Continuous Dry Kiln Fire Protection

Take steps to ensure fire protection is adequate and meets safety requirements

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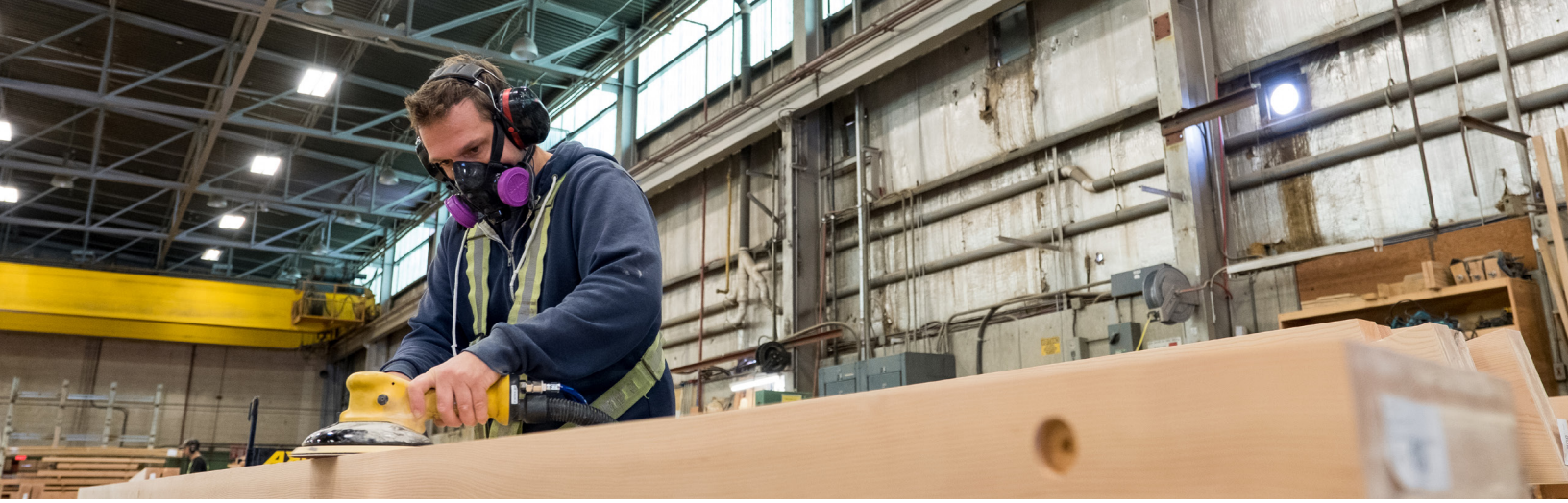


The forestry industry is a highly developed space with continual technical developments that increase the speed and efficiency of production processes. In recent years, continuous dry kilns (CDKs) have become an increasingly popular method of drying lumber products in a uniform and efficient manner. The challenge with CDKs is that they can be very difficult to protect from a fire protection standpoint, which can have a significant impact on the insurance program for your facility.

WHAT ARE CONTINUOUS DRY KILNS?

Continuous Dry Kilns are known by many names including Continuous Drying Systems (CDS), Dual Path Kilns (DPK), Counter Flow Kilns (CFK), and more. These types of kilns were first introduced in Europe and have rapidly gained popularity as the benchmark in lumber drying technology due to their increased production capability, energy efficiency, and drying quality. These kilns typically use a counter flow, double-track design, incorporating preheating, drying, cooling, equalizing and conditioning phases all in one extended chamber. Unidirectional Continuous Dry Kilns (UCDK) are also gaining traction. The main difference between a CDK and a UCDK is the lumber in a UCDK travels continuously through the kiln in a single direction. Regardless of the type and design of a CDK they all have one thing in common; that is the lumber travels through the kilns continuously. This is in direct contrast to traditional batch style dry kilns where lumber is loaded, the kiln is closed, and the lumber is run through a drying cycle before being unloaded.

