This manual is to be used as a Guidance Document only and does not replace the actual Rules and Regulations as written in Chapter 511-6-1 for food service establishments.

SECTION I - DRY STORAGE

REFERENCES (Chapter 511-6-1)

.04 Food:
(4) Protection form Contamination After Receiving (q) Food Storage and
(r) Food Storage, Prohibited Areas

.05 Equipment and Utensils:
(2) Design and Construction (hh) Case Lot Handling Equipment, Moveability.

I. General:

1. *Dry storage space needed depends on the menu*, number of meals served between deliveries, frequency of deliveries, and the amount and type of single-service items to be stored. The location of dry storage rooms or areas should be adjacent to the food preparation area and convenient to the receiving area. Food should not be stored on shelving or in cabinets located under exposed or unprotected sewer lines, open stairwells or other sources of contamination.

2. D*ry storage areas or rooms* may be designated for the storage of packaged or containerized bulk food that is not potentially hazardous (non-time/temperature control for safety food) such as bagged flour, sugar or dry beans, and dry goods, such as single-service items. The room may be unfinished *as long as packaging or cases are not opened and the presence of vermin is being controlled*. *Opened packages of dry food and or single-service items shall be stored within the protective environment of a completely finished, enclosed facility.*

3. *Shelving, dollies, racks, pallets and skids* shall be corrosion-resistant, non-absorbent and smooth. The highest shelf for practical storage use should be no higher than seven-feet for employee safety and for the ease of routine food storage monitoring reasons. The *lowest shelf* for storage use shall be at least six-inches from the floor. *Clearance between shelves* should be at least fifteen-inches. Sufficient moveable racks, skids and dollies should be provided to store all bulk containers. Shelving, dollies, racks, pallets and skids should be spaced away from walls to allow for cleaning and pest monitoring/inspection.

   An exception to the above 6 inches from the floor minimum storage requirement would be for warehousing and/or bulk food purchase. Food in packages and working containers may be stored less than 6 inches (15 cm) above the floor on case lot handling equipment if the equipment can be moved by hand or by conveniently available apparatuses such as hand trucks and forklifts. In addition, pressurized beverage containers, case food in waterproof containers such as bottles or cans, and milk containers in plastic crates may be stored on a floor that is clean and not exposed

to floor moisture.

4. *Approved food containers with tight-fitting covers* should be used for storing bulk foods such as flour, cornmeal, sugar, dried beans, rice and similar food.

II. Dry Storage Calculations Examples:

1. These formulas can be used to *estimate and verify* dry storage space requirements based on the facility design or layout:

A. Formula # 1

$$\text{Linear feet of storage shelving} = \frac{\textit{Volume per meal} \times \textit{Number of meals between deliveries}}{D \times H \times C}$$

Volume per meal = 0.1 cubic feet
D = Depth of the shelves in feet
H = Distance between shelves in feet
C = 0.8 or 80% effective capacity of shelf height

For example, *assume 200 meals per day and a 10 day storage between deliveries = 2000 meals between deliveries, shelf depth of 18 inches (1.5 ft.), clearance of 18 inches (1.5 ft.) between shelves and 80% effective capacity of shelf height:*

$$\textit{Linear feet of storage shelving} = \frac{0.1 \text{ cu, ft} \times 2000 \text{ meals}}{1.5 \text{ ft.} \times 1.5 \text{ ft.} \times 0.8} = \textbf{\textit{111 Linear feet}}$$

B. Formula # 2

$$\text{Square feet of storage area} = \frac{\textit{Volume per meal} \times \textit{Number of meals between deliveries}}{\textit{Average height (ft.)} \times \textit{Fraction of usable storeroom floor area}}$$

Volume per meal = 0.1 cu. ft

Usable storage height = 5 to 7 feet (total height of the ceiling minus the distance of shelving from the floor and ceiling)

Fraction of useable storeroom floor area =.4 to .6 (total floor area minus door openings, aisle space, distance of shelving from walls)

For example, *assume 200 meals per day and a 10 day storage between deliveries = 2000 meals between deliveries, 5 feet useful storage height, and .5 of usable floor area.*

$$\textit{Storage Area} = \frac{0.1 \text{ Cu. Ft.} \times 2000 \text{ meals}}{5 \text{ ft.} \times .5} = \textbf{\textit{80 square feet}}$$

1. *Formula one should be used to determine the minimum shelving necessary to store supplies between deliveries.* It can also be used to determine the minimum storage shelving necessary to store supplies between deliveries for facilities designed without a dedicated dry storage room. It is highly recommended that a dedicated storage room be design into the food service floor plan. Finally, formula one determines the linear feet of storage shelving required to adequately maintain the food flow in the establishment.

