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CITY OF PORTLAND, MAINE
Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 03/21/17

Date: 6 February, 2017

Memo Report

From: W. Mark Cummings, P.E.

To: Mr. Luke Davidson; Maine Craft Distilling

CC: Ryan Senatore; Senatore Architecture

Subject: **Fire & Life Safety Hazards Assessment of the Proposed Maine Craft Distilling Site at 123 Washington St., Portland, ME.**

As requested, Fire Risk Management (FRM) has reviewed the proposed layout/design for your new distilling operation, along with the associated restaurant that will be located adjacent to the distillery. The distillery and restaurant spaces are to be located within the east end of an existing commercial building located at 123 Washington St. in Portland, ME. The purpose of this review was to evaluate the proposed layout/design for the distillation processes and assess the potential fire/explosion and life safety hazards that may be present. The end result for this assessment is to develop recommendations to mitigate any potential fire and life safety hazards and ensure compliance with all applicable codes and regulations.

Background

This assessment is based on a review of the proposed floor plans for the distilling and restaurant spaces provided by Senatore Architecture; including drawings G1-1 and A1-0, dated January 18, 2017. Additional details regarding the specifics associated with the proposed distilling operations were provided by the owner, Mr. Luke Davidson.

The proposed distillery is intended to occupy a significant portion of the northeast section of the building; encompassing approximately 9200 ft^2. In addition to housing the distilling equipment, this area will be subdivided to also include mechanical, storage, and office spaces. The stated plan for this distillery is to produce quantities of a number of alcoholic beverages (spirits). To produce these various beverages, stills are being installed in the space, which will be used to produce the various liquids; a variety of alcoholic beverages with alcoholic contents ranging from 40% to 60% by volume.

The restaurant that is associated with this facility is to be located in the southeast portion of the building, encompassing approximately 1900 ft^2. This area will include a food preparation room/kitchen, along with a bar (with seating) and the main seating area for the restaurant, which will consist of tables and chairs dispersed throughout the remaining floor area.

A portion of the distilling space will be used to store some of the finished products (whiskey & Rum) in wooden (oak) barrels as part of the overall aging process for these beverages. An exact quantity that is likely to be stored in this facility at any one time is not specifically known at this time; albeit it was stated that the room dedicated for barrel storage could accommodate up to 100 barrels. It is intended that those products that will not require aging may be temporarily stored in stainless steel drums (approx. 55 gal.) prior to the liquid being transferred into glass (750 ml) containers, which will ultimately be stored within cardboard cases until shipped from the facility. Once transferred to the smaller glass containers, the product will only be stored on site for relatively short periods of time prior to being shipped to clients; intended to be less than two (2) weeks. As such, this product will likely represent a small(er) percentage of the total product being stored on site. Prior to leaving the distillery, both the whiskey and rum products will be transferred from the wood barrels to glass containers that will be placed in cardboard cases and installed on pallets in preparation for shipment.

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Based on the parameters outlined in the Maine Uniform Building and Energy Code (MUBEC), which prin consists of the 2009 edition of the International Building Code (IBC), the occupancy classification that best this distillery operation would be that of a "Factory Industrial, F-1, Moderate-hazard." The restaurant porti the facility would be classified as an Assembly (A-2) occupancy. Based on a review of the information provided by the Architect, the construction of the commercial building would be classified as a Type IIIB, as defined by the IBC. The building is reported to have (or will be provided with) an installed fire sprinkler system throughout; designed in accordance with NFPA 13, the *Standard for the Installation of Sprinkler Systems*. Additionally, an automatic fire alarm/notification system will be installed throughout the distilling and restaurant spaces in accordance with the requirements of NFPA 72, the *National Fire Alarm and Signaling Code®*. It was also noted in the review of the Code Review Plan (dwg G1-1) provided by the architect that the distilling and restaurant spaces will be separated by barriers having at least a 1-hour fire resistance rating (FRR); as required by the codes. It will also be necessary to verify that the existing walls separating the distillery from the other tenant spaces in the building also have a FRR of at least one hour.

The space that will be used to house the distilling operations consists of approximately 9200 ft^2. Within this space, a portion of the area is to be used for "Malt Drying", along with having a number of separate rooms for the mechanical and electrical equipment, and a barrel storage room and office (business) areas. Attachment 1 to this report provides a basic layout for the proposed distillery.

The Federal Government has a requirement that all access doors to the space(s) where the beverages are being produced/stored must have a padlock installed. Such a configuration conflicts with the egress requirements of the Life Safety Code®, NFPA 101, which is adopted in the State of Maine. It will be necessary to ensure that at any time when the facility is occupied, the padlocks will be removed from all/any doors that are needed to provide adequate egress from the facility. Based on the review of the proposed floor plans, both the distillery and restaurant areas are provided with adequate exit capacity and locations, and appear to be fully code compliant for all components associated with the means of egress.

