Guide to Effective Warehouse Operations

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Introduction Letter

Dear Member:

We are pleased to offer all IARW members and facilities this new online edition of the IARW Guide to Effective Warehouse Operations. This publication should be an extremely valuable resource for your facilities and employees.

We would like to recognize the following IARW members who contributed their time and talents to this latest revision of a valuable industry resource, especially our review chapter leaders Ken Johnson, Drew Greenburg, Tony Leo, John Naylor, Nick Pacitti, John Horvath, and Jim Marella. Below is a list of the members of various review committees:

Scott Boerman	Hanson Logistics
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Steve Paden	Paden Cold Storage
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Larry Rauch	Los Angeles Cold Storage
Ryan Silberman	RefrigiWear
Marty Steinmetz	United States Cold Storage

As with all of our publications, please make your employees aware of their value and keep them in an accessible location. You have and will receive new manuals and revisions to other manuals.

As manuals are continually revised and kept up-to-date, please give us any feedback on this manual or its usage. We hope you find it very helpful.

Sincerely,

Corey Rosenbusch, CAE
President and CEO

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1 Effective Receiving Practices

1.1 Receiving Practices, Including Receiving Checklist

Effective receiving practices are important aspects of successful warehousing. Receiving must involve both the front office staff and warehouse personnel to effectively receive and track inbound products.

A receiving checklist is provided in Chapter 8 of this manual.

Front Office:

The receiving process usually begins when the customer or carrier notifies the warehouse of an inbound shipment and the warehouse schedules the delivery for a specific day and time.

Data Collection & Receiving Dock Notification:

Normally, the front office personnel will receive or gather information specific to each load, including but not limited to:

- Purchase order number
- Load weight
- Number of cases or containers
- Number of different items
- Type of loading (pallets, slip sheets, floor loaded)
- Temperature the product should be stored (chilled or frozen)
- Arrival time at the facility

This information will help determine the length of time and equipment required to handle the shipment. It will also make the entire receiving process much smoother. A schedule of inbound delivery appointments should be maintained. Front office personnel should keep dock personnel informed of inbound loads and scheduled appointments.

Data Entry:

Front office personnel should initiate the paperwork necessary, perhaps including a receiving form, for documenting the inbound load. If paperless tools are used, information should be transferred to dock personnel when appropriate so that preparations on the dock are made for the timely receipt of the inbound product. Front office personnel should reconcile any paperwork discrepancies, notify the customer of any discrepancies and/or changes, and then enter any necessary data into electronic database systems.

When the delivery vehicle arrives, the driver will present a Bill of Lading (BOL) containing information regarding the content of the load, including description,

quantity, and temperature requirements. As a precaution against theft, some warehouses ask for and make a copy of the driver's license. It is at this time that the warehouse verifies if the load is properly consigned and assigns the carrier a receiving door. A similar procedure is utilized with rail car deliveries. It should be noted that some refrigerated warehouses use a control or confirmation number to verify that the load is the appropriate load being delivered.

Warehouse Receiving Dock:

Once the shipment arrives at the warehouse dock area, the receiving clerk should record the customer name, the carrier, and any loading information, using standardized forms or electronic data collection systems. The receiving clerk should also record the arrival time, the start time, and finish time of unloading. This data helps the supervisor to maintain information about productivity, future schedules, and customer service levels.

Trailer & Seal Inspection:

As the vehicle approaches the assigned dock door position, door seals should be checked to verify they are intact, and seal numbers and the status of the seals noted (broken, missing, or intact). If the seal is broken or has been tampered with, notify a supervisor or manager immediately to determine if the customer needs to be contacted. The seal number should be recorded on the receiving document. The trailer temperature and thermostat setting on the control panel should be checked and the exterior of the trailer visually scanned to detect any defects resulting in leakage of cold air.

Once the appropriate information has been collected and the exterior of the trailer visually inspected, the driver should be asked to open the truck doors and back the unit up to the pre-assigned dock door. Warehouse personnel should ensure that the trailer is properly positioned at the dock and that appropriate safety procedures, including but not limited to wheel chocks, ICC locking bars and door locks, are properly placed to prevent injury. It is important to be absolutely certain that the trailer is properly secured before allowing warehouse personnel to enter the trailer and begin unloading. It should be noted that the driver may not be required to open the doors prior to backing the trailer into the dock space if vertical dock plates, dock doors and ICC bars have been integrated into a system which allows the warehouseman to press a button on a control panel and cause the dock door to open, the dock plate to be released and the ICC bar to be engaged. A green light on the control panel will verify that this process has safely taken place.

Lot Numbers & Labels:

Each load or shipment should be assigned a unique lot number. Additionally, a separate lot number should be assigned for each different item on the shipment. If the warehouse engages in pre-receiving, where the carrier advises the warehouse of

the trailer contents before the load arrives (ASN-Advanced Shipping Notification), the lot labels may have been previously produced and are immediately available to the warehouseman. If pre-receiving has not occurred, the load is assigned a lot number and lot labels are produced when the driver arrives. The warehouseman should place the appropriate lot label or appropriate barcode label, on the bottom left hand case facing the forklift operator who will engage and place the pallet in storage with the label facing the aisle. It should be noted that some warehouses elect to place additional lot labels on the back and side of each pallet for extra ease in identification of pallets once in storage. One label per pallet is required, which the warehouseman should apply to the case or container and not to the stretch wrap or other coverings on the pallet. It should also be noted that some refrigerated warehouses stamp a lot number on as many cases as possible, especially if the product goes out in an intense case pick format. This additional safeguard helps maintain the integrity of the pallet and lot and helps to check the product when it is flowing outbound.

Data Collection:

If the shipment is a refrigerated load, product temperatures should be checked immediately after opening the load. It should be noted if the trailer refrigeration unit is working. Temperatures should be checked at the rear, middle, and front of the trailer as the product is removed. To check temperatures, insert the temperature probe between the inner packs within the carton. Product will be damaged if the probe is inserted directly into the product. Carefully position the probe between the inner packs or between the carton and liner if inner packs are not present. Temperatures should be recorded by trailer location on the receiving document. If the load fails to meet acceptable temperature requirements as detailed on the receiving bill of lading, notify a supervisor who will either contact the customer or follow previously established standard operating procedures. While waiting for a response from the customer, close the trailer door with the refrigeration unit running. Whenever temperatures fail to meet warehouse specifications, always record the temperature, the time, and the date, and have the driver verify the information with his or her signature.

If product temperatures and apparent product condition appear to be acceptable, the unloading process can continue. During the unloading, the condition of the product should be noted and damage or discrepancies in the unit or case count should be recorded on the receiving document. Visual damage, including but not limited to crushed, wet, and/or torn cases, exposed product, inappropriate odors, dirt, product leakage, and rodent and/or bird droppings should be noted. If damage is evaluated as significant, the warehouse should contact the customer to advise him of the condition of the product at receipt. The load may be refused depending on the deficiencies noted. The customer will then dictate the disposition of the product. Even if product does not appear to be damaged, check the inside of the trailer for damage, dirt, odor, or other contaminants, which could cause product to be rejected at a later time. Notify a supervisor or manager in the event of such problems. If

there are defects, damage or problems with the inbound load, it is recommended that the warehouse note the damage and then obtain the driver's signature on the annotated BOL attesting to the fact that defects were evident at the time of receipt.

As product is unloaded from the trailer the cases or cartons should be counted and compared with information on the Bill of Lading. It is important to count each pallet load and look for changes in the count per layer, number of layers, units within each layer, and particularly check for multiple items and/or code dates on the same pallet. Any discrepancies with the count should be recorded on the Bill of Lading for the driver's signature. At the same time, warehouse staff should carefully inspect the incoming pallets to prevent introduction of rodents or other pests and insects into the warehouse. The use of a black light helps with the detection of rodent droppings or evidence. At this time, the receiver should also note the condition of the pallets the product is received on and insure that only good pallets without broken boards are placed into storage. It is important to ensure that the inbound load is consigned properly. The load should be consigned to your customer in care of the receiving facility.

If the receipt is error free, the load can be accepted into the warehouse.

Information that should be collected during the unloading process may include, but is not limited to:

- Customer name or identification number
- Carrier name (trucking company)
- Quantity shipped
- Quantity received
- Product code number
- Item identification or product description
- Lot number, production date or expiration date, depending on customer preference
- Case weight
- Temperatures
- Seal information, if required
- Over, Short and Damage (OS&D) information
- Pallet information, if required

Put Away Practices:

If the warehouse does not have a refrigerated dock and the product being received is a frozen or cooler load, the product should be moved into the refrigerated areas immediately to prevent temperature abuse. Some warehouses perform a "double check" of the product before allowing the driver to leave. In this situation, the truck driver should not be allowed to leave until the tally of the person receiving the product is compared to the forklift operator's tally. The "double check" helps eliminate receiving errors. Once the counts have been verified, the driver is signed out and the

person receiving the product signs the receiving manifest. It is important to obtain the driver's signature on the Bill of Lading. However, it is important to note that not all warehouses use the "double check" procedure, since it may lead to additional waiting time and potential fees from the carrier in the form of detention

If the load is not completely located in the storage area, the forklift operator can add the quantity, by item, on the dock to the quantity already placed in the storage area, which expedites carrier departure. Staging areas are not always used during put away, with some loads being transferred directly from the dock to the racks in order to expedite the unloading process.

While product is being received, a forklift operator places the product in a designated storage area. Depending upon the level of automation in the warehouse, pallet positions are either pre-assigned using directed put away, or manually noted by the forklift operator. In either case, each pallet position in the warehouse should have information pertaining to the number of units on the pallet, lot number, product code and item description of products in that particular slot.

Warehouse management should always use consistent logic when it comes to put away practices. Put away practices are sometimes prioritized with the following emphasis:

1. Grouping lots together
2. Grouping product codes together
3. Grouping customers' products together
4. Using any available space

