RESILIENCE OF THERMAL ENERGY SYSTEMS SERVING MISSION CRITICAL FACILITIES

University of Alaska – Fairbanks
Utilities Department Central Heating and Power Plant
Kurt Knitter – Utilities Maintenance Manager

Like our neighbors at U.S. Army Post Fort Wainwright and U.S. Air Force Base Eielson, the University of Alaska Fairbanks Central Heating and Power Plant facility is tasked with serving the UAF "mission critical" facilities including student housing and multiple support buildings (classrooms, etc.), as well as "critical" research project laboratories, support equipment, and the like. Our ability to provide uninterrupted utilities, including heat, electric power, water, and sanitary systems is essential, particularly during extreme cold weather events.

Of utmost concern during extreme cold weather events is the maintenance of the integrity of the steam distribution system and its ability to provide thermal energy to heat the many structures on the UAF campus. Should the ability to maintain heat on campus be significantly compromised, arrangements must be made to move students to alternative off campus housing (and to arrange for feeding the students off campus). Sensitive research projects may require alternative heat sources to protect equipment, or other project-related materials, or may also need to be relocated to an alternative location.

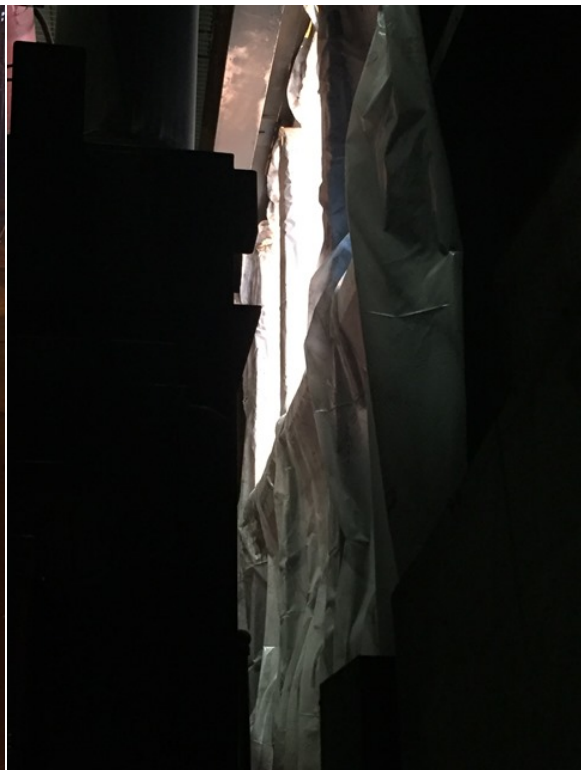
The "distribution" side of the utilities at UAF (as well as other CHPP systems in the area) are located in underground "utilidors" or are direct buried which reduces the effects/impact during extreme cold weather incidents. Utility systems located in the utilidors include water, steam, air, and sanitary system piping. However, should the steam supply in particular be down for any length of time during an extreme weather event, temperatures in the utilidors may drop to such a level that freezing is a threat, the same being a consideration for direct buried piping, etc., should the extreme weather event duration be over an extended period of time.

If, during an extreme cold weather event, there is a loss of heating steam and correction of the situation is not foreseen within an reasonable amount of time, then actions must be taken either to drain systems in buildings, utilidors, etc., to prevent/limit damage from freezing, or to take other means to limit potential freezing damage.

A good imagination is sometimes required to work during extreme cold weather. Pre-planning for potential extreme cold weather problems is essential as well. How to handle such problems may be included in your Emergency Action Plan. Questions to be considered may include: Where can students be housed if there services are to be out for any considerable length of time? If portable heating plants are required, where can they be obtained during off hours? How will the heating plants be refueled? Are there contractors available to assist with recovery efforts if on site labor is not sufficient? Has there been an pre-incident training with outside agencies?

