Controlled Atmosphere Storage Rooms: Confined Spaces to Identify, Evaluate and Control

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Controlled Atmosphere (CA) storage, as defined by State of Michigan in Act 228 of 1958 means "the storage of fruits or vegetables in an approved sealed storage room or in an approved sealed storage building, or in a sealed storage space within the room or building, under controlled conditions of time in days, oxygen content, carbon dioxide content and temperature as established by this act or rules adopted under this act. The term controlled atmosphere may be referred to by the initials "CA" or similar terms or abbreviations." A CA storage room meets the definition established by both the federal Occupational Safety and Health Administration (OSHA) and the Michigan Occupational Safety and Health Administration (MIOSHA) as a confined space. MIOSHA General Industry Safety Standard, Part 90, Confined Space defines a confined space as a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults and pits are spaces that may have limited means of entry); and
- Is not designed for continuous employee occupancy.

A CA room when sealed by the internal panel door but does not have an atmosphere drawdown is considered a confined space: it is large enough to enter and has a restricted access and egress – the internal panel door access window limits access to/egress from the room. Depending upon the period of time the internal panel door has been in place, and if no forced air exchanges have taken place, the atmosphere inside the CA room may become oxygen deficient due to the stored product utilizing atmospheric oxygen as it respires. Prior to entry into the room, test the air for oxygen levels to ensure the room oxygen level has not dipped below 19.5%.

When a CA room is sealed and the oxygen level drawdown has occurred, the CA room becomes a permit-required confined space. A permit-required confined space (permit space) is a confined space that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere;
2. Contains a material that has the potential for engulfing an entrant;
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
4. Contains any other recognized safety or health hazard.

Permit-required confined space warning sign NOT MIOSHA compliant

An in-use, sealed CA storage room certainly meets the first criteria of a hazardous atmosphere (as does the room if the oxygen level is below 19.5%). A clear, legible MIOSHA compliant Permit-Required Confined Space warning sign should be posted at every conceivable sealed CA room entry point. If roof access to the room is available, then also post the sign at that entry point. Consider posting permit-required confined space warning signs that contain verbiage in the language of your non-English speaking workers. Figure 1 contains a flowchart to determine a confined/permit-required confined space.

MIOSHA compliant permit-required confined space warning sign

MIOSHA also defines entry as an action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred *as soon as any part of the entrant's body* breaks the plane of an opening into the space. Note this definition: this covers product sampling by retrieving the product with your hand through a sample port in the door. Technically, this is considered an entry into a permit space. Although there could be an outflow of low oxygen atmosphere from the room due to room over pressurization, the likelihood is remote due to the room ventilation design (equalizing pressure between the CA room and the ambient air pressure). You should check with the refrigeration/ventilation contractor to ensure that all components are in proper working order prior to storing the product.

All individuals working with CA rooms should review the scope of work they perform. A written permit confined space program is NOT required for those individuals who are performing work in the Standard Industrial Code (SIC) agricultural classifications of 01 and 02. The Agricultural definition is limited to practices performed by a farmer or on a farm incident to or in conjunction with farming operations including preparation for market, delivery to storage or market, or to carriers for transportation to market. If an individual is storing only their own product, then the exemption to developing a program applies. If the individual is storing other growers' product in addition to their own in the CA room and/or building, then the exemption does not apply because storing other growers product is considered an Agricultural Services activity, not an agricultural (SIC 01 and 02) work-related activity and the individual is required to comply with all applicable MIOSHA health and safety regulations, including a permit-required confined space program for any worker performing work activities in the building.

All facilities should develop a written procedure for repetitive entry into the permit space, and employees trained as to its requirements. A sample procedure is shown in Figure 2. Note: it is imperative that an Oxygen level reading is performed after opening the outside door to ensure leakage has not occurred and directly after opening the sample port to ensure an outflow of oxygen-deficient air is not occurring.

Recognize that if a person must enter a CA room under an oxygen drawdown condition, they are entering a situation that, if not adequately protected, could kill them. A permit-required confined space entry program should be developed in accordance with the provisions of MIOSHA Part 90 to protect the worker and you as an employer. Make sure employees and coworkers understand the meaning of the posted danger signs. Make doubly sure that employees and coworkers recognize the hazards posed by sealed, in-use CA rooms so all individuals may go home to their families at the end of the day.