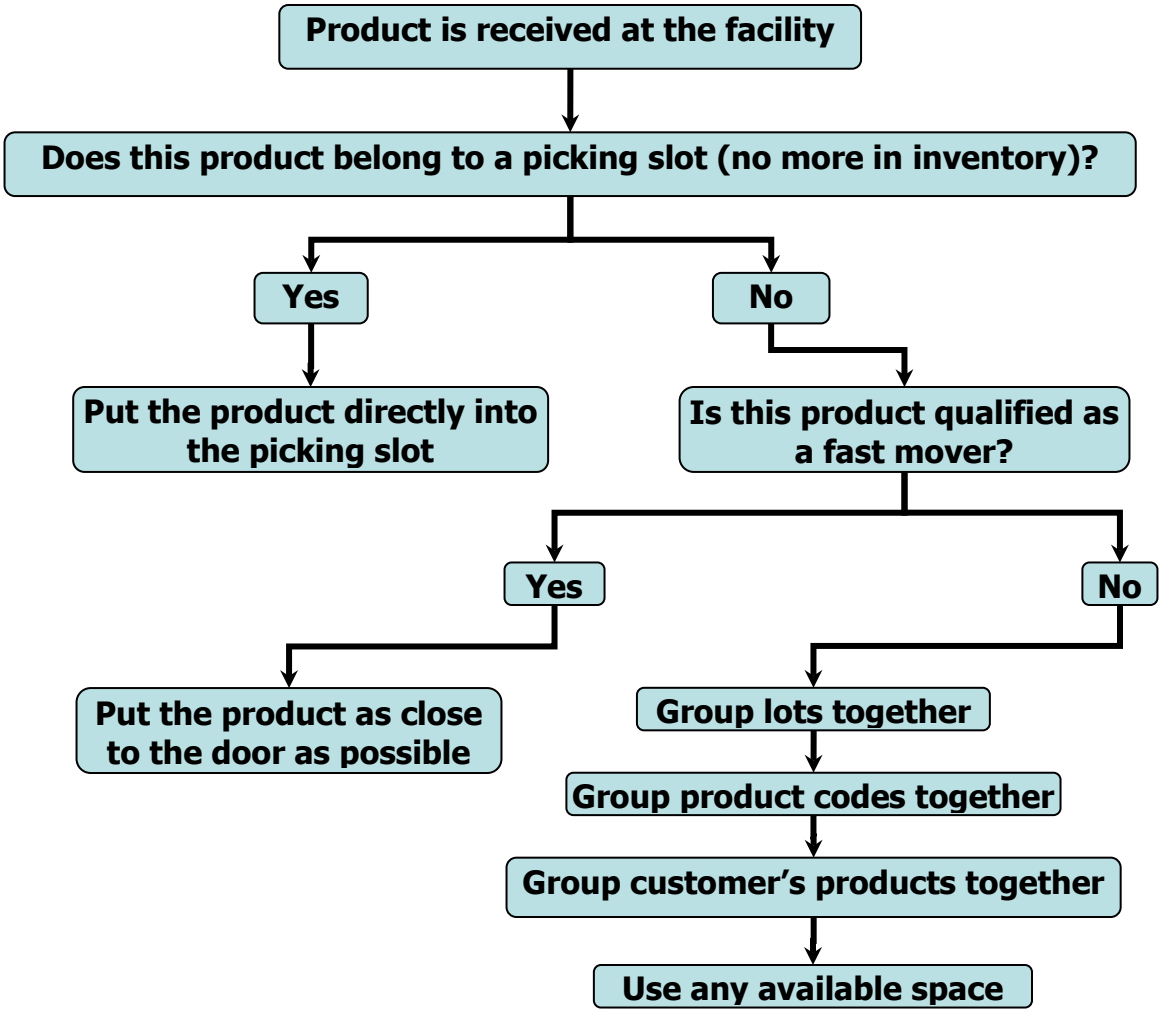
If the first criteria cannot be met, the warehouse operator should move on to the next. Not being able to group lots together could be symptomatic of honeycombing. Honeycombing can be defined as the waste of space that results from partial depletion of a lot and the inability to use the remaining space in the area. For example, a certain amount of honeycombing can be avoided at the time of put away by not putting a 20 pallet lot into a 24 pallet drive-in rack, which results in 4 pallet slots that are physically accessible but not usable to the warehouse.

Additional factors to consider during put away include pallet height and weight. The height factor is fairly obvious, with put away practices focused on minimizing the amount of lost storage head space due to the height of the pallet. Pallet weight is somewhat more complicated, and involves the warehouse having detailed knowledge about the maximum capacity of its racking, the capacity of the material handling equipment, and the combined weight of the product located in the racks. In some instances, pallets exceeding certain weights can not be stored on specific racks or levels. If maximum weight capacities are not managed with internal systems, such as WMS, the racking capacity should be clearly identified at the beginning of each aisle.

Some warehouse operators try to distribute their high-value products throughout the warehouse in order to avoid grouping the highest value products in one area, thereby minimizing a catastrophic loss should a leak or damage occur in one area. Spreading risk across the warehouse is most commonly used with high value commodities such as seafood, dairy products and/or meat. Since high-fat dairy products and refrigerated meats are very sensitive to smoke and ammonia leaks, a significant amount of damage could arise from a single incident if the product is heavily concentrated into one area. The decision to spread the risk should be done according to the risk management plan and insurance policies, and should be managed during the put away process.

Likewise, some warehouse operators attempt to place fast moving products as close to the dock as possible, thereby maximizing worker efficiency while reducing travel time. In order for warehouse operators to effectively use this technique, they must have the ability to clearly identify which are the fast moving products, since they are not always the ones that might seem obvious. For this reason, a detailed report on product movement should be generated prior to selecting fast movers for special placement in the warehouse. The same philosophy holds for managing Stock Keeping Units (SKU) slots used for picking. If a fast moving product is being unloaded yet there are no more inventories of that item in the facility, the manager may elect to put the product directly into the picking SKU slot instead of a replenishment slot in order to reduce the number of times a product must be handled. Once again, this technique should be managed during the put away process.

A simple flow chart for put away logic may look similar to this:



Final Paperwork:

Once the receiving process has been completed and the products put away, a receiving manifest should be created. The receiving manifest should identify any over, short or damaged information along with the location information of the stored products. This document should be sent to the front office staff for processing. The data on these documents are used to update the inventory and location files, and the receiving paperwork filed and held for future reference.

At this point, the transaction is completed with office personnel checking the warehouse receipt to be sure the received quantities agree, proper rates have been applied, and storage date, product location, and incoming temperatures are properly recorded. The plant manager or designated representative should sign the warehouse receipt and send one copy to the customer. It is recommended that warehouse receipts be sent within twenty-four hours from the product receiving date.

1 Effective Receiving Practices

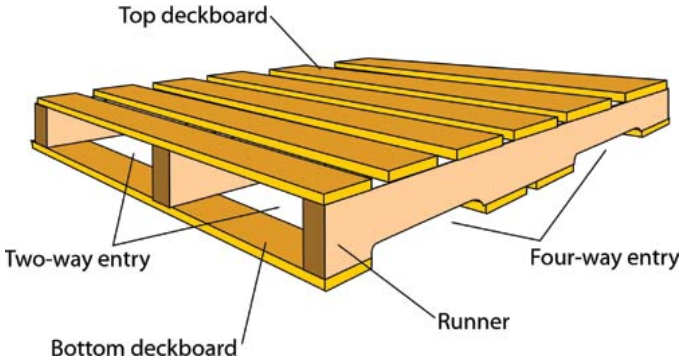
1.2 Palletizing Inbound Products

Pallet use during shipping facilitates ease of loading and unloading of products. However, pallets consume space and add weight to the load, thereby reducing the number of cases or amount of product allowed in the trailer or container. Lightweight products tend to "cube out" in volume rather than weight, whereas dense products may exceed the maximum legal weight limit before filling the trailer. For example, a case of doughnuts might weigh only 6 pounds per cubic foot, while the same size cube of meat might weigh 40 pounds.

Therefore, in order to maximize the number of cases a customer can ship without exceeding the legal weight limits, and for the purpose of utilizing the maximum available space, products may arrive at the warehouse without pallets. When pallets are not used, the product is either loaded directly onto the floor (floor-loaded) or loaded using slip sheets.

Products arriving at a warehouse without pallets must be palletized prior to put away into the facility. When palletizing inbound products, it is important to consider the best configuration of cartons on the pallet. The product manufacturer may have printed the proper pallet "tie" and "high" on the top of each carton. These are the instructions to use when unloading floor loads. If there is not a clear tie and high displayed on the cartons, then use the guide provided in this document. "Tie" is a term used to describe the pattern of boxes or cartons per layer. The "tie" pattern helps stabilize the pallet and provides a uniform configuration by altering the pattern of each layer. "Tie" patterns will vary depending on the dimensions of the cartons. "High" is a term used to describe the number of layers per pallet and will vary depending on the dimensions and weight of the cartons as well as the specific rack heights in the storage area of the warehouse.

Pallet Selection:



Consider the following when determining which type of pallet to use for a particular product:

1. Load Conditions:
   a) Type of container (cases, bags, bulk containers, barrels)
   b) Maximum & minimum unit load dimensions (length, width, height)
   c) Maximum, minimum & average unit load levels
   d) Load stabilizers to be used (shrink wrap, stretch wrap, adhesives)
   e) Will pallet sheets, spacers or unit-load caps be used?
2. Support Conditions:
   a) Is the pallet to be placed in racks?
   b) What are the maximum and minimum unsupported free spans?
   c) How many unit-loads will be stacked in the warehouse?
   d) What is the maximum length of time a unit-load will remain stacked?
3. Other Considerations:
   a) Will the pallet be handled with lift trucks?
   b) What is the maximum allowable weight per pallet?
   c) What is the range of acceptable pallet heights?
   d) What is the range in acceptable pallet length and width?
   e) What is the capacity of the racking per pallet?

Palletizing:
Once a pallet has been selected, the product can be palletized using an acceptable "tie" and "high" pattern. Most refrigerated warehouses use a 48" X 40" four-way GMA pallet. It is important that the outside edges of the cartons be aligned with the edge of the pallet, so the cartons do not extend beyond the pallet. Cases overhanging the edge of the pallet can result in considerable

damage during handling and when pallets are placed in and taken out of storage locations. The stacking pattern for a layer is changed on alternating layers to "tie the product together" and create a more stable load.

While it is important to "tie" the layers together, it is also important to make certain that the height of the product fits properly in the rack position opening. This is not difficult to achieve if all rack elevations are at the same height, but it is more challenging if the facility has variable or multiple rack elevations within the warehouse. In this instance, dock personnel will have to coordinate proper stacking height with the forklift operators who are responsible for the storage function.

It is also important to make sure to use good clean pallets. This will minimize accidents from falling debris and will help keep from pallets getting stuck in the rack. This will also help maintain the integrity of the product and the boxes.

In addition to "tie" and "high" considerations, **finished pallet weight** must be considered when palletizing inbound product. The combined product and pallet weight must never exceed the safe lifting capacity of the forklift or the storage capacity of the racks. Maximum pallet weights should be common knowledge with the warehouse staff.

When palletizing "catch weight", variable or independently weighed boxes, it is important to ensure that all of the product labels containing weights are facing to the outside of the pallet so that weights can be captured during the scanning or recording process.

Securing the Pallet:
If the cartons on the pallet are light weight or if the boxes are slick, the top layer of the cartons should be taped, tied or wrapped to prevent them from falling off while being transported, lifted or placed in the storage racks or bulk locations. This can be accomplished with stretch wrap, twine or adhesive tape.

Pallet Handling Basics:
Training warehouse personnel to properly manage pallets will reduce damage, improve efficiency and prevent injuries. A few helpful hints for pallet management include:

1. Inspect pallets for damage prior to use
2. Do not step, stand, or lean on pallets
3. Do not stack pallets higher than specified
4. Do not load pallets with more weight than specified
5. Standardize the unit load to fit the pallet
6. Stabilize the unit load before moving

7. Keep forks horizontal when entering the pallet
8. Put the forks all of the way in before moving the unit load
9. Approach the pallet at a 90-degree angle to the pallet
10. Lower the pallet slowly and gently to the floor, do not drop
11. Do not push or nudge the pallets with the forklift tines or forks
12. Keep the load as low to the floor as possible
13. Do not slide pallets on the floor, empty or loaded
14. Do not pull a unit load from a delivery truck by hooking onto the pallet
15. Stack unit loads straight within the footprint of the unit load
16. Always travel backwards when a pallet is on the forks

Palletizing Products to be Frozen:
If the arriving product is to be frozen, special care must be taken when determining the stacking configuration. When the unfrozen products arrive in cartons, spacers or spreaders should be placed between each layer of cartons on the pallet. Begin by placing a layer of product on the pallet and then placing a spacer on top of that followed by another layer of product, repeating until the pallet is the correct height. Within each layer, allow approximately two inches of space on all sides of the cartons. Do not stack the cases tightly as this will prevent air flow and prolong the freezing process, which could damage the quality of the product. Stretch wrap around the cartons should not be used if possible. However, if a small amount of stretch wrap is necessary to stabilize the products being frozen, it is recommended that holes be pierced in the wrap to allow cold air to penetrate and surround the boxes and product.

Occasionally product will arrive palletized with instructions for freezing. Other times customers will ask that product be placed in the storage freezer and allowed to "room freeze" rather than undergo the traditional "blast freezing" process. Unless this is an established practice with an existing customer, contact your supervisor who will provide direction and guidance. Room freezing has the potential to cause product quality deterioration and claims against the warehouse. It is imperative to seek direction on how to handle a shipment if any doubt exists.