CDKs typically have multiple zones. At either end of the kiln is the preheating / cooling zone. The action of this zone comes from the incoming cool wet lumber passing the outgoing hot dried lumber. At the center of the kiln is the heating / drying section which can be comprised of multiple zones where the main heating and drying of the lumber takes place. The challenge with these kilns is their size. These kilns can be very large at over 250 feet long. The sheer size of these kilns is what makes protecting them difficult.

ADVANTAGES OF USING A CDK

CDKs are seen as very advantageous for numerous reasons.

- They significantly increase production compared to batch kilns of equal capacity
- Lower energy consumption per board foot dried
- Less deviation in moisture leads to straighter wood potentially leading to less downtime at the planer mill

CDK HEATING?

CDKs can be heated using both direct and indirect heating methods. Indirect heating includes thermal oil, hot water, or steam, while direct heating uses natural gas- or shavings-fired burners. It is vitally important that the heat source be considered when designing the sprinkler system as it has a direct effect on the required design density. Existing standards do recognize the different heat sources and do take them into consideration.

DRY KILN PROTECTION

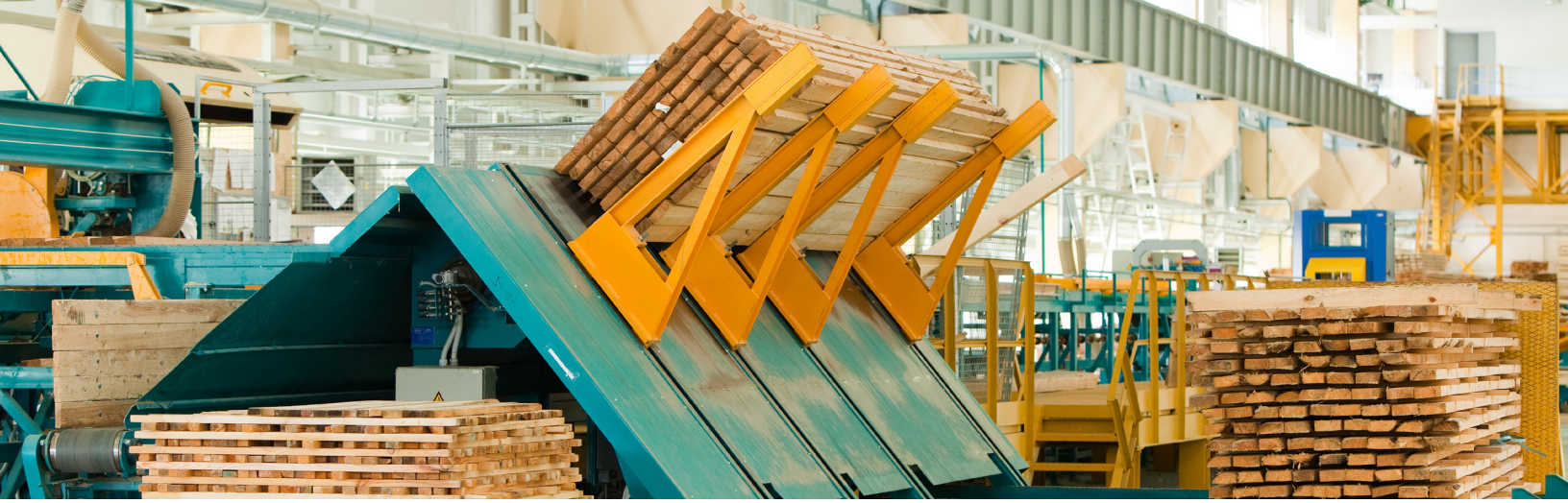
Current standards and data sheets include:

- NFPA 13 Standard for the Installation of Sprinkler Systems
- NFPA 664 Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
- FM data sheet 7-10 Wood Processing and Woodworking Facilities

Unfortunately, these standards and data sheets have not kept pace with industry improvements and changes. Existing standards for the protection of lumber drying kilns note a minimum sprinkler system design of 0.15 GPM per square foot over the entire area of the kiln above the internal fan deck. The same minimum 0.15 GPM per square foot over the entire area is required below the fan deck (where the lumber sits) however, the height of the lumber (Class 3 commodity – stickered lumber) inside the kiln must be taken into consideration when designing the sprinkler system density for this area.

