Incinerator Plant Safety

JAMES A. GILDERSLEEVE
Superintendent of Sanitary Services
Town of Oyster Bay
Syosset, N.Y.

SAFETY

Designing "SAFETY" into Incinerator Plants is one of the fundamentals of design that many engineers seem to overlook. This is understandable to some extent because, after the design has been completed and price estimates prepared, something has to be eliminated to get the cost under the money available. However, most safety precautions or devices can be added by operators later. When once recognized, hazards that are inherent in design can be readily corrected or can at least be guarded against by warnings and by proper safety procedures.

Preventative Methods

The prevention of physical injuries begins with good housekeeping. Tools, parts, and other items should not be left lying around. The installation of peg-boards for the holding of hand tools acts as a deterrent to indiscriminate scattering of tools. The use of portable tool boxes with proper locks aids in the prevention of theft. In this way, we not only tend to keep a clean work area but are better able to pay for the necessary appurtenances by lowering replacement costs.

Guard railings should be provided around all open hoppers, stairs, hatches, or other openings. In addition, a 6-in. curb should be provided around all open hatches so that tools, etc. cannot be accidentally pushed off to drop on persons below. This also aids in preventing water, paint or other necessary cleaning devices from cascading down open hatches to floors below.

An incident occurred several years ago to the writer when he first assumed the duties of Superintendent.

A 5-gal can of paint was inadvertently spilled on the charging floor and the cascading gray paint came down the open hatch. The resulting mess always made me wary of open hatches.

Ladders and steep stairs should be avoided especially where materials must be carried. Permanent vertical ladders over 10 ft in height should be equipped with a hoop cage surrounding the ladder in such a manner that the man climbs within the cage and is protected. All other ladders should be equipped with proper "footing". All metal ladders should have rubber base pads. The improper use of extension ladders has resulted in many accidents, and when purchasing this type of equipment, consideration must be given to the heights such ladders will be required to reach. Whenever an extension ladder is used to a hazardous height someone should "foot" the ladder to prevent slippage and to assist the employee on the ladder. Special care has to be used in the raising and lowering of extension ladders and the "buddy" system should always be in effect when this is being accomplished to prevent injuries to hands and feet.

One of our employees lost parts of three fingers due to the top fly of an extension ladder slipping and coming down the guides like a guillotine blade.

Adequate light should be provided at any points where maintenance or repair work is required, or at any point where good visibility is necessary. Unprotected light bulbs have caused many serious accidents when subjected to impact by employees in a work area. All portable hand lights should be properly caged and any permanent fixtures in close proximity to work areas should also be protected.

Outside facilities must be considered.
An employee of a neighboring incinerator received scarring facial cuts from an unprotected light bulb that exploded near his face when cold water was accidently spilled onto the bulb.

The current trend in operation of incinerators is 24-h, round-the-clock operation and this mandates that proper outside illumination must be available so that all crews can function in simulated daylight.

Doors should be of adequate size to permit removal of equipment. The height of the door is as important as the width. Due consideration should be given to which way a door opens. The installation of improper sized doors often makes double handling of material and equipment a necessity. This results in sprains, strains, and back injuries and sometimes injuries to hands and feet.

In our old incinerator the truck entrances were undersized and prevented our vehicles from entering the building. All material and equipment had to be unloaded outside in all types of weather and hand-carried into the shop.

Hoists or traveling cranes should be considered. Where impractical, an “eye bolt” should be provided to permit the use of lifting equipment. The replacement of refractories, pumps, and grates are constant in any incinerator. The lifting of this material and equipment is hazardous by itself and attempting to move it without proper devices results in many avoidable accidents.

Electrical Hazards

Electrical hazards are present in many of the older incinerators. New types of enclosed switch gear are quite safe, but the older open types of switchboards need to be approached with care. A rubber mat on the floor is an added safety factor for either type. Any portable power tool should be equipped with a ground wire and a special outlet and plug. When work is being done on equipment controlled by a switch located at some distance from the equipment, the switch should be tagged to prevent others from accidentally throwing the switch on. At no time should any work be done on electrical equipment in wet areas or should any electrical lines be laid on wet floors or exposed to the elements. All permanent electrical lines should be placed in conduit and installed under proper supervision.