When unfrozen product such as meat arrives unpacked, there are other considerations that must be taken into account. When large pieces of meat, generally hams, are securely wrapped and sealed in plastic bags, they must be placed as a single layer directly on sheets of clean cardboard (slip sheets are perfect for this application). In other instances, pieces of meat may be placed in large cartons or totes, again using single layers and stacked on pallets using spacers, with two inches of air space separating the cartons on all sides. Also, small pieces of meat wrapped and sealed in plastic may be placed directly on

clean spacers and pallets and stacked several layers high for freezing. As always get guidance from the customer to help determine the best method of stacking and freezing their product.

2 Effective Receiving Practices

2.1 Managing Product Damage During Receiving, Storage and Shipping

Product damage can occur at many points during the distribution cycle, during loading at the source facility, during transit in trucks, at cross docking facilities for less than truckload quantities, during offloading at the warehouse, during put away for storage, during picking or during loading for shipment. This section focuses on managing damage reporting when receiving, storing, picking and shipping products at the warehouse. Product damage in the warehouse is a casualty of normal business operations, but should be managed to maintain a solid company reputation and relationship with customers and minimize financial losses

It is important to note that not all product damage is visible upon initial inspection. If cases or products are damaged inside the pallet, they may be hidden from detection until the pallet is picked prior to shipping or when the pallet is received at the customer's location. When receiving products in the warehouse, most warehouses reserve the right to deny a claim for "hidden" or "concealed" damage, as is stated on the GCCA standard Non-Negotiable Warehouse Receipt, when there are damaged boxes inside the pallet that cannot be detected until the pallet is broken down. In order to reserve this right, the warehouse should indicate this information on the Bill of Lading (BOL) produced by the warehouse. It is important to document that the load is under review for damage. If hidden damage is discovered in the warehouse, it is important to take pictures of the damage while the product is still on the pallet, and immediately share these pictures with the customer.

Any visible product damage that occurred prior to arrival and unloading at the warehouse should be noted at the receiving dock and immediately communicated to customer. Any additional damage, except concealed damage, noted or discovered after receipt is most likely the responsibility of the warehouse and is presumably caused by warehouse staff.

If dealing with a less than truckload shipment, use the Delivery Receipt to document that the delivery is under review. Appropriate terminology to include is "subject to count and inspection" if you believe there to be hidden damage or shortages. That said, this will be disputed by the carriers and if at all possible, any shortages or damage should be documented with the carrier to help avoid an ambiguous situation where it may be a customer shortage or a freight claim.

A failure to identify discrepancies on the "signed BOL" or "signed delivery receipt" with null your or your customers' right to file a freight claim at a later time.

Received Damage: If products arrive at the warehouse with visible damage, the following procedures should be observed:

1. Verify the title of the load and that the load is consigned to the customer in care of the facility prior to taking any additional steps. If the load is not consigned to the facility, close the doors and contact a supervisor. If there are questions on the Title of the load, work with a supervisor and refer to the contract of services.
2. Conduct a cursory visual inspection to determine the extent of the damage (slight, moderate or severe).
3. Initiate a report of damage. Some facilities use a standardized "Over, Short & Damage" (OS&D) report. This report should document visible damage without disturbing (unloading) the load. Be certain to document any temperature readings (product, trailer, or thermostat) at the time of the report. See the following example "Report of Over, Short and Damaged"
4. Photo document any damage or conditions before and after unloading.
5. Regardless of the severity of damage, notify a supervisor that inbound product has been damaged.
6. If there is evidence of food safety risk (off condition, foul odor, leaking packages, or exposed product), contact a supervisor and prepare for immediate inspection by authorized representative of the consignee or carrier. **DO NOT UNLOAD** the product until instructed to do so. Loads containing severely damaged products can be rejected. If a load is to be rejected, the warehouse should inform the customer and/or carrier of this action. Remember that according to the FDAs Sanitary Transportation of Food (STF) rule the carriers must provide proof, if requested, that temperature conditions were maintained during transportation. The temperature monitoring equipment should be listed on the BOL if available.
7. If the damage is slight and the product safety is not adversely affected, the load may be unloaded. In cases where the damage is minor or the customer needs the product for sale and/or does not want the product turned over to the carrier for a claim, the customer may request re-coopering service. Such service can be performed by warehouse personnel, if available, or by outside contractors. Generally, in-house re-coopering is billed to the customer on the basis of man-hours as set forth in the rate structure provided to the customer. Contracted labor

agreements, as well as in-house rates, should be agreed upon before starting the work. The salvaged product is returned to the original lot while damaged merchandise is placed in a separate "hold" lot awaiting disposition instructions from the customer.

8. Once the unloading process has been completed, have the driver, carrier agent and warehouse agent sign the damage report. The driver cannot leave until the BOL or Delivery Receipt is signed.
9. Contact the customer and/or carrier with notification of damage. Provide a copy of the damage report to the customer and retain a copy for company records.

Communication with the customer is the key to success when dealing with inbound product damage. Always look to the customer when in doubt and let them guide the warehouse on the appropriate course of action.

Product Damage

Product damage can be slight or severe. Each type of damage requires that different procedures to be taken:

Slightly Damaged Products:

Each customer may choose to handle slightly damaged products differently, depending on their corporate policies or procedures and whether the damage occurred upon receiving or in the warehouse. The warehouse should maintain close communication with the customer pertaining to product damage within the warehouse. Do not assume to know how the customer wants to manage product damage, but rather check with them to get specific directions, policies or procedures for slightly damaged products.

When product cases are slightly damaged, crushed or torn **but** the inner packs are not affected, the product may still be used for distribution.

1. When possible, outer boxes should be properly taped and shipped with the original lot. However, if the customer's policy requires a new box to replace damaged or torn boxes, or the existing box can not be effectively taped, then boxes must be kept on site or ordered from the customer.

2. If new boxes are to be used, products should be removed from the existing lot and placed in a "hold lot" to ensure that they are not shipped out as damaged goods.

3. Once the replacement boxes arrive, the damaged boxes can be disposed of and the product returned to the original lot in new boxes. These products are commonly referred to as "Re-Cooped" product.

4. The warehouse supervisor should prepare an Over, Short or Damage (OS&D) report and submit to a manager.

Severely Damaged Products:

When product cases are severely damaged, crushed, or torn **and** the internal product has been contaminated, compromised or damaged, the products should be properly disposed of. These products should not be allowed into commercial trade and must be accounted for in inventory management systems.

1. Remove the damaged products from the original lot.

2. Collect relevant data about the incident, including:
    a. Product code and/or description
    b. Lot number
    c. Weight
    d. Number of cases
    e. Condition
    f. Cause of damage
    g. Date and time of incident

3. Properly dispose of the damaged goods. Check with local health inspectors or government authorities when determining the proper location for disposal. Even if it is still permissible, it is strongly recommended that products **NOT** be disposed of in dumpster units. The warehouse is responsible for the contents of their dumpsters; and spoiled or dangerous products may pose a risk for food poisoning if not properly denatured and disposed of. Products must be rendered inedible for human consumption, which is accomplished by applying a denaturing agent (available commercially), legally disposed of, and in some cases a certificate of disposal.

4. The warehouse supervisor should prepare an Over, Short or Damage (OS&D) report and submit to a manager.

5. Contact the customer to inform them of the product damage.

6. Adjust inventory numbers to account for the reduction in product due to disposal.

7. Process the claim. It should be noted that not all customers' process product damage claims against the warehouse, sometimes as part of an ongoing relationship or due to pre-negotiated "shrink allowances."

An Over, Short & Damage report is provided in Chapter 8 of this manual.

2 Effective Handling & Storage

2.2 Pallet Management

A pallet is a device used for efficiently moving and storing product. It is used as a base for assembling, storing, stacking, handling, and transporting goods as a unit load. Industrial pallets are commonly 48" x 40" and are constructed to facilitate the placement of a forklift's forks between the levels of a platform so it may be moved onto or off a trailer or railcar or into a warehouse. Pallets are generally "All Way" or "Four Way" in design, meaning that a forklift can access (enter) the pallet from both sides and the ends.

A pallet's length is measured between the pallet ends (including overhang) parallel to stringer or stringer board. A pallet's width is measured between pallet sides (including overhang) perpendicular to pallet length. A pallet's height is measured from outer edge of bottom deckboards to outer edge of top deckboards.

There are six (6) common types of pallets:

Type I:	Single-faced, non-reversible pallet
Type II:	Double-faced, flush-stringer or block, non-reversible pallet
Type III:	Double-faced, flush-stringer or block, reversible pallet
Type IV:	Double-faced, single-wing, non-reversible pallet
Type V:	Single-faced, single-wing, non-reversible pallet
Type VI:	Double-faced, double-wing, reversible pallet

If a warehouse elects to maintain their own pallets, then efforts to repair broken or damaged pallets should be of high priority. Most refrigerated warehouses outsource pallet repair or pallet core services; although some maintain in-house repair departments. Many warehouses, customers and shipping companies, however, participate in some form of pallet exchange or bank programs. Many times, if specialized or premium pallets are used in transportation between the supplier and customer, the warehouse has little input into the decision, and is only asked to assist in managing the pallet exchange or premium pallet program.

Pallet exchange programs are an agreement between two or more shippers and receivers to make each responsible for the total stock of pallets. "Like" Pallets are exchanged on a one-for-one basis, and records are maintained on each pallet movement. Pallet exchange eliminates the need to off-load products from shipper to receiver, thus saving significant warehouse labor.

An even exchange of acceptable "like" pallets is not a problem. Difficulties arise when the warehouse provides a carrier more or higher quality pallets than it receives. For example, if a warehouse provides pallets to a customer or carrier not on an exchange program, the warehouse will probably not be able to recover the pallets that were given away. If a pallet exchange does not exist with a carrier, the shipment may have to be floor loaded or the carrier will have to obtain pallets from an outside source. Sometimes the warehouse will sell pallets to the driver, so that he does not have to floor load the product. If pallets are to be sold by the warehouse, the cost of pallets should be determined by plant management in advance. The shipping and receiving office should collect these funds and turn them in to an accounting office as soon as possible.

Proper controls should be in place if the warehouse is going to engage in these types of transactions. If there is an authorized carrier participating in a pallet exchange program, the warehouseman should obtain the driver's signature on the pallet exchange document. Even exchange transactions should also be recorded. The reason for recording even transactions is to ensure a paper trail in case the transportation company claims that the transaction was not even. It also reduces the likelihood of forgetting to record uneven exchanges if all transactions are recorded.

If pallets exist in the trailer, the warehouseman should record the number of acceptable pallets received on the pallet exchange form. The warehouseman must make the driver aware of this activity to eliminate potential problems when the exchange is made. Make sure that the person evaluating and accepting the pallets is aware of the warehouse's pallet acceptance policy, and that all pallets are examined to verify that they can be used. All defective pallets should be returned to the driver. If the driver refuses to accept the pallets, the pallets are forfeited, and the driver will receive no credit or compensation for the defective wood left at the warehouse. Make it clear that the warehouse will not hold the pallets for pickup at a later date. Finally, remember that the driver must sign the exchange form.

Specialty Pallet Programs:

Aside from standard wood pallets, there are options for renting or participating in specialty pallet programs. Commercial pallet rental from companies such as Commonwealth Handling Equipment Pool (CHEP), or the Canadian Pallet Council (CPC) are available. These services have advantages and disadvantages, and warehouses should consider the costs associated with these programs as well as their ability to manage, track, inventory, store, and reconcile specialty pallets. Aside from pallet rental programs, there are other specialty pallets on the marketplace, including heat treated and/or fumigated pallets for specialty products or uses.