Fire / Explosion Hazards

In general, all the individual, constituent materials used to support the distillation and packaging processes do not represent significant fire hazards. The primary fire fuel loading that will be present in this space will be any empty wood barrels stored within the facility and any cardboard cases that will ultimately be used in storing the finished products. Additionally, the building is supplied with natural gas, which will be used as the fuel to supply the boiler in the Mechanical Room. This boiler will produce steam that is used to heat the various stills/vessels used in the distilling process

The final stage of the distillation process is that which represents the greatest potential for a fire/explosion hazard; when the liquid has been distilled and the alcohol content is increased to the point that the beverage becomes a "flammable liquid" and the ethanol and/or methanol (vapor) that is being produced by the distillation (boiling) process could result in the development of a flammable vapor/air mixture that is within its lower flammability limit (LFL). The design of the stills that are being used are relatively basic and are not designed to operate under any significant pressure. At ambient atmospheric pressure, methanol and ethanol will boil at just over 64°C (147°F) and 78°C (172°F), respectively. Should the boiling rate within the still increase beyond that which is desired, pressure/vacuum relief devices are installed that will lift, thereby relieving any excessive pressure; albeit also releasing the ethanol or methanol vapor as well. These vapors are heavier than air and would ultimately migrate toward floor level. With an auto-ignition temperature in excess of approximately 400°C (≈750°F), it is unlikely that the surface temperatures of the still will ever approach the point that it might be expected that contact by any of the flammable vapor/air mixtures with the still's hot surfaces could result in fire initiation.

Due to the alcoholic content, 40% to 60% by volume, of the final product (liquid) being produced by the distillation process, it will primarily be classified as a Class IC flammable liquid, as defined by NFPA 30, the *Flammable and Combustible Liquids Code®*. This classification stems from the fact that beverages with alcoholic contents in the range specified above will have flash points between 22.8°C and 37.8°C (73°F and

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100°F). Another potential fire hazard that will be associated with the distillery's operation is that of a pot spill of the flammable liquids, such that they, and any vapor that might then be produced, could then be exp to a potential ignition source. It is reported[1] that the evaporation rate for ethanol at "standard" am temperatures of approximately 25°C (77°F) is relatively low, such that even the presence of natural ventilation should be sufficient to prevent the development of an ethanol vapor cloud that would be exceed its lower flammability limit. However, if a spill was of significant volume (quantity) or if the area where a spill occurred was subject to "stagnant" air, the potential still exists that the LFL could be achieved. It is beyond the scope of this evaluation to attempt to determine a specific spill volume(s) that could result in such an occurrence.

The presence of other stored materials, such as any wood structures that might exist, cardboard for the shipping cases, and the empty wood barrels, will also cause an increase in the overall fire fuel loading (fire potential) within this space. Given that the wood (oak) barrels have a relatively high ignition energy requirement, these represent a very low potential as being an "initial" fire source. The cardboard is much more readily "ignitable", but must still have another ignition source to result in fire initiation. Although not directly involved in the distillation process, the operations and materials associated with the office and break room areas also represent a potential source of fire initiation. However, this risk is no greater than any other typical office location.

The overall evaluation of the distilling facility included an assessment of past research of available historical data involving fires and explosions associated with distilleries in general. Based on that research, it is apparent that, in general, fires resulting from the distillation processes themselves are extremely rare. Most of the historical data indicates that the greatest risk of fires involving distilled beverages is primarily that resulting when these beverages are exposed to the effects of fires that originated from other sources not directly involving the distillation process. When these (flammable) liquids are exposed to the thermal insult from an adjacent fire, they will begin to rapidly evaporate, potentially producing significant volumes of a flammable vapor. Equally, an adjacent fire can result in the failure of the packaging of the stored liquids, thus resulting in spillage and a significant increase in fire intensity and if sufficient flammable vapors are produced; an explosion.

Review and Assessment of Code & Standards Requirements

Existing national building (IBC) and fire (NFPA) codes do not readily apply to the type and scope of distillery operations that are being proposed for the Maine Craft Distilling facility. Other codes that the State of Maine has adopted that are applicable to this project and that were used in the code evaluation for fire and life safety include the latest editions of the National Fire Protection Association's codes; NFPA 30 – *Flammable and Combustible Liquids Code*, NFPA 54 – the *National Fuel Gas Code*, and NFPA 101 – *Life Safety Code*®. Additionally, the applicable Factory Mutual (FM) Global Property Loss Prevention Data Sheet, 7-74 – Distilleries, was reviewed and used as a source of information and reference, since much of the fire protection information provided in these sheets is based on historical data specific to that industry.