If the height of the lumber results in a higher required density, the higher density must be used for the design. As stated earlier the heating system must be taken into consideration as well. The minimum design of 0.15 GPM is used for most heating systems; however, 0.25 GPM must be used if the CDK is heated using thermal oil. Generally, the demand below the fan deck will be greater than that above the fan deck.

Because the water demand for a kiln is based on a set amount of water per square foot for the entire footprint of a kiln, designing a sprinkler system for a traditional batch kiln using these standards is achievable as these kilns are typically much smaller than CDKs. A traditional kiln has a typical footprint of between 3000 to 4500 square feet. In contrast, the footprint of a CDK is typically 10,000 square feet and up. What do we mean by achievable? Sprinkler system design demands require a water supply to meet the pressure and flow required for the kiln. Because CDKs are much larger than a standard batch kiln, the demand for water will be much higher to ensure all sprinkler heads over the entire footprint of the kiln receive the appropriate amount of water as designed. Again, this is based on current standards as noted earlier. In some cases, the water demand for the entire kiln can exceed 5000 GPM which is extremely hard to achieve. For this reason, sprinkler protection systems for CDKs are typically designed in multiple zones.



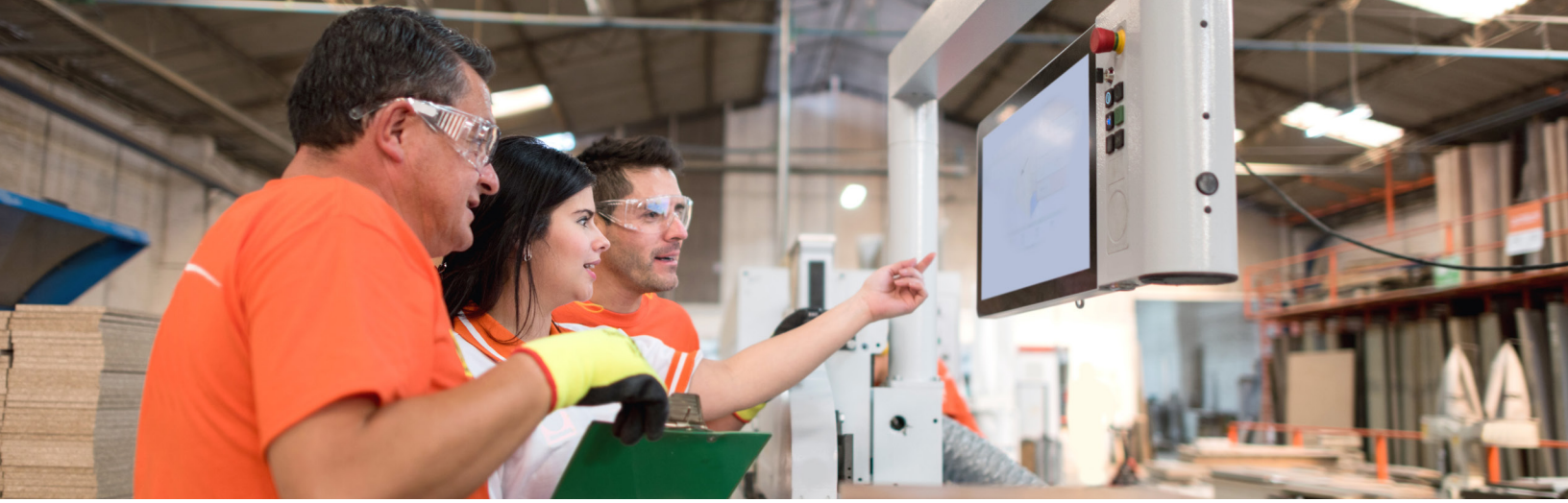
CURRENT APPROACHES TO CDK SPRINKLER SYSTEM DESIGN

To help alleviate the excessively high water demands, sprinkler systems for CDKs are being designed in multiple zones. Typically, these zones include a preheating / cooling zone at either end of the kiln and two zones in the heating section. This example has four zones in total. Sprinkler system design engineers have been designing these systems in one of three ways:

1. Exactly as required by NFPA & FM standards
2. Using high heat heads rather than deluge heads, then calculating the number of heads that can trip with the existing water supply meeting that demand. When noting the demand, the design engineers are clear to note the design is less than that required by NFPA / FM standards but will meet the demand for X% of the kiln. Typically, this is in the range of 50%.
3. NFPA standards note an exception for Veneer and Fiber Board dryers. This exception allows for the water flow demand from 2 of 4 deluge systems to be used to determine the needed water supplies flow and pressure. Again, this is a lower water supply than that required by NFPA & FM standards specific to kiln dryers and should be noted as it will only meet the water demand for 2 of 4 systems flowing.

Looking at 2 & 3 above, these approaches reduce the water supply demand making it possible for existing water supplies to meet the CDK's sprinkler system demand. Water supply systems can be very costly to purchase and install when considering all that goes into them: fire / booster pumps, reservoirs with appropriate capacity, underground piping, etc. Designing a CDK sprinkler system using approaches 2 & 3 above can significantly reduce the expense associated with designing a water supply that meets the demand of the CDK's sprinkler system. These alternative design approaches are being accepted in some cases by carriers.

It is extremely important to note that when considering alternative design approaches, your broker and carrier partners must be consulted prior to any work beginning. This is to ensure the design is accepted once completed. It should also be noted that using an alternative design approach could become an issue should the need to engage a different carrier down the road arise.



General Kiln Protection Considerations

High temperature safety limits (set to a maximum of 50°F above the maximum process temperature) as well as sprinkler system operations should be independent of all other operating controls and shall include the following interlocks:

- Shut off fuel to all burners or provide a means to stop heat from entering the kiln.
- Stop all fans and blowers that provide air circulation within the kiln.
- Close kiln dampers if equipped.
- Initiate visual and audible alarms, indicating high temperature situation.

ADDITIONAL MEASURES OF THERMAL OIL HEATED KILNS

- An automated interlock isolating oil flow to the kiln should the sprinkler system (if equipped) become activated.
- An automated interlock isolating oil flow to the kiln should be in place if an oil leak is detected.

See applicable NFPA and FM heat transfer fluid heater standards for additional protection measures.

EMPLOYEE SAFETY CONSIDERATIONS

- A kiln is a confined space, therefore a written policy should be documented and implemented with procedures to allow safe access to the kiln, including adequate personal safety protection equipment.
- Opened door detection switches: a door switch should be interlocked to prevent the kiln from operating if the main doors allowing access to the kiln are opened.
- Opened ceiling/roof access door limit switches: every access from the upper level to get to the heating coils should also be equipped with limit switches, not allowing the kiln to cycle should one of these access doors be opened.

EMERGENCY RESPONSE PLAN

- A documented ERP should be in place that includes fire department response and sign off to protect the kiln and extinguish an internal fire from outside the kiln.
- Detailed steps should be documented and practiced that include specifics concerning the type of heating system. This is vitally important when the kiln is heated using thermal oil or when there is a combustible fuel bed (shavings / hog).

Conclusion

This is a growing topic in the fire protection world as more and more CDKs are being constructed. This challenge continues to grow as does the size of these kilns. Standards are continuously reviewed to ensure they stay current. There may be specific standards in place in the coming years taking into consideration these types of kilns and the challenges associated with protecting them. Carriers can pick and choose between NFPA and FM standards which makes it difficult to advise on the standard or approach to design to. In some cases, carriers may have their own requirements in place. In addition, local Authorities Having Jurisdiction (AHJ's) such as building, and fire code enforcement may have additional considerations or requirements. For these reasons, it is very important to include your broker in the early stages of sprinkler system design discussions as they can advise you on current standards, carrier requirements and possible building or fire code requirements.

The fire protection industry along with insurance brokers, manufacturers and equipment owners are pushing back on current standards. Progress is being made, however slowly, in more clearly defining standards for these types of kilns. Continue to stay in touch with your HUB Broker and Risk Services Consultant to ensure the ongoing protection of your people, your property and your profitability.