Pallet Trailers:

Pallet trailers are used to transport pallets to and from the warehouse, and can often be contaminated with dirt, rodents and/or insects. It is recommended that warehouse operators implement an inspection procedure to verify that trailers bringing pallets to the warehouse are clean and free of contamination or pests, thereby preventing insects, rodents or trash from entering the warehouse. The trailer inspection form provided in Chapter 8 could be modified and used for this purpose.

Pallet Definitions:

'Premium A-Grade'

These are mostly used by retailers where they will sit out on the floor in order to remain an integral part of a product display. They are also used for pharmaceutical, food manufacturers and suppliers where the cleanest recycled pallet available is required.

Features:

- 7 boards on top
- 5 boards on bottom
- 6" lead boards top and bottom
- Average top deck spacing 2.5" to 3.5"
- 3 stringers (1 ½" x 3 ½" each)
- 4-way entry
- Flush
- No block or metal repairs to stringers
- No colored or painted stringers

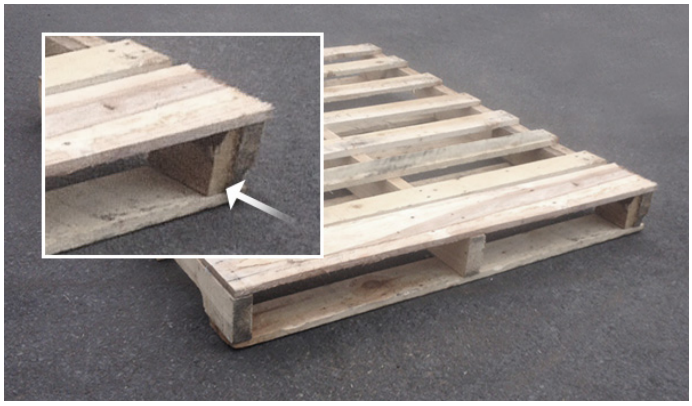
'A-Grade'

A-grade pallets are more readily available but will have a more worn appearance than a 'Premium A-Grade.' The specs on an A-grade are more consistent than on a B-grade pallet and will never have any block repairs to the stringers. The overall appearance is also better, as an A-grade pallet likely has had fewer cycles than a B-grade.

Features:

- 7boards on top
- 5 boards on bottom
- Average top deck spacing 2.5" to 3.5"
- 3 stringers (1 ½" x 3 ½" each)
- 4-way entry
- Flush
- No block repairs to stringers
- Each stringer can have one repair plate to strengthen any split

'Premium B-Grade'



The perfect fit between a standard A and standard B. This cost saving pallet will have fewer transfer cycles than a standard B and as a result will likely have fewer markings, chips, cracks or other wear and tear damage.

- Same as a standard B grade but with only one of the three stringers having a plug or other type of repair. May have multiple repairs on the same stringer.

'B-Grade'

B grades are considerably less expensive than A grades and are used primarily for warehousing or shipping where it is likely the pallet will not be coming back.

Features:

- Between 6 to 7 boards on top,
    - Board width which can be 3 ½" to 5 ½" wide
- No less than 4 boards on bottom
- Average top deck spacing 2 ½" to 3 ½" but can be up to 4"
- 3 stringers (1 ½" x 3 ½" each)
- 4-way entry
- Flush
- Has plugs (repairs) on stringers
- Can be various length and location
- No more than two boards (stringers) thick at any one point
- Chips or partial split boards are acceptable

'Heat-Treated A-Grade'

A new 48" x 40" heat treated 4-way 5/8" wood pallet, also called a GMA pallet or standard pallet in many industries.

2 Effective Handling & Storage

2.3 Order Picking

The process of selecting products to ship, called order picking, is one of the most critical functions in warehousing, and represents an opportunity for additional revenue, with the risk of error, damage or loss if not properly managed. Order picking is central to effective warehouse operations and represents one of the primary competitive advantages of modern refrigerated warehouses and third-party logistics companies. Order picking efforts should be managed for maximum efficiency; attempting to reduce travel times, mis-picks and product damage while maximizing worker efficiency and reducing time spent picking. Order picking can be accomplished using paper-based methods, commonly called a "pick sheet", or electronic methods such as using a radio frequency (RF) terminal to scan cases or Voice Pick. RF terminals can be hand-held scanners, hands-free (wrist or arm mounted) units or truck-mounted terminals on forklifts.

Not all order picking functions are the same, however, and warehouse operators should have strategies in place to accommodate the wide array of picking schemes. The most basic form of order picking is the retrieval of **full pallet quantities**. This is the easiest form of picking, and results in only a slight chance for error on the part of the warehouse. Other methods of picking include **full layer picking**, whereby a full layer of a pallet is retrieved at a time. **Case picking**, whereby full cartons or cases are retrieved from storage is yet another common warehouse picking method. There are also some more complicated order picking methods, including **split-case** and **broken-case** schemes. These methods involve picking inner packs or individual items from cases.

Most refrigerated warehouses utilize full pallet, layer, or case picking schemes, although split case and inner-pack picking are possible customer requests. The recent growth in **Just in Time** (JIT) inventory management and category management by retailers is driving the industry towards more broken case picking and consolidation.

The key to efficient order picking is knowledge of inventory amount and location, including Stock Keeping Unit (SKU), lot numbers and inventory rotation schedules. Warehouse Management Systems (WMS) can effectively manage the exact location of all products in the warehouse, thereby reducing travel times, pick times and errors. Irrespective of the system in place in a warehouse, an effective stock location program is imperative for streamlined and efficient order picking and slotting replenishment.

In spite of the method used, paper-based or RF, the pick process begins with the worker being informed of the SKU, lot number, description and location of the product(s) to be picked. Picking documents or instructions should be simple yet

specific. Attempting to leverage the shipping and picking documents together to save paper or effort often times results in picking documents that contain too much extraneous information, which can confuse the picker.

Picking information should include the basic information in the order of importance to the picker:

- Location of the item(s)
- Stock number (SKU)
- Item description
- Unit or material
- Quantity of material required

Additional information, such as special labeling, distinguishing characteristics, or specific packaging may be noted to aid the picker in identifying the product to be picked. Picking functions should be pre-routed according to stock location in order to reduce travel time and back-tracking through the warehouse. Efforts should be made to ensure that there is adequate supply at the desired location to fill the order.

The importance of a properly trained order picker can not be overemphasized. The order picker provides the ultimate control in quality assurance and customer service. Mis-picking orders, damaged products, and missing items all lead to claims and customer dissatisfaction. The order picker must be able to accomplish his or her job without constant oversight and should be accountable for order accuracy. Using a quality control checker to verify order accuracy is an added expense, and unnecessary if the order picker is properly trained, motivated and required to confirm the picking accuracy.

There are many strategies to efficient and effective order picking, depending on the level of technology in the warehouse, the labor pool and configuration of the storage area. Common picking methods include **Zone picking**, **Batch picking**, **Wave picking**, or a combination of the three.

Zone picking involves organizing the pick area into distinct sections or zones, with an employee assigned to that zone. Within each zone, the worker picks all products located there and transports the items to a consolidation area where the order is assembled. Zone picking systems can be modified to be sequential, whereby orders from zone 1 are transferred to zone 2 and added upon, then transferred to zone 3 and so on. This is sometimes referred to as a "pick and pass" method.

Batch picking is when a worker picks a group of orders, called a batch, at the same time. If the same product is to be included in more than one order, the total amount of products necessary for the batch are picked at the same time, and then segregated into the appropriate order during the assembly process at the consolidation area. It

should be noted that batch picking can result in mistakes, since multiple orders are being considered at the same time. However, this method can also significantly improve worker and warehouse productivity by limiting travel times and maximizing trips to the storage location.

Wave picking involves a worker picking orders one line or product at a time, often times resulting in longer order consolidation times and travel distances. The advantage of wave picking is simplicity and order accuracy.

Once at the appropriate location, the worker is able to pick the appropriate number of units required to fill the order. Order picking can be to a pallet, tote, cart or roller belt. Most warehouse picking functions are to a pallet, either on a forklift or pallet jack. If only a portion of the units are removed from the pallet, the remaining inventory should be returned to the original storage location. An exception to this rule occurs when the remaining product is relocated for space considerations and to reduce partially filled pallets. Under these circumstances, the warehouse worker should complete a relocation sheet identifying the new location used to store the product. The relocation sheet is turned into the office where the location file is updated reflecting the change made by the warehouse worker.

If the warehouse worker goes to the proper location and cannot locate product to be retrieved he or she should notify the supervisor and report this information to the office. The office staff should be able to provide an alternate location from which the product can be retrieved. If the product is in the alternate location, it should be pulled for shipment, and the location on the delivery ticket should be changed to agree with the proper location, and then the original location should be deleted from the file. If the product is elsewhere in the warehouse, the problem can sometimes be corrected by looking for the item and adjusting the location file when the product is eventually found. This searching for products in the warehouse is counterproductive, and results in lost time and efficiency. Obviously, the office will be contacted, and they will enter the location where the product resides.

If the product is not found, the warehouse worker, or in some warehouses a quality control warehouseman, may have to analyze the lot history reports to determine if the entire lot was previously shipped. If that is the case, the product was probably picked incorrectly where another lot was substituted for the lot appearing on the picking document. The mis-rotation of lots cannot be tolerated since it may result in having product in storage beyond its shelf life, and the possibility of the warehouse having to pay for the error. In researching this problem, the warehouse should be able to identify which warehouse worker was responsible for the location error. That worker should be contacted and informed of the problem his error created.

Another concern is removing cases of the same lot number from multiple pallets, potentially creating unused space in pallet locations, commonly called

"honeycombing." Honeycombing and loss of density will occur where the warehouse will be storing more than one partial pallet from a lot. Revenue is seriously impacted if the warehouse fails to maximize warehouse density. When the warehouse worker picks the product, he or she should correlate the lot number and product code or item description appearing on the case to the data appearing on the pick ticket. This cross check may identify errors where the lot number was accidentally applied to the wrong pallet.

2 Effective Handling & Storage

2.4 Product Recalls

Product recalls, as the name implies, involves removing product from the distribution network and returning or destroying the product. As a third-party service provider, the refrigerated warehouse plays a significant role in assisting with, if not managing, the product recall process. The customer may request a recall on the basis of quality, labeling or packaging defects. At other times, Government agencies such as the United States Department of Agriculture's (USDA) Food Safety & Inspection Service (FSIS), the United States Department of Health & Human Service's Food & Drug Administration (FDA), the Canadian Food Inspection Agency (CFIA) or another regulatory agency in charge of food safety may require a recall for food safety reasons. The USDA and CFIA classify product recalls into one of three (3) categories:

Class I: This is a health hazard situation where there is a reasonable probability that the use of the product will cause serious, adverse health consequences or death.

Class II: This is a health hazard situation where there is a remote probability of adverse health consequences from the use of the product.

Class III: This is a situation where the use of the product will not cause adverse health consequences.

A Product Recall Checklist is provided in Chapter 8 of this manual.

It should be noted, however, that from a warehouse point of view, a recall is a recall and should be handled in basically the same manner. Many customer's have more sophisticated and intensive recall procedures for quality and packaging issues than do government agencies, so the warehouse should be certain to adhere to the minimum standard established by the recall body, but continually strive to meet customer recall directives. Improperly handling a recall, regardless of the nature of the recall, can result in a claim against the warehouse.

Many customers will have established recall procedures, and warehouse operators should be familiar with these procedures and protocols. However, if the USDA, FD, CFIA or another regulatory agency in charge issue a recall notice, of any Class, government procedures supersede any and all customer instructions or procedures.

In the event of an actual product recall, time and accuracy are of critical importance. The longer a recall takes, the more likely those potentially hazardous products will make it into human or animal consumption food supply chains. As a result, it is recommended that refrigerated warehouses conduct "Mock Product Recalls" on an

annual basis, practicing the procedures and improving operational efficiency with regard to product tracking, verification and customer communication procedures.