2. *Formula two should be used to design a room dedicated to dry storage items. It establishes the square footage required to meet the dry storage demand.* The formula accounts for walkway space, unusable areas and shelving.

3. *See Table I-1 for listings of estimated linear feet of storage shelving and estimated square feet of storage area needed for storage between deliveries.*

III. Renovating Existing Facilities:

1. Inevitably, there will arise an occasion whereby the storage room will be too small and cannot be enlarged to accommodate the volume of food and supplies needed for the calculated meals to be served. An example would be:

   A. *An existing building is being converted into a restaurant and the local zoning regulations require a fixed number of parking spaces*. There is not any available land for the possible addition of an outside storage building or to build onto the existing building: or

   B. The same conditions as stated above in example number one in addition to the fact *the internal layout of the building floor plan cannot be altered*: or

   C. An existing food operation's *volume of service has exceeded available storage space without any room for expansion*.

2. The solution to the above problem examples would be to *calculate the needed maximum number of days that could be tolerated before a supply delivery* would be required to continue serving the increased volume of meals.

3. Example Resolution:

   A. Assume the restaurant from the previous example will undergo renovations. The space in the facility was calculated to serve *200 meals per day with 10-day* storage between deliveries. This equals *2000 meals between deliveries.* The *storage space has 5 feet of useful storage height and .5 or 50% usable floor area*. *A total of 80 square feet was required for storage purposes.*

B. The renovated facility has estimated it *will serve 400 hundred meals per day,* double the previous occupant output.

C. If no constraints were present, the new operator would have a few options to solve the dry storage requirements:

(i) Enlarge or construct additional storage;

(ii) Reduce the number of days between meal deliveries; or

(iii) *Install the required linear feet of shelving in an appropriate space*.

4. Although each variable in the dry storage calculation can be manipulated to determine the best course of action for the facility to meet the storage requirements, some actions may be more achievable than others. In this example, the renovated facility would require double the square footage for dry storage, if all other parameters where left the same in the example. The following scenarios may be faced in the plan review process:

A. Situational Given Information:

i. We estimate an *increase from 200 meals to 400 meals per day and maintain 10-day storage between deliveries.* This is equal to *4000 meals between deliveries. The room has 5 feet useful storage height and .5 or (50%) of usable floor area.* Presently, we only have storage capacity for 200 meals per day with 10-day storage between deliveries equivalent to 2000 meals between deliveries.

$$\textit{Required Storage Area for 400 meals per day} = \frac{0.1 \text{ Cu. Ft. x } 4000 \text{ meals}}{5 \text{ ft. x } .5} = \textit{160 square feet}$$

$$\textit{Available Storage Area for 200 meals per day} = \frac{0.1 \text{ Cu. Ft. x } 2000 \text{ meals}}{5 \text{ ft. x } .5} = \textit{80 square feet}$$

ii. The following scenarios will help provide solutions to our example storage needs:

I. Scenario #1: Build additional dry storage space to meet the increased meal demand:

(i.) Use formula # 2 to determine the square feet of storage area *required to support 400 meals served per day with 10-day storage* of supplies:

Square feet of storage area =
Volume per meal **x** *Number of meals between deliveries*
Average height (ft.) **x** *Fraction of usable storeroom floor area*

= 0.1 Cu. Ft. x 4000 meals
5 ft. x .5
= *160 square feet*

(ii.) Next, determine the amount of dry storage area required to support the increase in meals:

Additional Square Feet of Storage Area =
Required Square Feet of Storage Area - (Available Square Feet of Storage Area)
Additional Square Feet of Storage Area =
160 square feet – 80 square feet = ***80 square feet***

II. Scenario #2: Adjust the number of days between deliveries to accommodate a given storage room capacity:

(i.) Calculate the size of existing storage room: *(Factoring in room height and usable floor area)*

0.1 Cu. Ft. x 2000 meals = *80 square feet*
5 ft. x .5

(ii.) Determine the total number of meals per day the facility will serve:

Given as 400 from example above or calculate if unknown.