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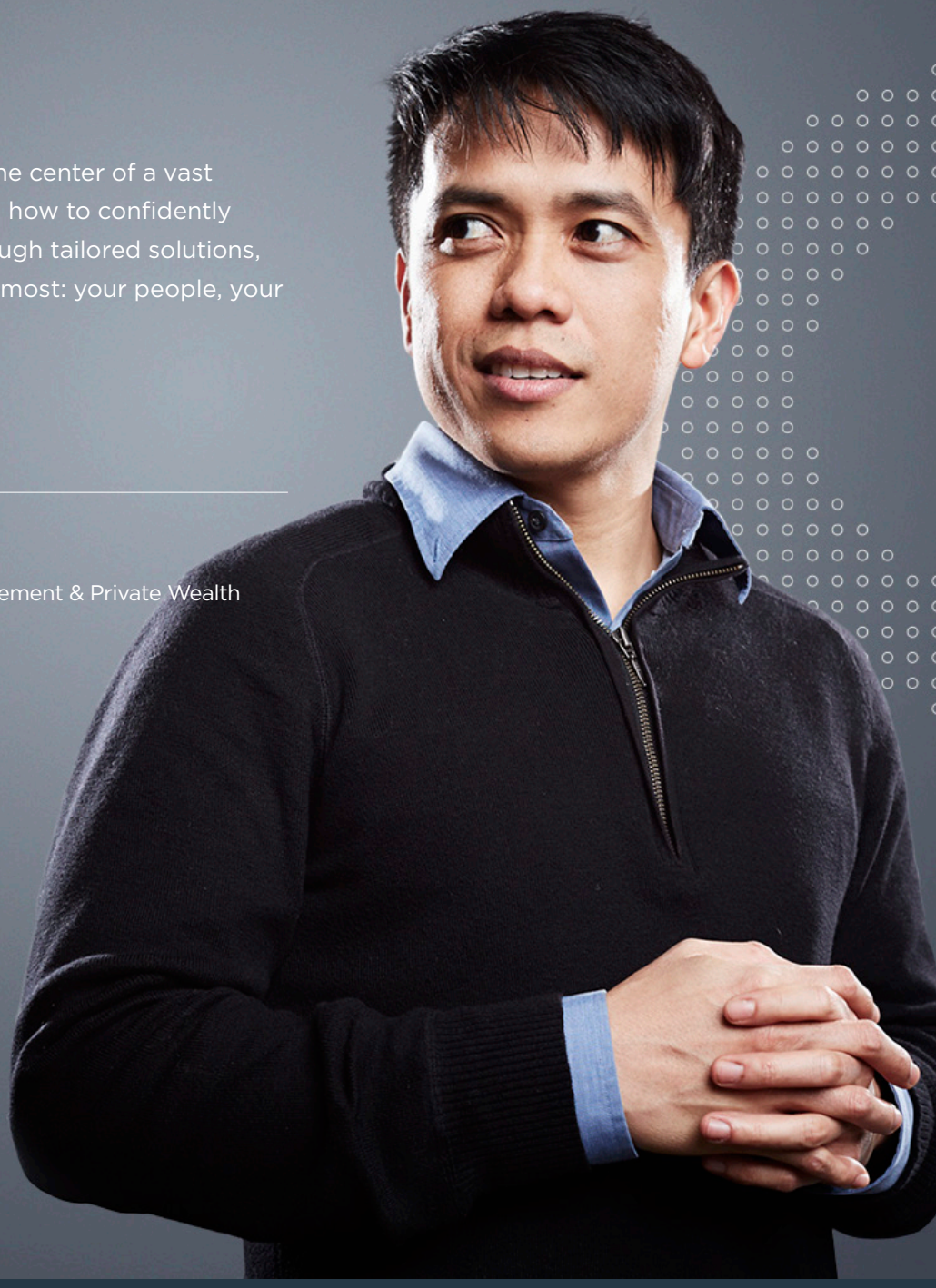

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