Product recalls will potentially involve both internal products stored in inventory or in the process of being distributed as well as external product that have already been shipped or distributed through the warehouse system. It is critical that all products being recalled are properly accounted for, both electronically and physically.

The following steps should be taken during an actual or mock recall procedure:

Step 1: Customer Notification

Upon notification from a customer or government agency that a recall is ongoing, warehouse management should be notified. Likewise, warehouse operations should be notified that a recall is ongoing, thereby limiting additional exposure by preventing potentially hazardous products already on trucks from leaving the facility. A temporary "Hold" on outbound truck to verify that recalled product is not onboard may be advisable.

Step 2: Contact Person

The warehouse should identify a primary point of contact as well as a secondary point of contact, to deal with the specific recall. These individuals would be responsible for coordinating the recall process, as well as serving as the points of contact with the customer, with government officials, and with companies that have received potentially hazardous products through normal distribution cycles.

Step 3: Written Authorization & Data Collection

The warehouse points of contact should request and receive written authorization to hold and/or recall products belonging to the customer. Critical data should be gathered to define the parameters of the recall, including but not limited to:

- Item Code(s)
- Lot Number(s)
- Production Date(s)
- Pallet Identification(s)
- Product Description(s)
- Brand Name(s)
- Weighs (Gross, Net, Lbs. or Kgs.)
- Distribution Scope: Domestic only, or Imported & Domestic

- Distinguishing Marks, if any
- Original Delivery Date(s) to Warehouse

The warehouse should also gather any inbound paperwork that arrived with the load or loads being recalled, including receiving reports and warehouse receipts.

It should be determined if the warehouse will be serving as the collection point for recalled products already in distribution, in which case external products will be received at the plant and must be placed with other recalled inventory in a single "open lot."

Step 4: Inventory Search & Report

Internal: A search of the warehouse inventory, both electronic and physical, should be initiated. Computer systems should be queried for and recall products in inventory in storage, on the docks or in trucks at the facility. An inventory report should be generated, and a physical search of the premise should be conducted to a) verify that the inventory listed on the report is properly located; and b) that additional recalled product is not located elsewhere in the facility.

External: A search of records to determine the location of any recalled product inventory that the warehouse has already shipped to other locations should be initiated. Specific information pertaining to the recalled products that have been shipped out should include:

- Consignee(s)
- Consignee(s) Physical Address(es)
- Quantities Shipped (net weight & number of pieces)
- Weight Sheets
- Release Date(s)
- Export or Domestic Location (if export, pull copies of export paperwork)

Once the internal and external searches, both electronic and physical (in the case of internal inventory), have been completed, the warehouse should produce an *Inventory Summary Report* for the customer and/or government representative. This report should contain information pertaining to the location of all products within the scope of the recall that passed through the warehouse.

Step 5: Product Hold & Store

Recalled product remaining at the warehouse should be held, both physically at the facility as well as in the electronic inventory. Physically holding the product should involve the following:

- Locating products within the facility
- Placing "Hold" tags on all products or pallets
- Re-locating all "Hold" products to a centralized area, segregating from remaining inventory within the warehouse
- Restricting access to products being held, if possible, with fencing, cable, chain or rope

If additional products are to be added to this inventory, perhaps from outside sources, the recall lot should be held as a single "open lot" until all recalled products have been gathered. As additional products are received at the warehouse, they should be counted, tagged with "Hold" tags, and placed in a segregated area with the other recalled products from the same open lot. Information should be provided to the customer daily with case counts, weights and status of recalled product location(s), if possible.

Warehouse operators may want to consider investing in some black stretch wrap to use on recalled pallets of product, thereby further identifying the product as recalled and isolated. Other ideas include posting photos of the recalled products on bulletin boards and in employee information areas.

Step 6: Warehouse Response

Once the internal and external product being recalled is in a centralized location provided it is at the warehouse, the warehouse may be asked to assist with the proper response. Potential responses could include:

- Product testing
- Product return to the customer
- Product destruction

It should be noted that many customers will evaluate the warehouse performance on an actual or mock recall, including the efficiency of the recall process, time taken to recall the products and information transfer back to the customer. For this reason, it is recommended that warehouse operators train employees on recall procedures and conduct mock recalls on a regular basis to improve efficiency and response time.

2 Effective Handling & Storage

2.5 Cross Docking and Short Hold Storage Services

Cross docking Services

Cross docking is the process whereby inbound product is received at a warehouse, occasionally combined with other products going to the same destination, and then shipped at the earliest opportunity without entering into long-term storage. Cross docking requires advance knowledge of the inbound product, the final destination of the consolidated load, and an effective management system for routing the product to the proper outbound vehicle.

Short Hold Storage Services

Short hold storage involves holding product in storage for a day or two and then shipping the products to customers. In these circumstances, it is important that the warehouse and the customer have a clear understanding of what is expected. If the warehouse offers short hold storage, a special short hold day rate for storage may be appropriate since it is a fair way to treat this situation. The warehouse must get compensated for its services, and it does cost more to hold and ship than it does to ship directly.

Critical components of effective cross docking and short hold storage system are:

1. **Time**. Since cross docking procedures, as defined, result in products being moved *through* a warehouse *without* entering into cold storage rooms or inventory, time is of the essence. If receiving and shipping docks are not maintained at cooler temperatures, then the longer the products being cross docked remain on the dock(s) the greater the potential for temperature abuse and product damage or deterioration. It is important to minimize the time cross docked products spend on the receiving and/or shipping docks. Generally speaking, cross docking procedures that require in excess of one day are inefficient and potentially dangerous (product quality and safety) and should not be considered. These products should be stored in coolers and/or freezers rather than cross docked. At this point, it would be considered short hold storage and be charged that fee.

2. **Motion**. The process of efficient cross docking is contingent upon effective product movement across the receiving dock and to the outbound container or trailer at the receiving dock. Products that sit idle or are placed in storage coolers reduce overall efficiency and reduce profit potential. Likewise, products staged on docks for extended periods of time reduce overall

productivity and inhibit the movement of inbound and outbound loads into and out of the coolers or freezers. A standard warehouse rule is that increased product handling significantly increases the cost associated with operations, reduces the efficiency of the warehouse and provides an increased opportunity for product damage.

3. **Information**. Information systems are critical to effective cross docking functions. The effective exchange of physical products must be accompanied by an effective exchange of information. Coordinating inbound products through effective scheduling, unloading procedures at the receiving dock, information transfer through electronic systems, and outbound shipping at the shipping dock is a critical component of an integrated cross docking system. Failure at any level of the aforementioned network will result in inefficiency and productivity losses. Data transfer remains an important component that required coordination between all areas of the warehouse. Ideal cross docking will have a timely, accurate, paperless information flow among trading partners and a smooth, continuous product flow that is matched to actual demand. This information is used by the logistics planner to schedule the receipt of products to coincide with the outbound shipments.

Additional considerations with regard to implementing cross docking systems include:

1. **Cost**. Cross docking systems can be profitable, yet they can also add unforeseen and immeasurable costs to the refrigerated warehouse system. Cost analysis and cost justification should be performed to ensure that cross docking systems are cost effective and profitable. While cross docking is an excellent and valuable customer service tool, unforeseen costs must be measured and managed.

2. **Personnel**. Warehouse personnel are responsible for efficient cross docking functions. Properly trained, motivated and capable personnel are required for profitable cross docking systems. Warehouse personnel should recognize the urgency associated with cross docking systems, especially since the products are not being stored in coolers or freezers during the process. Tracking performance is a useful tool to evaluate the efficacy of cross docking procedures.

3. **Management**. Since cross docking is a distribution tactic it must be effectively managed. Management goes beyond personnel, and must include inventory, transportation, logistics and category management for Just in Time (JIT) inventory. In spite of the fact that cross-docked products do not remain in the warehouse for very long, it is recommended that efforts be made to

enter the inventory into the WMS system, thereby reducing the potential for shortages and lost products.

Potential Benefits of Cross Docking Include:

- Increased speed of product flow through the warehouse
- Increased inventory turns
- Reduced handling costs
- Allows for the efficient consolidation of products
- Supports customers' "Just in Time" inventory management strategy
- Promotes better asset utilization
- Reduces cooler/freezer space requirements
- Reduces product damage because of minimal handling at the facility
- Reduces pilferage and shrinkage due to faster turnaround
- Reduces product obsolescence and out-of-date conditions due to limited product stay in the warehouse
- Accelerated payments to the supplier

Potential Drawbacks of Cross Docking Include:

- Requires supply and demand synchronization
- Inadequate facility design to effectively cross dock products
- Inadequate information systems support
- Inadequate management training system to support supply chain system
- Challenge to maintain product quality with limited time to conduct checks.
- Potential to be out-of-stock without back-up inventory
- Increased risk of product damage due to product sitting on the dock
- High turnover of product without an adequate paper-trail
- Opportunity for mistakes in shipping due to multiple cross docked loads staged on the same dock
- Deviates from standardized and established receiving and shipping guidelines
- May be more costly if not properly managed and documented

2 Effective Handling & Storage

2.6 Material Handling Systems

Material handling is integral to cold chain logistics. Over 90% of industrial activity involves some sort of material handling. Cold chain logistics involves transport within facilities and between workstations but also between linkages within the cold chain. Because of the high frequency of material handling within cold chain logistics, best practices for material handling can have huge impacts on the efficiency and profitability of cold chain logistics.

Sources of inefficiencies and profit/loss from sub-optimal material handling systems come from two sources. First, material handling inefficiencies can slow product movement within cold chain facilities or among cold chain linkages leading to losses in efficiency and profit. Second, poor ergonomics in material handling and transport can lead to worker injury from musculoskeletal disorders. Musculoskeletal disorders from worker injury in material handling are among the leading cause of illness of workers in Europe accounting for 50% of all worker absences and 60% of permanent work incapacity injuries. Lower back pain is the costliest and most expensive form of injury. Even minor back strains can take a long time to heal and can reduce worker output or result in days lost due to injury illness. Sprains, cuts and bruises are also extremely common sources of injury that reduce worker productivity and time on the work site.

Among emerging economies and rapidly industrializing countries, pneumoconiosis (inhaling dangerous dust) and major industrial accidents are the major cause of injury, but as industries mature, musculoskeletal disorders related to ergonomics inefficiencies will become increasingly important causes of worker injury. Therefore, introducing material handling best practices at current stages of development can help cold chains in emerging and rapidly industrializing countries prepare for and prevent this major cause of cold chain inefficiency and waste.

Musculoskeletal Disorders

Musculoskeletal Disorders (MSD) are injuries and disorders that affect the human body's movement or musculoskeletal system. The components of the human body that are most impacted by MSDs are muscles, tendons, ligaments, nerves, discs, and blood vessels. Common MSDs include Carpal Tunnel Syndrome, Tendonitis, Connective Tissue Disorders and Muscle/Tendon strain.

Highly repetitive tasks, such as those listed below, can lead to MSD:

- Frequent or heavy lifting
- Twisting or bending at waist
- Forceful pushing or pulling
- Vibration (whole-body or local)
- Static or awkward postures
- Bent wrists
- Elbows held away from body
- A twisted or tilted neck
- Extreme temperatures
- Improper lighting
- Hard or abrupt contact surfaces

Best Practices in Material Handling

The key to eliminating injuries and increasing efficiencies in material handling is to eliminate as many handling and transport steps as possible in order to streamline the handling process. This maximizes efficiencies, prevents worker injury and reduces material damage from handling. One way to reduce injuries from manual handling is to replace it with mechanical handling, but it also increases injuries associated with operating machinery and introduces costs associated with purchasing and maintaining machinery.

Manual injuries from material handling occur as a result of repetitive movements on the part of workers. It is not possible to eliminate repetitive movements, but the impact and intensity of repetitive movements can be reduced with the introduction of material handling best practices.

