FREEZING

INTRODUCTION

During cold weather, low temperatures are part of the normal weather pattern in many parts of the world. Loss by freezing can develop when cold temperatures harden or solidify liquids or damage goods and materials by exposure to gradual cold. For water the freeze damage temperature is 32°F (0°C) and below. By contrast, an "arctic freeze" is an unexpected and severely adverse climatic condition that can create catastrophic loss. Arctic freeze, which requires pre-emergency planning, is covered in PRC.15.5.1 and *OVERVIEW*, Section 7.

Freezing damage can occur in almost any piping, cooling, pumping or tankage system that contains liquid. Damage potential increases when temperatures fall below freezing and persist for a long time. Piping, pumps and tanks can be damaged. Production machinery equipped with cooling water jackets is highly vulnerable to freezing. Too often, freeze damage results from improperly protected equipment, inadequately drained piping systems or power failures. When freeze damaged systems thaw and the contents escape, liquid damage and contamination may result in severe loss.

Products with moisture content can freeze and be damaged. Low temperatures can solidify some chemical products or separate them into components. Some petroleum oils with a high paraffin content may solidify. If products being transported or stored are exposed to low temperatures, they may be damaged along with their containment and handling systems.

These perils can be controlled or damage prevented entirely if management follows a written and scheduled maintenance plan, and has a freeze contingency plan. A survey guide is offered in PRC.15.5.A.

POSITION

A **maintenance plan** helps ensure that various controls, safety devices, shut down mechanisms and alarms work as intended. Schedule at least one maintenance inspection before the cold season begins.

- Drain all liquid systems located outdoors or winterize them with appropriate non-freeze solutions. While systems may not freeze with temperature at 32°F (0°C) for a short time, freeze-up can result from a longer period of weather with subfreezing temperatures.
- Check large outdoor tanks. If the possibility exists for low temperatures to cause liquids to separate or solidify, tanks and associated piping should be heated or the products circulated as necessary to prevent freezing.
- Ensure that fire protection tanks and standpipes containing large quantities of water have enough heat to prevent freeze damage to the system.

- Install extra insulation in valve pits, valve houses and isolated, enclosed areas, even if there is only minimal exposure to outside temperatures.
- Repair all heating systems and controls as necessary.
- Check fuel supplies of heating devices.
- Provide heat tracing for process systems or other systems that might be exposed to freezing temperatures.
- Test low temperature alarms, and make sure they are working.
- Review inspection procedures and watchman services to insure that all areas of a facility are being observed on a regular basis.
- Inspect cold storage facilities or other systems designed to maintain cool temperatures. A period of sustained low temperatures can drop well below the required cool temperatures and damage stored contents.

Review written **contingency plan** annually.

- Check emergency electric power and emergency heat sources.
- Arrange for adequate fuel and other supplies to be available.
- Plan for extra personnel or extra watchman services during prolonged cold periods.
- Plan to thoroughly inspect all systems as soon as the temperatures rise above freezing.
- Detect and repair all damaged or leaking equipment as early as possible. This is essential in limiting the extent of loss.

DISCUSSION

Underground systems are better protected than those above ground are. However, where the ground freezes, it can heave and damage structures, foundations and piping systems located at shallow depths. The systems most subject to freezing are the domestic water supply systems. Although these are generally located inside heated buildings, when heat sources fail or temperatures drop well below those expected for long times, freeze damage can occur.

Freezing losses have occurred most commonly because:

- Windows, doors or skylights have been left open causing temperatures to drop in parts of a heated building.
- The heating system has failed during the night or on weekends when an area was unoccupied.
- Heating systems were set too low during a weekend or holiday period.
- Heating system thermostats have been located in the wrong areas. As a result, they may not effectively monitor or control heat in areas where piping systems are located.
- Low temperature alarms have failed to operate when the temperature has dropped.
- Severe snows or sleet storms have caused electric power failures that have led to heating system and alarm failures.
- Liquid systems have been installed in new construction before the heating system or other protective measures were ready.

Losses will increase more dramatically where freezing temperatures are less frequent and unexpected. In southern latitudes, systems may be outdoors, above ground, or in unheated buildings. Often, they handle heated liquids that are expected to keep the systems from freezing. However, at abnormally low temperatures, heat loss can be extreme and systems can freeze as a result.

FREEZING HAZARD SURVEY GUIDE

The survey guide should assist in evaluating freezing hazards.

1. What is the approximate latitude of the location being evaluated?
2. Is the area subject to temperatures below 32°F (0°C) for sustained periods on a regular basis, occasionally or infrequently?
    - If occasionally or infrequent, is there a written contingency plan which establishes procedures and precautions to be taken in the event of sustained low temperatures?
3. Are there any outdoor processes, cooling towers, piping or pumping systems, containing water or other liquids subject to freezing?
4. Are there any outdoor tankage systems containing liquid products which can be frozen or permanently changed or damaged by low temperatures?
5. Where liquid containment and handling systems are located out of doors, is there a written procedure for draining, heating, insulation or protecting the systems with antifreeze solutions during winter months?
6. Other than fire protection sprinklers, are there any indoor systems containing liquids subject to freezing?
7. Are there any areas containing concentrations of high value equipment or material that could be damaged by the freezing, rupturing and subsequent thawing of liquid systems?
8. Is there any critical equipment, processes or data processing system that could be damaged by freezing, or freeze-rupture-thaw incidents, which could adversely affect production?
9. Is there a low temperature alarm, watchman service or other surveillance method to insure that all building interiors are maintained above 40°F (22°C) during winter months?
    - Does the surveillance include all spaces and areas such as attics, stairwells and storage areas which contain any liquid piping or handling systems?
10. Are any liquid systems located indoors in unheated areas?
    - If so, is protection from possible freezing provided?
11. Are there any products, foodstuffs or other materials that can be permanently damaged or destroyed by low temperatures?
12. Is there an established procedure for inspecting and repairing heating systems, fuel supplies, low temperatures alarms and controls prior to the winter season?