In 1958 we had a near tragedy on our crane floor when an operator closed an open switch while mechanics were working on top of our other crane. The ladder was blown off of the floor but no physical injuries to our personnel resulted.

Fire Control

Fire extinguishers for particular usages and the proper type should be provided in readily available places. Extinguishers of the carbon dioxide or carbon tetrachloride type present a danger of asphyxiation from noxious fumes when utilized in confined areas.

The use of dry powder or carbon dioxide extinguishers should be demonstrated under the direction of a qualified individual who is well acquainted with firematics because many times an employee will use an extinguisher of the type not suited to fight the fire. If possible all employees should be instructed in the proper handling and use of extinguishers, especially the carbon dioxide type.

The location of fire hydrants and stand pipes within and outside the building is critical for fire control purposes. The availability of flushing water is essential to the operation of nearly all incinerators. It is a disagreeable job to drag a heavy hose a long distance when a pipeline and hydrant would provide the water near its point of usage. It must be insured that the hydrant thread matches the hose thread and the local fire department fittings.

Our Incinerator, Plant No. 1, had different threads on our hydrants from the internal stand pipes and our hoses did not match either threads. We used adapters until we could make the necessary modifications to standardize threads.

Emergency and Fire Department numbers should be placed in view throughout the building and employees, especially supervisory, should be instructed that when a fire occurs an immediate call should be made to the local Fire Department. We are often faced with well-meaning people attempting to extinguish what they consider a minor blaze until they realize that they cannot handle it and then place the call for assistance. This has resulted in employee injuries and considerable damage to incinerator facilities. The refuse storage bin containing tons of highly flammable materials harbors a constant threat of fire. In our experience a “pit” fire is the most difficult and hazardous to control. In a matter of minutes the building fills with noxious fumes and smoke creating havoc and if the fire is not put under control in a short period extensive damage to cranes and the building results.

Sanitary Facilities

Sanitary facilities are not adequate in many of the older plants and some of the newer ones. Although it is recognized that the facilities required will vary with the
size and type of plant, the following facilities should be provided:

(a) Hand washing facilities — which should include hot as well as cold water. Dispensers for soap and paper towels should also be provided.

(b) Showers — which will permit the employee to properly wash his entire body. If anyone has ever worked in the furnace chambers or chimney bases, he would consider that showers are essential.

(c) Lunch area — which should be heated, lighted, and adequately ventilated. This provision should prevent the use of the administrative offices as a lunchroom.

(d) Lockers — which will permit the employees to change their clothing before leaving for their homes. Lockers should be large enough to accommodate boots, rainwear, etc.

Practices which will help prevent transfer of disease are:

(a) Keeping hands below the collar at all times in an incinerator. A majority of infections are transmitted through the mouth or nose.

(b) Eliminating the use of community cups for coffee or other liquid beverages. The one-time plastic or foam cup should be used.

(c) Keep all areas clean and free from rodents, insects, and dust.

Machine Shop and Maintenance

This area should be well lighted, heated, and properly drained. All power driven equipment should be grounded and the necessary shielding devices installed to protect employees. Hand tools should be purchased and made available for the necessary daily chores. Instruction should be given in the proper use of hand tools. An example of the misuse of a tool that results in many injuries is a screw-driver being used as a chisel. The adjustable type wrench has a common name applied to it “knuckle breaker” this describes the end result of the misuse of this tool. If a machine shop has welding equipment, its maintenance and usage should be limited to specially trained personnel only. The improper use of this hazardous equipment can result in disabling injuries. The welding area has to be properly ventilated using exhaust system and flash shields to prevent flashes to other employees working near the area. Chain falls should be inspected regularly, and locking devices tested. The use of extension pipes on rachets and wrenches should be discouraged because the injuries sustained when slippage or breakage occurs are disabling. Several types of goggles should be supplied for welding, grinding, and chipping, and mandated use of same prescribed.