There are five (5) basic tasks of material handling and six (6) basic repetitive movements in material handling. The tasks of manual handling are completed using one or more repetitive movements; however, **unnecessarily complex repetitive tasks**, **overexertion** and **excessive fatigue** result in injury. Implementation of material handling best practices eliminates the causes of injury by minimizing the negative impacts of repeating basic movements in the accomplishment of material handling.

Material Handling Basic Tasks, Repetitive Movements and Sources of Injury		
Tasks of Manual Handling	**Basic Repetitive Movements**	**Causes of Injury**
Lifting	Bending	Overexertion
Pushing	Twisting	Excessive Fatigue
Carrying	Reaching Out	Repetitive Complex Tasks
Lowering	Lifting and Lowering	
Pulling	Pushing and Pulling	
	Carrying	

Risks from *Unnecessarily Complex Repetitive Tasks* are greatest when complex manual tasks, or tasks requiring more than basic repetitive movement are carried out to achieve one or more tasks of manual handling. This risk can be minimized by establishing handling conditions to require only one of these tasks at a time. Introduction of assembly line-type handling systems is one way this can be accomplished. Multiple workers can handle simple basic repetitive movements to complete complex manual handling tasks rather than asking fewer workers to handle complex repetitive movements. Though requiring more workers, increased efficiencies and reduced injuries more than make up for the cost of hiring more workers.

Overexertion is caused when workers handle more weight than they are capable of easily handling. Though a worker may be able to lift a relatively heavy load repetitively, overexertion wear and tear on the body accumulates as a worker repeatedly

manipulates unnecessarily heavy loads. Repetitive movements injuries therefore are reduced by reducing package and load sizes into easily manageable sizes and weights.

Excessive Fatigue injuries result as workers tire during the workday. As workers tire their basic repetitive movement technique deteriorates, that is they move less efficiently, creating opportunities for injury. Injuries from excessive fatigue can be prevented by adequate staffing, appropriate breaks, adequate access to hydration sources and proper stretching and warm-up techniques prior to the work shift.

Preventing Injuries in Material Handling

There are three (3) methods to reduce injuries and increase efficiencies of material handling: 1) separating complex tasks to several basic tasks is good; 2) reducing the difficulty and number of basic tasks is better; and 3) eliminating material handling tasks where possible is best.

Material handling injury prevention strategies seek to maximize efficiencies, increase profit through production efficiency and improved product quality while at the same time protecting employees. This principle can be applied to reduce complex tasks use the assembly line approach to replace complex tasks with several basic tasks in series. Though it may require more workers, each quickly can be more quickly and efficiently done, enabling overall efficiency to rise and the risk of worker injury to be significantly diminished.

Similarly, the impact of accomplishing basic tasks can be diminished by intensity and frequency of each. The table below provides a summary of principles that can be applied to reduce the impact of each of the basic tasks by reducing intensity or frequency.

Reducing the Impact of Basic Tasks	
Basic Task	**Methods to Reduce Intensity or Frequency**
Bending	- Eliminate the need to bend - Keep material at work level - No material lower than knuckle height
Twisting	- Put the work station and all material in front - Turn by pivoting or shifting feet rather than by twisting the body - If turning cannot be avoided provide sufficient work space to enable turning
Reaching Out	- Reduce distances from hands to the body - Provide grips or handles where possible - Reduce the size of objects - Keep material in the area between shoulder and knuckle height
Lifting and Lowering	- Eliminate the need to lift the load manually - Reduce the weight of the load - Use mechanical lifting/leveraging - Smaller container size - Utilize mechanical advantage/levering

Pushing and Pulling	- Eliminate the need to push or pull manually - Use casters or rollers to aid in pushing - Use larger wheels or casters on carts - Keep ramps below a slope of 5 percent - Use handles and firm grips - Reduce the distance of the push or pull
Carrying	- Eliminate the need to carry - Reduce the weight of the load - Shorten the distances the load is carried - Carry the load with arms straight down - Smaller container size - Utilize mechanical advantage/levering - Larger wheels or casters

Techniques in Material Handling

Application of efficient packing and lifting techniques can reduce load sizes, increase material handling efficiencies and reduce injuries.

For example, one of the greatest hazards of pallet building is the repeated bending at the waist to place boxes on the lowest level of pallets. Another common difficulty is that building/stacking pallets can cause employees to lift heavy loads. To reduce the probability of material damage or worker injury from the collapse of pallets, the following should be considered:

- The heaviest units should be placed on the bottom layer for stability.
- Raise the height of the bottom level. This allows employees to keep the load close to the body. This will minimize bending of the torso.
- Provide height-adjustable picking equipment so loads can be maintained at a height that minimizes bending at the waist.
- Educate employees about the hazards of bending while moving heavy loads.
- Ensure the use of proper lifting techniques.
- Stack extra empty pallets on the pallet jack to elevate the bottom of the load.
- Place a palletizer on the forks of the pallet jack to keep product at waist height.
- When possible, utilize power equipment rather than manual to reduce ergonomic stresses.

Efficient pallet stacking reduces injuries by preventing pallet loads from collapsing. Pallet packing standards for items should be established before packing so that all workers stack pallets efficiently and uniformly. Pallet stacking patterns with greater degree of overlap among items are more stable, but they also can be more complicated to achieve. Regardless of the pallet stacking method chosen, consideration must be given

to both material handling safety and efficiency. Several pallet-stacking methods are illustrated in Figure 1.

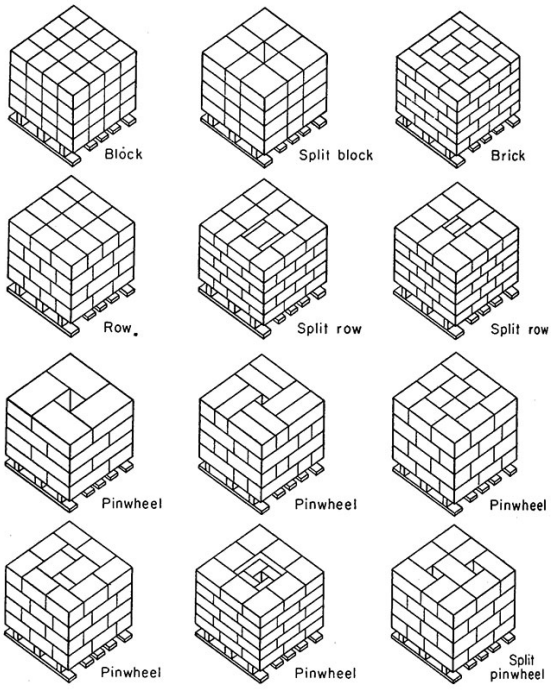


Figure 1: Pallet Stacking Techniques

An additional hazard in pallet stacking is from damage to pallet stacking equipment. Over long periods of time the solid rubber wheels of pallet jacks and forklifts can develop flat spots, resulting in unstable loads and poor handling. Employees can experience stress to their hands and arms due to the difficulty in steering and stopping these pallet jacks. The flat spots on these rubber wheels also create ruts and bumps that can result in worn floors. Possible solutions include:

- Provide periodic maintenance of pallet jacks and fork lifts so they can operate with the minimum amount of hand, arm, and finger force.
- Provide training to selectors so they recognize the early signs of mechanical breakdown. This will allow them to report problems or difficulties with the machine before the problems lead to injury.
- Keep floors well maintained (e.g. no ruts or bumps) to reduce force when using manual material handling equipment and whole-body vibration/shock from driven equipment.

Proper Lifting Techniques:

As described above, musculoskeletal injury occurs when overexertion, worker fatigue, the repetitive combination of too many basic manual handling tasks into a single job; or a combination of all three causes musculoskeletal distress. Proper lifting technique helps combat all three causes of musculoskeletal stress and engages the right muscles in efficient ways that avoid strains on the body that are

too great for the body to bear. Proper lifting techniques engage multiple muscle groups to smoothly and evenly exert force in an efficient way. It involves three components: 1) properly addressing the item; 2) utilizing the appropriate joints; and 3) maintaining a firm grip to efficiently engage multiple muscle groups and move the object efficiently.

Problems arise when the required movements are too complex, making it difficult for employees to repetitively carry out the sequence of movements needed, and when worker fatigue sets in resulting in poor technique or when the load is too heavy for the worker to safely manipulate.

Corrective Actions:

Step 1. Addressing the item. The first step in proper lifting technique is centering oneself on the item with firm footing, shoulder width apart. If the article is below the person, it is sometimes appropriate to straddle the item to put one's center of gravity in an appropriate location relative to the object. The key to properly addressing an item is to position one's body to serve as a base from which the lifting power will emanate. When force is exerted, every action causes and equal and opposite reaction. The key to appropriately addressing the object is placing oneself in a body position so that the reaction force exerted by the item will not cause strain to the parts of the body that aren't able to bear it, thereby resulting in injury. A common injury that results from inadequately addressing objects is back injuries. Back injuries often occur because too much strain is put on the lower back when lifting.

Step 2. Utilizing the appropriate joints. When handling objects it is important to utilize joints or a combination of joints so that the reaction force of the object is balanced and not too highly concentrated on any one joint or location. Engaging knee joints and leg strength is an important way to prevent lower back injuries when lifting carrying or manipulating objects. Similarly, when carrying or manipulating objects it is better to use two hands and arms rather than one because this distributes the weight across more joints, reducing strain on any single joint. Finally, if control over the object is lost it is better to drop the object rather than trying to catch the object. Catching objects in this way multiplies the force exerted because one is working against both the force needed to manipulate the object but also the downward acceleration of gravity as the object falls. Attempting to catch falling objects is a common source of joint and musculoskeletal injury.

Step 3. Maintaining a firm grip. Maintaining a firm grip helps all the limbs stay engaged in manipulating the object, keeps it from dropping and keeps all the muscle groups available to engage an object. If the object slips out of one's grip it is difficult to remain control over the object, putting more pressure on joints and muscle groups to regain control. Thus, maintaining a firm grip is an important part of good manual handling technique.

Lifting and Manual Material Handling Best practices that utilize each of the proper lifting techniques follow in the next sections. The worker should choose the appropriate lifting or manual handling technique to most efficiently manipulate objects. Lifting and manipulation techniques require practice, it is therefore good practice for managers to teach workers how to employ the lifting techniques here appropriately before without weight or with a very light weight until the worker has

demonstrated he or she can perform them appropriately. In addition, it is best practice for workers to warm up and stretch before working so that their joints and muscles will be prepared for the exertion of work.

Keep the Load Close

Keeping the load close to the body reduces the force exerted by the load on joints and the spine. It also allows all the muscle groups, especially the muscle groups in the core to engage. This achieves greater control and alleviates strain on joints, the lower back and individual muscles, thereby reducing the probability of musculoskeletal injury.

Diagonal Lifting

Diagonal lifting is a technique for lifting moderately heavy objects. Diagonal lifting aligns the center of gravity relative to the object so that the reaction force of lifting or manipulation is distributed evenly throughout joints and muscle groups. Diagonal lifting involves the following steps:

- Straddle the object by using a wide diagonal foot placement and assume a full squat position.
- Lift the object by standing straight up, keeping the back in a neutral "S" curve position throughout the lift.
- The head and shoulders are held upright, and the legs actually provide the strength for the lift.
- The key to this lift is keeping the back arched. Using an improper technique will generally allow the hips to rise first, thus bending (arching) the back forward.

Power Lift

Power lifting is used when lifting moderately heavy objects. The power lift is similar to Diagonal Lifting, but it only requires a partial squat. The steps for the Power Lift are:

- Begin with the same diagonal foot placement as before. This time bend mostly at the hips rather than doing a full squat.
- Bend the knees partially; keep the head and shoulders up.
- Grasp the load and stand up by lifting the head and shoulders up, keeping the lower back in a neutral "S" curve position.