Figure 1. Confined Space Determination Flowchart

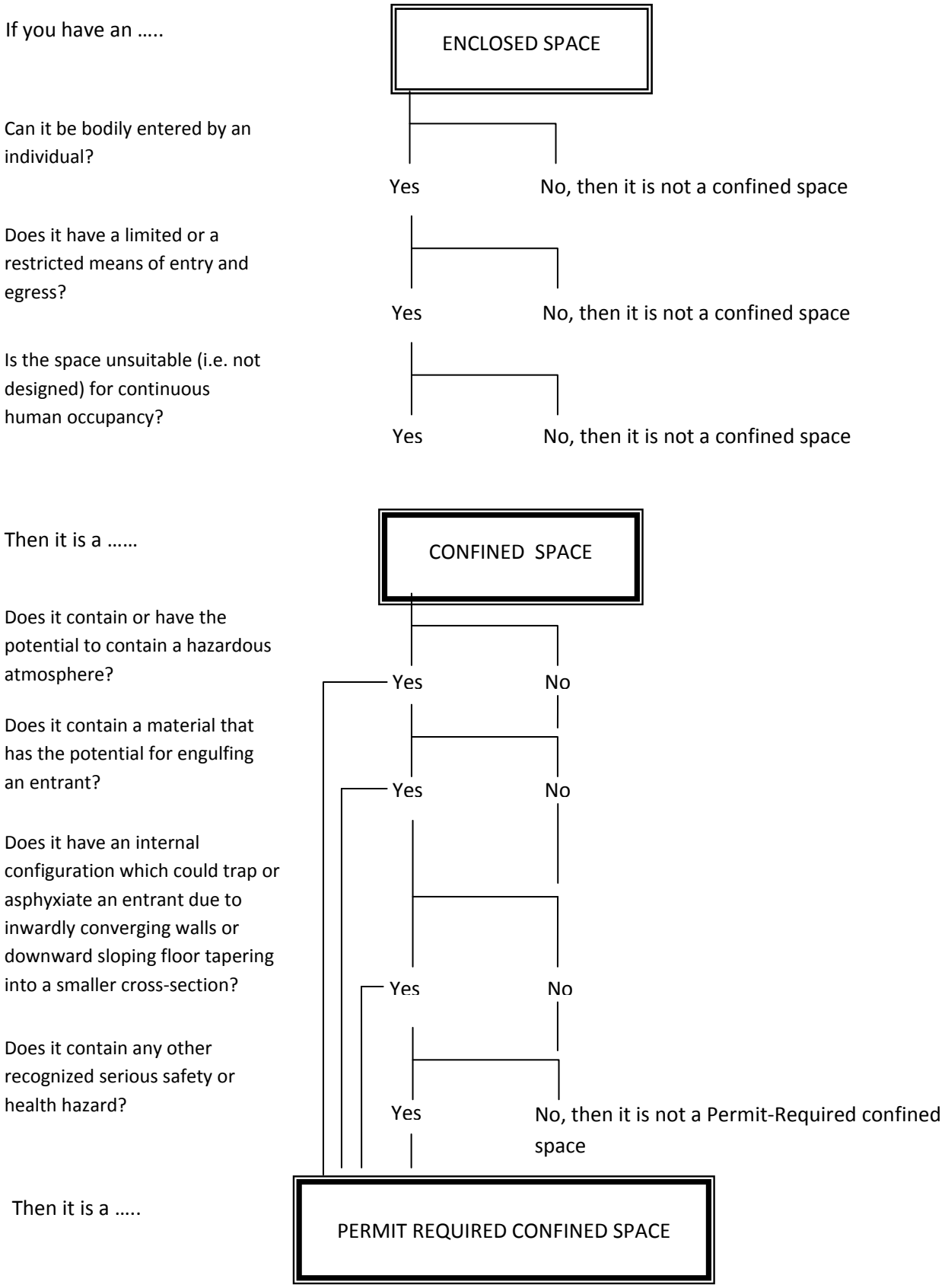

Figure 2. Example of Product Sampling Written Procedure for a Sealed, In-Use CA Room

Procedure For Product Sampling in Controlled Atmosphere Rooms				
Entry Supervisor				
Authorized Entrant				
Date of Product Sample				
NEVER ENTER A ROOM WITHOUT FIRST TESTING THE OXYGEN LEVELS				
NEVER ENTER A ROOM WITH OXYGEN LEVELS BELOW 21%				
	Room #/Description	O_2 Level	Time of Completion	Initials
1)	Turn off nitrogen generator and CO_2 scrubber			
2)	Open outside door			
3)	Open sampling port			
4)	Test O_2 level outside port			
5)	Take sample			
6)	Close sampling port			
7)	Close storage door			
8)	Turn on nitrogen generator and CO_2 scrubber			
9)	Time completed			