(iii.) Determine the *number of days between deliveries required to prevent overcrowding the available storage room capacity*:

Number of days between deliveries =

Useful storage height (ft) x Fraction of usable storage x (Square feet of available storage area (Sq. Ft.))
Volume per meal (Cu. Ft.) x Number of meals served/day

OR

$$\text{Number of days between deliveries} = \frac{USH \times FUS \times Sq.\ Ft.\ ASA}{V/M \times NMS/D}$$

Number of days between deliveries =

$$\frac{(5 \text{ feet}) \times (.5 \text{ Sq. Ft.}) \times (80 \text{ Sq. Ft.})}{0.1 \text{ Cu. Ft.} \times 400 \text{ meal/day}} = \textbf{\textit{5* days}}$$

***A five-day delivery versus a ten-day delivery will allow you to use the existing storage space.**

III. Scenario #3: Determine linear feet of shelving that can be installed in suitable space to meet the increased dry storage demand without constructing an additional storage room square footage:

(i.) Calculate the size of the existing storage room: *(Factoring in room height and usable floor area)*

$$\frac{0.1 \text{ Cu. Ft.} \times 2000 \text{ meals}}{5 \text{ ft.} \times .5} = \textit{80 square feet}$$

(ii.) Determine the total number of meals between deliveries the existing storage area can support:

Number of Meals between Deliveries =

$$\frac{\textit{Average height (ft.)} \times \textit{Fraction of usable storeroom floor area} \times \textit{square feet}}{\textit{Volume per Meal}}$$

$$\frac{5\text{ft.} \times .5 \times 80}{0.1 \text{ cu. ft.}} = \textit{2000 meals}$$

(iii.) Find the linear feet of storage shelving that *will be required to support the remaining meals between deliveries*:

Linear feet of storage shelving =

$$\frac{\textit{Volume per meal} \times \textit{Number of meals between deliveries}}{D \times H \times C}$$

Volume per meal = 0.1 cubic feet
D = Depth of the shelves in feet
H = Distance between shelves in feet
C = 0.8 or 80% effective capacity of shelf height

$$= \frac{.01 \text{ Cu. Ft. x 2000 meals between deliveries}}{1 \text{ ft. x } 1\text{ft x } .8}$$

= ***250 linear feet of storage shelving***

TABLE I-1

ESTIMATED LINEAR FEET OF STORAGE SHELVING NEEDED (Formula #1)			
Based on 0.1 Cu. Ft. per meal			
Meals Served Between Deliveries	1 ft. deep x 1ft. high shelves (D x H = 1)	1.5 ft. deep x 1.5 ft. high shelves (D x H = 2.25)	2 ft. deep x 1.5 ft. high shelves (D x H = 3)
200	25	11	1
300	37.5	17	12.5
400	50	22	17
500	62.5	28	21
600	75	33	25
800	100	44	33
1000	125	55	42
1500	187.5	83	62.5
2000	250	111	83
2500	312.5	139	104
3000	375	167	125
4000	500	222	167
5000	625	278	208

ESTIMATED SQUARE FEET OF STORAGE AREA NEEDED (Formula #2)			
Based on 0.1 Cu. Ft. per meal			
Meals Served Between Deliveries	Height = 5 ft. Floor Area = .5	Height = 6 ft. Floor Area = .5	Height = 6 ft. Floor Area = .6
200	8	7	6
300	12	10	8
400	16	13	11
500	20	17	14
600	24	20	17
800	32	27	22
1000	40	33	28
1500	60	50	42
2000	80	67	56
2500	100	83	69
3000	120	100	83
4000	160	133	111
5000	200	167	139