Pivot, Don't Twist

Twisting the body is a common cause of musculoskeletal injury when workers are manipulating loads. Twisting is best avoided by shifting the feet or pivoting rather than twisting waist joints. Pivoting is turning the whole body rather than turning or twisting only part of it. It is best practice to give employees adequate room within their workplace so that they are able to pivot and rather than twist.

Golfer's Lift

The Golfer's Lift is the most appropriate for light objects or for workers with knee problems. Use the following steps when using this lift:

- Keep your back in a neutral "S" curve position, put one leg back and bend over the other leg.
- By raising one leg, the upper body is counterbalanced and forward bending of the lower back is reduced
- This is how most golfers retrieve their golf balls from out of the hole. It is useful to have another support object like a chair or table (golfers use the golf club) to assist in providing lifting stability.

Efficient Order Picking

An important part of manual handling best practice is planning for efficient order picking. There are several methods of order picking, the choice of which depends on the type of warehouse, warehouse operation being employed as well as the type of product being stored. Order picking methods also vary in material handling efficiency and safety. **Traditional**, **Flow-Through**, **Belt** and **Cross-Docking** order picking are commonly employed order picking methods. For additional information on Order Picking, see chapter 2.3 of this manual.

Traditional Order Pick Systems

Traditional Order Pick Systems are commonly used. Pallets of product are taken from the dock, where they have arrived from the producer, and are placed in racking slots. Workers then remove a specified amount of product from the slots and place them on pallets, so they can build loads of goods as per customer specification. The worker moves the pallet from slot to slot collecting the specified goods using some sort of lift and transport device. Generally, this device is a pallet jack but in some warehouse operations a forklift may be used. The pallet jack is often capable of carrying two pallets at a time and the selector can sometimes ride on the device from slot to slot. After a palletized load is fully assembled, it is wrapped with a plastic material and loaded into a truck for delivery to the customer's facility.

The advantage of Traditional Order Pick Systems is that the method allows tremendous amounts of product to be stored in reduced floor space since much of the product is stored in overhead slots. Product handling is minimized since it is lifted only once from the slot to the destination pallet. Product is moved using a pallet and mechanical means for most of the operation. Large orders can be filled as full pallets with little manual lifting. Employees are also provided frequent micro-breaks as they move from one slot to another.

The disadvantages of this system are that it exposes workers are exposed to combinations of musculoskeletal stresses such as combinations of heavy lifting, bending, reaching, twisting, and carrying stresses. In addition, because employees move about the warehouse, development of mechanical aids to assist with heavy lifting or reducing awkward postures is difficult. Therefore, when Traditional Order Pick Systems are employed it is more critical to not understaff warehouses, and schedule sufficient worker breaks to prevent over exertion and fatigue.

Flow–Through Order Pick Systems

In flow through systems, products are received at an in-bound dock, broken down, and placed on a conveyor system. The product is coded immediately after arrival and moved via conveyor to a sorting area where it is sent to the appropriate out-bound truck for shipping. Products are neither stored nor palletized.

The advantage of this flow-through system is that material handling is significantly reduced. This protects workers from musculoskeletal injury and protects material from damage. In addition, flow-through systems allow the use of mechanical lifting aids and equipment, reducing risks of worker injury from overexertion, fatigue or repetitive performance of complex tasks that create excessive musculoskeletal stresses.

However, implementation of flow–through order pick systems requires significant planning and coordination to move product through the system at the right time. Also, flow–through systems require larger amounts of floor space than other systems.

Belt Picking

In belt-picking systems, pallets of product are taken from the dock and placed on a belt or in racking slots. Workers then remove a specified amount of product, as per customer order, from the slots and place it on a conveyor belt that runs down the center of the slot aisle. Product from each aisle comes to a central area where the product is removed from the belt and placed on a pallet. After palletized loads are fully assembled, they usually wrapped with a plastic material and loaded into a truck for delivery to the customer's facility.

Advantages of this system are that since the employee works at a defined space the use of lift devices and assists is more practical. Hoists or lift assists can be placed along the line to help employees. The height of the receiving conveyor can be maintained at a level which minimizes bending and elevated reaches. The final palletizing station can be designed in a manner to eliminate torso bending and elevated reaches by using platforms, turntables and lifts. Fixed workstation positions allow lift-assist devices to be mounted at these stations.

Belt-picking systems reduce load weight and size musculoskeletal strains on employees, but they increase the frequency of repetition of tasks, because in belt-picking systems, all products must be handled at least twice instead of just once. The musculoskeletal strain however is reduced because different employees perform different functions. One employee pulls the product and places it on the belt, while another lifts it from the belt to the destination pallet.

Cross–Docking

In cross-docking systems, pallets of material are received on one dock, broken down into customer specified loads while still on the dock and transferred to outbound trucks. Items are not placed in slots for storage.

Cross-docking systems are often used when shipping in bulk is common. Therefore, cross-docking systems reduce musculoskeletal stresses by reducing the frequency of lifting repetition, however, they also increase musculoskeletal

stresses by increasing the size and weight of loads that workers must bear. Because of the size of loads, cross-docking systems often require the use of mechanical aids such as forklifts or pallet trucks. If pallets must be broken down into smaller units, this can be performed without the confines of storage racking. Using cross-docking facilitates the use of lifts and other mechanical means and increases the access of employees to product.

Cross-docking systems are not feasible when mechanical lifting equipment is not available or when product must be broken down into small units. The system also requires high levels of coordination of incoming and outgoing product and computer automation is often required. For additional information on Cross Docking, see chapter 2.5 of this manual.

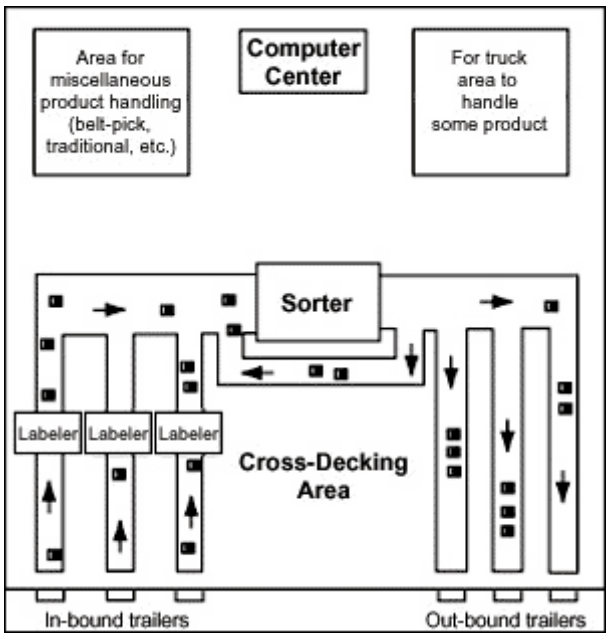


Figure 2: Diagram of a Cross-Docking Order Picking System

Material Handling Hazards in Refrigerated Warehouses

Material handling best practices require knowledge of sources of injury and should include proper planning and training for employees to prevent injury or loss of material handling efficiencies. Knowledge of specific material handling hazards common in warehouses raises employee and manager awareness, but it also enables employees and managers to generate standard operating procedures for dealing with them.

The following sections list several common warehouse hazards and provides tips that can be developed into standard operating procedures to mitigate risks of musculoskeletal injury or damage to material from material handling. Material handling hazards often consist of job features, which have potentially harmful effects on the body.

Material handling hazards in warehouses can be the result of:

- Faulty workstation layout/environment: poor lighting, excessive reaching for phone or mouse, sitting or standing continuously.
- Improper work methods: application of excessive force to get the job done, high repetition rate, and improper lifting techniques.
- Improper tools: tool does not match task, extreme or awkward postures when using tool, tools that dig into the palm.
- Job design problems: inadequate work/rest regimens, pace of work is too fast.

Transport hazards

During transport, employees often move material through the warehouse on pallet jacks. A pallet is placed on a pallet jack and merchandise is removed from a storage area called a slot or pick bin, and then placed on the pallet. Many of these loads, especially in refrigerated or freezer warehouses, are extremely heavy. Case weights upwards of 80 to 100 pounds are not uncommon.

Problems from transport can be mitigated with the use of racking. Racking is used to expand the amount of storage that is possible. Properly installed racks also are placed so that material can be quickly and easily moved to and from pallets. Metal racks are used for storage and the area created within the racking is called a pick bin or slot. Slots range in size, depending on the products stored. Considerations for slot size include:

- Low locations
- High locations
- Double or triple slots
- Reaching
- Aisle width

Low location hazards

Palletized products in warehouses are often stored in pick bins that are typically placed on the floor. This requires employees to bend at the waist to access these palletized loads that come to the warehouse stacked only a few feet high or may be unloaded to the point where they are only a few feet high. Even when these pallets are stored in taller slots, employees must still bend at the waist to access product. This is a significant problem since the heaviest product is usually in the shortest stacks.

Low racking can force employees to bend at the waist to access loads. Loads in the bottom bins, requires forward torso bending to reach under the rack, even when the top levels of the stack are at waist height or higher. Hazards from low racks are greatest when:

- Pallets are stored in pick bins a few inches from the floor
- Low racking requires employees to bend at waist
    - Is a significant problem since the heaviest load is in the shortest stack
    - Storing pallets in taller slots still requires employees to bend at waist

Solutions to low location hazards include the following. Managers should choose appropriate interventions that make sense for their operation:

- Elevate pallets within slot bin. Whenever possible, elevate the pallets within a slot bin. The best technique is to place a palletizer into a tall bin. A palletizer will lower in height under the weight of a full pallet, then will raise the load as items are removed. The use of a turntable allows employees to reposition the load. This keeps the load close to the body.
- Place empty pallets under load. Pallets that do not have product stacked above waist height may be elevated by placing these empty pallets under the load. Care must be taken so the top level of the heavy product is not raised higher than mid-chest height.
- Raise bottom level of racking so loads are at heights where bending is not necessary.
- Provide a device such as a forklift with a built-in vacuum hoist. The strong suction can lift up to 150 lbs.

High location hazards

Employees often have reach above their shoulders to access products on upper shelves. This causes stress to the shoulders and back. Additionally, lifts above shoulder height often require awkward hand and wrist postures. Solutions to high location hazards include:

- Use elevated rack locations as the overstock storage areas, and lower pallets to more appropriate heights prior to being selected.
- Provide employees with "Pick Sticks" or "Bow Peep" hooks to pull lightweight product close to the edge prior to lifting.

Multi-slot hazards

Double or triple slotting, used to maximize shelving space so the greatest amount of product can fit in the smallest amount of space, may increase ergonomic stressors such as bending and elevated reaches. Workers may be forced to bend at the torso to reach under low racking to access product. Stacking product at more desirable heights that would not interfere with racking system would eliminate worker bending. Workers must reach above shoulder height to access material placed on three-tier racking or to access tall, palletized loads placed on two-tiered shelving. In general, bottom and top racking in three tiered systems creates significant access issues. Solutions to multi-slot hazards include:

- Providing full slotting for heavy or bulky products, so employees can have better access without undue reaching or bending.
- The bulkiest and heaviest products should be placed in the most accessible middle slots so that they can be accessed with the minimum of effort.
- Use gravity feed flow racks to store compact slower moving product.

Reaching-Out hazards

Hazards due to reaching-out are usually the result of product that has often been removed from the front of pallets first. This leaves the remaining product stacked in the

back of the pallets, where employees must reach out to access and lift the product. This creates additional stress on the shoulders and back. Solutions to deep slot, reaching-out hazards include:

- Developing a product rotation process where pallets are regularly turned using a forklift after the majority of product has been removed. This involves pulling the pallet out of the slot, turning it 180 degrees and replacing it into the slot.
- Place pallets on turntables so the pallet can be turned and optimal access to the product can be maintained at all times.
- Use roller and channel devices. These devices allow the load to be pulled out for better access. The addition of a turntable at the end of such device will allow the pallet to be turned and then replaced into the slot with the load closer to the front.
- Provide wider slots, especially for heavier products. This will allow workers to walk into the slot and access all sides of the pallet. Stockers should be trained to leave at least 16 inches between pallets so there is enough space for workers to move around the pallet during selection.

