused the current to "arc" and burn the worker's ankles and legs.

OSHA Outcome

OSHA cited the employer for two violations. The first violation was issued under the General Duty Clause, Section 5(a)(1) of the Occupational Safety and Health (OSH) Act,[2] which requires the employer to provide a safe and healthful workplace for employees. The second citation was for the employer's failure to perform a hazard assessment to determine necessary PPE.

The Agency issues a citation under the General Duty Clause when there is no OSHA standard that covers a particular hazard. In order to use the General Duty Clause, OSHA must first establish the following four elements:[1]

1. The employer failed to keep the workplace free from a hazard to which employees were exposed.
2. The hazard was recognized.
3. The hazard was causing or likely to cause death or serious physical harm.
4. There was a feasible and useful method to correct the hazard.

In this case, OSHA confirmed all four elements, meeting the burden of proof to issue a citation. The employer was cited for exposing employees to a high level of RF radiation in excess of the safe level as set forth in IEEE-C 95.1-1991, and for failing to ensure that all the identified broadcast systems were turned off or switched to an alternate antenna or tower before allowing workers to ascend and perform their assigned duties.

Conclusion

The employer in this case did not challenge the citations, and revised its procedures to ensure that, prior to any future work, each of the broadcast stations would be directly contacted to confirm that it had either shut down or switched to an alternate antenna. The employer also stated that it would investigate the possibility of using individual probes linked to each transmitting section of each antenna to ensure that no RF signal was being transmitted prior to any worker ascending the towers. The probes would be wired to a panel monitored by the engineering firm. Additionally, the employer established new guidelines for training contractors and their employees on RF safety, proper PPE, and the use of monitoring equipment.

Disclaimer

The opinions, findings, and conclusions presented by the author are not necessarily those of OSHA. Any mention of materials or products does not imply an endorsement by OSHA.

REFERENCES

1. Occupational Safety and Health Administration: The Field Inspection Reference Manual. USDOL (OSHA) Instruction CPL 2.103. OSHA, Washington, DC (1994).
2. Public Law 91-596: 91st Congress, S. 2193. U.S. Government Printing Office, Washington, DC (December 29, 1970).

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