First Aid Equipment

First aid kits should be located in several areas of the plant, in places that are under observation by supervision. A first aid kit should not be locked and should be kept fully stocked at all times. A locked kit is of no use to anyone nor is an empty one.

The installation of an instantaneous face and eye bath should be mandated wherever chemicals are used.

Two of our employees were burned recently by caustic solution spouting out of a drum while they were removing the bung. Both were wearing goggles and helmets, but even with protective covering the seepage could have blinded them if water had not been close at hand to immediately flush their face and eyes.

Except for minor injuries, wounds should be treated by a doctor and reported for possible workmen’s compensation.

Safety Equipment

The safety equipment to be provided for a given municipal incinerator has to be judged as to the plant itself. Some units with open hoppers require personnel to wear safety harnesses with chain attached. Where hand stoking is done, the attendant should have heavy gauntlets, face shield, goggles, and helmet. Dust problems can be resolved by the use of masks. Wooden clogs to protect the soles of shoes and feet should be provided to clean out dry chambers if the brickwork is hot. Wet bottoms, or ash pits call for safety boots with puncture proof soles and steel cap toes. Where heavy maintenance is performed, all maintenance men should wear safety shoes. If funds are available, uniforms should be contracted for on a scheduled basis. Generally, helmets should be worn at all times and in all areas of an incinerator plant except in administrative offices.

We tried many safety helmets and shields and decided on a simple bump type plastic cap with an attached movable shield made of copper and steel mesh. The dark covering and fine mesh helped reduce glare but allowed for passage of air. This eliminated the possibility of “roll under” flashes and heat being trapped between the worker’s face and shield. Shortly after using these safety items a quart bottle partially filled with ammonia exploded directly into one of our stoker’s face. He received several sutures in his upper chest and around his shoulders, but even though the face shield was completely impacted with glass and his helmet had several gouges, his face and, more important, his eyes were not injured. The medical testimony received by us from the emergency hospital confirmed our first impression: if
the man had not been wearing protective devices he would have lost some, if not all, of his sight and his face would have been severely lacerated.

Too often an employee will consistantly refuse to follow procedures and utilize safety equipment. Meetings with representatives from the insurance carrier can often bear fruitful returns. A safety program can be made into a joint venture and participation of all employees mandated.

**Power Generation**

Incinerators equipped with power generation units and/or steam generating units have to maintain a stringent, safety conscious staff. In many areas, operators have to be licensed by local law, while in some municipalities they do not demand licensing.

Where an incenerator has a boiler generating steam under pressure, the slightest miscalculation can result in a tragedy. Operating personnel have to be thoroughly schooled as to the critical nature of their duties. All safety equipment must be checked constantly and valves and gauges must be considered as part of the safety check list.

Electrical generating devices are usually equipped with safety controls but the nomenclature should be familiar to all operators and awareness as to proper safety procedures constantly programmed. The area containing generators, turbines, or stand-by power equipment should be isolated from the normal operating personnel and considered off-limits to all unassigned employees. There have been many cases of avoidable accidents caused by under-schooled employees mishandling controls. Lock-out type switches should be installed on all distant stations.

Safety is the concern of all personnel from the supervisory levels, entrusted with the responsibility to initiate proper safety techniques and regulations, down through all employee ranks that must be impressed with the need and importance to comply with safety regulations at all times. Safety regulations, when simply posted on bulletin boards or written down on inter-departmental memorandums, do not make lasting impressions on working men. It is necessary for supervisors and the operational employees to constantly discuss safety regulations and potential hazards. The need for additional safety equipment or modifications in operational procedures can be brought to light, and in this way, prevent injuries from occurring. The burden of funding a good safety program is a wise investment that will reap high dividends in reduced insurance costs and more important, prevent serious injuries and the accompanying lost time.