On a routine basis, there should be a relatively comprehensive “winterizing” plan in place. Is heat tracing equipment operational? Is the equipment checked on a regular basis during cold weather season? Is the building envelope “air tight” prior to cold weather? Are windows, doors, vents, etc. close up prior to the cold weather setting in? The list can go on and on.

UAF Utilities discontinued operation of two coal fired boilers and reduced operations of Turbine Generator No. 3 at the Atkinson Power Plant in mid-December 2019 in support of shifting of operations to the new CHP plant. The boilers and TG unit contributed a significant amount of heat energy within the building, that of which was essentially lost when the boilers were taken out of service. This was the first time in recorded history of the plant that the two coal boilers and the TG unit would be off line at the same time for any considerable length of time during the winter months. A considerable amount of time was spent finding any areas where heat could be lost from the envelope and assuring that these areas were temporarily or permanently repaired. Unit heaters that had not been in service in several areas of the building were repaired/overhauled and put back into service. During the “cold spell” in the latter part of December, the efforts that were put into “tightening up” the building envelope, etc., proved to be successful in preventing freeze ups to ambient temperatures approaching -40°F.



Coal unloading grizzly cover **Temporary repairs to windows**

Power plant operations can be particularly trying during extreme cold weather events. Of any operating condition affected by cold weather, fuel handling is probably the most challenging. Getting frozen fuel out of rail cars is particularly troublesome. Depending upon the amount of fines that are in the load, surface moisture content, length of time the car is exposed to extreme cold, availability of (or lack thereof) car thawing at site, and many other factors will dictate the difficulty in getting the fuel loaded into the plant. Frozen coal will also affect what will happen when the material is finally in the fuel handling stream, up to and including admission into the boiler. Fuel can be anywhere from “freeze dried” (no large clumps of frozen fuel), to an entire car of fuel frozen together. Although “freeze dried” fuel does not present too many problems at the rail car and/or grizzly, as the fuel is exposed to warmer temperatures, some of the fuel will thaw and stick to other frozen material resulting in clumping. This issue is predominant in coal silos/bunkers when the same are located in the building. At this point the difficulty is with getting the clumpy fuel out of the bunkers, through feeders and into the boiler.

On the other end of the spectrum where a majority, if not all of the fuel is frozen monolithically in the car, getting any fuel out of the rail car may not be possible or may take a significant amount of manpower to get the material broken up enough to pass the bottom gates of the car. Sometimes use of the rail car shaker may be enough to break up the frozen fuel to get it to pass through the bottom gates. Other times the shaker may be of little to no use in getting the coal out. This is where “manpower” comes into play. The coal needs to be “attacked” from below and above in some cases. Use of brute force and a variety of tools will need to be utilized.

When the situation calls for “brute force,” safety is a very important consideration. Safety hazards that can exist include, but not limited to:

- *Line of Fire*: – when using a tool such as a long bar, should material fall down onto the bar, of the bar slips off what is being worked on, is the worker in the “line of fire” if the bar kicks out of position, etc., possibly hitting them in the head, face or arms.
- *Pinch Points*: Is there a possibility of hand/fingers being caught between a stationary object and the tool being used, causing pinching/crushing of the appendage that is involved (wearing gloves can considerably reduce the damage involved in these events).
- *Fatigue*: During cold weather, battling frozen fuel can seem like a never ending evolution. People will get tired at some point. With fatigue comes possible diminishing of “good judgement” which may ultimately result in injury. Personnel need to take rest breaks.

There may be times when testing or other evolutions need to be performed during extreme cold weather events. Performance testing, which required boiler emissions monitoring outside on the main stack, was carried out in just ahead of Christmas at the CHP. This coincided with the first extreme cold weather event in the area. Arrangements were made to provide protect personnel and delicate equipment from the extreme cold temperatures. A temporary enclosure was erected at the stack sample port level and large indirect fired portable heaters were stationed to provide heated air to the enclosure.