A primary focus for the review of both the IBC/IFC (MUBEC) and NFPA 30 was to ascertain if there would be any limits on the amounts of flammable liquids (Class IC) that could be present / stored within the distillery's space. The published limits on the amounts of flammable liquids that can be stored within a facility such as this, listed in both of these codes, were specifically exempted for alcoholic beverages that are contained in wood barrels and/or individual containers that do not exceed 1.3 gallons (5 liters); refer to para. 9.1.4 of NFPA 30 and para. 3401.2 of the IFC. It has been stated by the owner that the spirits (flammable liquid) produced at this distillery will primarily be stored in the wooden barrels until ready for transfer to the individual 750 ml (0.2 gal) bottles that will be used for shipping. However, it was also indicated that the potential exists for some of the liquid to be temporarily stored in a stainless steel "drums"; having a capacity of approximately 55 gallons. The codes do not specifically address distilled spirits that are to be temporarily stored within the stainless steel (metal) tanks. As such, if only the requirements for storage of a Class IC flammable liquid are imposed, this would limit the maximum quantity stored, ostensibly in these tanks, to 240 gallons. The manner in which the codes are

[1] *Potential Explosion Hazards due to Evaporating Ethanol in Whiskey Distilleries*, HSL/2003/08, H.S. Ledin, Health & Safety Laboratory, Buxton, England.

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written would indicate that this is to be the maximum quantity allowed within this (control) area. However, g the fact that the product stored in the wooden barrels and glass bottles is not limited, this simply does not r practical sense for this situation. Equally, it appears that when storing the flammable liquids in a sprink facility, the codes would allow maximum quantities that far exceed that which is anticipated to be stored at any one time in this facility.

Other than the potential limitation on any product stored in the steel tanks, no other specific code limitations exist for the amounts that can be stored on site; such that no code restrictions exist that would specifically limit the total expected maximum quantities of the products (spirits) that are stored within either the barrels or small glass bottles. Also resulting from the exemptions provided for these products, no specific fire protection code requirements exist with regards to the "storage" of these liquids. NFPA 30 does, however, have specific requirements for "processing facilities" and those that "dispense, handle, transfer, or use" these liquids. The requirements that do apply to these distilling operations are primarily to provide a fire detection/notification system and a ventilation system that is designed to prevent the accumulation of flammable vapors; refer to chapters 17 and 18 of NFPA 30.

Without specifically performing calculations to ascertain a specific ventilation rate that will prevent the accumulation of flammable vapors, within 25% of the LFL, the code requires that a minimum ventilation rate of 1 cfm/ft^2 be provided. Given the approximate "foot print" of the area where the distilling operations are to be performed, this would require that a ventilation system that can provide approximately 7000 cfm be installed. Furthermore, the inlet and exhausts for this system must be located within 12 inches of the floor and should be installed on opposite sides/ends of the room, such that the air movement will "sweep" vapors from all areas of the space. The ventilation system should be installed such that the flow of air movement will move any vapors created during "transfer operations" away from the area(s) where potential ignition sources are located; such as the electrical and mechanical rooms. Based on the floor plans provided, it is suggested that air be exhausted from the east end of the distilling space; with make-up air entering in the northwest corner of the space.

Chapter 17 of NFPA 30 also has separation requirements between a "processing" facility and any other facilities that could represent exposure hazards. Unfortunately, the requirements of this chapter do not adequately accommodate the situation that exists for the Maine Craft Distilling facility; whereby these operations occupy only a portion of a multi-tenant building. However, given the specifics associated with the planned distilling operation, coupled with the separation requirements outlined in Table 17.4.3 for the "process vessel", it would be necessary to keep the still(s) at least 5 ft from any adjacent property line or building. If the walls that separate this area from the other tenant spaces and the exterior are to be considered as the "property line", an argument can be made that the stills should be located at least 5 ft from any wall within this area. However, based on the specifics of the still configuration and the amounts of liquid involved, providing the 5-foot separation is not considered essential to maintaining a "fire safe" environment. The maintenance of this minimal separation distance between the stills and any of the surrounding walls is unlikely to provide any notable benefits, either to property protection or life safety that would warrant this being a mandated requirement for this operation. However, it is recommended that such a separation exist between the stills and any wood structures within the space.

As outlined above, many of the requirements in NFPA 30 do not apply to distilled spirits. Although in finished form these liquids are classified as flammable, they would not be considered a "hazardous" material. NFPA 30 does include some requirements with regards to containing and/or controlling spillage from storage containers. The plan for the Maine Craft Distilling facility includes some storage of the finished product, both in small containers and in the larger wooden barrels and steel drums. The code specifically exempts any need for containment systems for the products stored in the small containers ($\leq$ 5 liters). However, the need to provide containment where the steel drums are to be stored is less clear. If the facility is provided with floor drains, the locations to be used to transfer and store product should take into consideration the locations of these drains to minimize the potential for any spillage to spread to other areas of the facility. Should a spill occur that results in some of the product entering the municipal sewer system, it is likely that it would quickly be diluted below its flammable range, including the alcohol evaporating. Equally, there should be no potential ignition sources within

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the immediate vicinity of the locations where the product is to be stored and/or transferred; such that sho spill occur, there is no immediate danger of the product being ignited. With the possible exception of the f process, which is being done manually and represents a very low risk of any significant spillage, the wood ba and steel drums do not present a high risk of spillage or being accidently ruptured. Once filled, the wood barrels are not involved in any other process until such time has passed that the contents are ready to be transferred into the smaller containers for distribution/sale, which will also be a manual process. Any time the products are being transferred to/from the different containers, which represents the highest risk for leakage/spillage, personnel will be present and can quickly take actions to mitigate any spill that might occur.

In general, all pertinent requirements associated with the Life Safety Code® (NFPA 101) are currently being met by the proposed layout for the new Maine Craft Distilling space. Due to Federal regulations, if it is necessary to install padlocks on all doors that provide access to the distilling area, where the distilled liquids are to be stored, administrative procedures must be in place to ensure any padlocks on doors needed for egress are removed any time the space(s) is occupied. In general, NFPA 101 does not allow locks involving the need for keys to be installed on doors required for egress, but para. 7.2.1.5.4.1 does provide an allowance for this, along with other specific measures that must also be implemented, including the installation of a sign that indicates the door shall not be locked when the building is occupied.

Summary and Recommendations:

The primary focus for this assessment was the distillery portion of the new facility. Although the facility appears to meet all fire protection and life safety code requirements outlined in NFPA 101, a detailed evaluation of all life safety requirements associated with the proposed restaurant facility was not performed.

The research associated with this fire & life safety assessment indicates that, in general, fires resulting directly from distillery operations are rare. However, should a fire occur that ultimately exposes/involves the distilled products (flammable liquids), the results could be catastrophic. Based on this assessment and the historical data reviewed, it is likely that the office area or the other systems within the facility represent a greater risk of fire than do the actual distilling operations. This is based on the fact that the distilling operations will only occur while the facility is manned, such that any problem that might occur during these operations should be immediately identified and corrective measures implemented. However, this is not meant to imply that the operation of this distillery is not without inherent fire risks.

The facility is currently protected throughout by a fire sprinkler system. The existing fire sprinkler system should be evaluated to ensure that it is, in fact, providing adequate coverage for this new operation. Additionally, portable fire extinguishers should be provided; with, at a minimum, one installed by each of the two access/exit doors.

Based on the results of this assessment, the following recommendations are provided:

1. Provide an approved, integrated fire detection/notification system throughout both the distillery and restaurant facilities. Based on the requirements within NFPA 30 for "processing facilities", this system is needed to provide early warning to occupants of the building, not just the Maine Craft Distilling employees. Although a case can be made that the installed sprinkler system with its associated flow alarm constitutes a fire alarm system, a separate detection/notification system is recommended. Since a security system is already scheduled to be installed, the fire detection/notification feature could easily be included with this system and be monitored by the same entity. Given that the greatest risk to both the building and responding firefighters will be a fire occurring when the facility is not occupied, coupled with the storage of flammable liquids on site, early notification will significantly improve the fire safety of this facility. Due to the presence of the fuel-fired boiler, detection for carbon monoxide (CO) will also be required as outlined in NFPA 720, *The Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment*.
2. Provide a mechanical ventilation system. This system is needed to ensure no accumulation of potentially flammable vapors can occur, which could then present a fire risk; especially in the vicinity of electrical systems/components. Since the vapors will be heavier than air and would accumulate near the floor, the inlet and exhaust for the ventilation system must be within 12 inches of the floor. Absent of any specific calculations to

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determine the minimum ventilation rate required for the specific configuration used at the Maine Craft Dis facility, it is recommended that a ventilation rate of at least 7000 cfm be provided. The system should be arra such that it facilitates the movement of air "away" from locations where potential ignition sources exist. As this should also be in the direction that moves any potential vapors that could be produced when distilling or dispensing the products away from the mechanical and electrical spaces.

3. Ensure that the installed sprinkler system does, in fact, provide adequate protection for the distilling operations/equipment.
4. Contact the building owner to ensure that all fire extinguishers are maintained and inspected as required by NFPA 10.

Should there be any questions regarding this assessment and the recommendations contained herein, please do not hesitate to contact me.

W. Mark Cummings, P.E.

ATTACHMENT 1 – Maine Craft Distilling and Restaurant Floor Plan

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