Aisle width

The width of aisles in many warehouses is often insufficient for access to fast-moving product. This may be due to the size of the aisles, or the congestion of products on skids that are being loaded or unloaded into supply bins. Aisle width may be insufficient for access to fast-moving product and may create congestion. This can cause workers to stop farther from the pick slot and carry product longer distances. To save trips, workers may also be tempted to carry multiple parcels at the same time. Solutions to aisle width problems include:

- Increase the width of aisles for fast-moving products. This allows for closer access and reduces the distance loads must be carried.
- Stagger start times for workers at the beginning of the day so fewer selectors hit the same slots at the same time. Five- (5) to ten- (10) minute start time differentials should provide adequate spacing for sufficient disbursal of selectors.

Packaging Problems – Heavy Containers

Products in warehouse can vary in weight by up to 100 pounds and are shipped to the warehouse in a variety of containers, including boxes, bags, and cans. The shape, weight, and/or material of these packages greatly affect the stress that a warehouse employee experience.

In cold or freezer warehouses many boxes are excessively heavy, and may weigh as much as 100 pounds. Manually lifting loads in this weight range places great stress on the employee's muscles. Back injuries, such as muscle strain and disc injury, can repeatedly occur when lifting these heavy objects. Possible solutions to heavy containers include:

- Work with suppliers to provide product in lighter containers.
- Improve access to heaviest items. Employees should be able to access these items without bending at the waist.

- Redesign storage and transport devices to improve the employee's ability to maintain neutral postures.
- Provide handhold cutouts or handles on all heavy products.
- Work with suppliers to ensure that containers will be adequate, so the unit will not break apart during lifting.
- Load heavier pallets with lighter product in the center and heavier product on the outer edges to ensure easier access to heavier items.

Packaging Problems – Inadequate Handholds

Many packages that come into warehouses do not have adequate handles or handle cut-outs. This makes heavy cases difficult to grasp and/or retrieve, which forces employees to use awkward postures when lifting these packages. Without hand cut-outs or handles, employees must press on the sides of boxes, slip fingers under the lips of products, or grasp the loose material of bags to gain control.

These techniques place strain on the hands and shoulders. A possible solution to the inadequate handhold problem is to:

- Encourage suppliers to provide product in stable boxes with hand hold cut-outs or handles. This is especially important for products that are extremely heavy as it will reduce the strain on lifting these products.

Packaging Problems – Plastic wrapping

Many cases are now packaged in plastic rather than cardboard containers. Plastic from one package may stick to another package. The added resistance of the plastic can create additional stress to the hands, arms, shoulders, and back. Selectors often pull cases toward their body to gain better lifting advantage. Forces required to pull the cases with these restrictions may actually be greater than the weight of the case. Possible solutions to the plastic wrapping problem include:

- Working with suppliers to put a slip-sheet between the layers. This decreases the force needed to slide product.
- Treat cases as heavy loads regardless of their actual weight, use pallet jacks and other equipment to move them, at least initially. After they are separated, it may be possible to treat them as normal loads again.
- Provide additional headroom and space on the side of stacks for access.
- Request that suppliers wrap items to wrap only the sides and tops of cases, leaving the cardboard bottom exposed to facilitate sliding.

Packaging Problems – Wooden pallets

Wooden pallets weigh often between 30 and 70 pounds. These items are considered extremely heavy, and repeated lifting of these items causes stress to the lower back. Splinters from handling the wood are also a hazard. Solutions to problems from wooden pallets include:

- Requesting that suppliers provide product on lighter, plastic pallets. Employees of both the 3PL and supplier will benefit from the reduced weight.

- Plastic pallets easily nest together to reduce the space of stacking. This will eliminate splinters and uneven surfaces that employees may step on when walking over pallets.
- Provide a pallet dispenser to reduce handling of pallets. This device allows selectors to drive their pallet jack to the dispenser. An empty pallet is then automatically loaded onto the forks without manual lifting.

Packaging Problems – Wrapping Pallets

After loads have been built, they are often stretch-wrapped with plastic to maintain integrity during transit. Employees may be injured when performing this task manually, as they often may bend at the waist to wrap the bottom of the pallets or stick their fingers into open ends of tubes to wrap, and risk getting cuts. Solutions to this problem include:

- Using an automatic plastic wrapping machine with palletized product sitting on a turntable. This ensures the employee will not have to bend at the waist to wrap the pallet.
- If manual wrapping must be performed, use rolls that weigh as little as possible to minimize the lifting hazard. A handle attached to the roll will prevent employees from placing their fingers into the tube, thus decreasing the risk of cuts.

Opening hazards

Boxes in warehouses come in many sizes, and shapes, and usually have to be cut open with a razor knife. If the knife is too small, employees have a tendency to use a pinch grip, which may stress the tendons of the hands. The use of in-line knives (handles are in-line with the cutting blade) can cause the employee to twist their wrist while exerting finger force, thereby increasing the risk of musculoskeletal injuries.

A solution to the opening hazards problem is to:

- Use ergonomic razor-knives that require less wrist bending and have substantial handles that require less finger force for control.

Material Handling Work Practice Hazards in Refrigerated Warehouses

As in other types of industries, management and staff employees who work in a warehouse need be aware of best practices that minimize the possibility of injury. Items such as the patterns for pallet unloading, break schedules, training, or the number of hours worked can greatly influence the potential for injury. Some of the work practices that need to be of concern include:

- Depalletizing
- Taking shortcuts
- Unexpected exertions
- Holding objects while lifting
- Using improper foot wear
- Utilizing medical programs
- Training new employees

Depalletizing

Workers encounter many racking situations in a typical warehouse and often depalletize in ways that expose them to unnecessary stressors. Depalletizing is where material is removed from a pallet where it has been stacked, usually in multiple layers. There are two common techniques of depalletizing: 1) layer-by-layer; and 2) pyramiding. Either technique may be used depending on racking and product types.

An evaluation of each racking situation should be performed either by management or by a trained employee to determine the least stressful method of depalletizing. An appropriate selection should consider the nature of the load, the weight of the load, and the type of racking system used.

Layer-by-Layer Technique: In a layer-by-layer technique, selectors remove all cases from one layer before the cases from the next layer are removed. This technique requires employees to reach to the back of a palletized load and pull an item forward. This process moves the load closer to the body prior to lifting, but it can also create back and shoulder hazards if cases are extremely large or heavy. Also, weak or small handles, stacks above shoulder height, or cases that do not slide easily can stress the shoulder, back, and possibly the knee during reaching and pulling motions.

Pyramiding Technique: In the pyramiding technique, cases are removed in a diagonal pattern from the top front to the rear back. This technique is preferred when weight, size, and handle types are like those mentioned above. In these situations, the employee can limit forward reaching and pulling by moving closer to the load and lifting the closest container, often leaving the remaining stack in a pyramid shape. Pyramiding is not suggested if the pallet is unstable or in an area with little clearance space for employees. Many of the new racking systems, such as the push-back model, are elevated on slides and tightly packed into a pick slot. These configurations limit stability and accessibility, forcing employees to reach considerable distances across empty portions of the pallet to access and lift loads. Even lighter loads can create considerable stress to the shoulder, back, and knee when held away from the body.

Employees should generally use a layer-by-layer technique in push-back racking systems where employee access is limited, and pyramiding creates longer reach distances. Examples best suited for layer-by-layer depalletizing are:

- Boxed product, preferably with handles or cutouts
- Lighter boxes that slide fairly easily
- Product stacked below shoulder height (measured with the pallet on the rack)

A layer-by-layer approach can be made easier using the following methods:

- Use a hook to pull product from the back of pallets, allowing the arm to stay closer to the body, and reducing stress to the shoulder.
- Order product, such as bagged produce, with slip sheets between the layers to facilitate sliding
- Order product in boxes rather than bags. Boxes are easier to slide than bagged product, and boxes are usually packaged in smaller quantities, so the overall package is lighter.

- Place a slip sheet made of low friction material on partially emptied layers to facilitate sliding of product from the back of the pallet

Pyramiding on a push-back system may be acceptable for lighter product such as toilet tissue or Styrofoam plates. Product on push-back systems should be stacked low enough so reaches above head height are not required. Pyramiding may be acceptable for heavier items or items that do not slide easily, such as bagged onions, if the pallet is placed on the floor or another solid support that provides adequate access and the pallet itself does not present a hazard if walked on to provide easier access. Plastic pallets will provide a better base than wood slat pallets.

For lighter loads stacked above shoulder height, it may be possible to use a combined approach. The top layers can be pulled down the sides in a controlled fall using the pyramid technique. When stack height drops below shoulder level, product can be removed in a layer-by-layer fashion.

If a push-back system is to be used with a pyramiding technique, equip it with a positive lock mechanism such that the pallet is held firmly in place and cannot be pushed backward if an employee steps on it. This will allow employees to place one foot on the pallet to improve access and limit reaches. These postures will still not be acceptable for heavy product such as most meat items.

Tag slots as to what type of technique should be used and train employees about both the tagging system and selecting techniques. Develop systems so employees keep product that has to be lifted closer to the body, minimizing reaching out and twisting. Possible solutions to reduce reach-out stresses and twisting stresses include:

- Utilizing a turntable in bays so pallets can be rotated to ensure that the product is close to the aisle prior to lifting
- Create space around palletized loads so employees can access product from the side, keeping it close to the body prior to lifting
- Develop a product re-orientation process for unloading using the pyramiding technique. The turning process should turn the pallet around 180 degrees to improve access. This will place the empty portion of the pallet at the back of the slot and place product closer to the aisle. This can be done by replenishing personnel during the stocking process or by a designated individual assigned to this task.

Taking Shortcuts

In many instances, workers tend to reach across a pallet rather than walking around. This puts unnecessary stress on workers and can cause chronic strain, which, over time, often develops into injuries, especially to the shoulders and upper back. Workers may feel pressure to take shortcuts and risk injury if they are not given adequate time to complete given tasks. Solution to workers taking shortcuts is to:

- Factor proper work practices into pick times. Time limits should not force employees to use shortcuts.

- Employers should provide training to workers so they understand the importance of performing tasks using proper ergonomic techniques.

Unexpected Exertions

Many times, even experienced workers will come upon situations where they must perform unexpected exertions. This can happen when: a box weighs more than expected; a box falls apart, creating the need to perform quick and unexpected actions to save the load; boxes stick together, and additional force is needed to separate them; poor footing causes the load to be supported in an awkward posture; and when quick motions occur while handling a load. Solutions to unexpected exertions problem include:

- Tagging slots with case weights. This can be accomplished by noting the case weight on the slot in clear and easily read terms, or by color-coding the slot to indicate the hazard. For example, the area in front of the slot can be marked with a red marker to indicate those areas where the heaviest product is stored.
- Request suppliers pack product in sturdy cases, appropriate for the environment.
- Clean areas in the stocking aisles to avoid slipping.
- Educate workers on the importance of appropriate footwear.

Holding Objects while Lifting

Stickers are often placed on boxes after they have been selected. This requires employees to hold a sticker sheet while selecting and lifting product. If employees hold these sheets while performing this task, their contact with the box is reduced. This can lead to slippage and unexpected exertions, which increase the chance of injury to the back and shoulders. Another problem is that one hand may exert more force than the other, which can lead to uneven weight distribution. This increases the chance of injury to the back and strains to tendons in the hand or forearm. Solutions to this problem include:

- Using sticker dispensers that can be worn around employee's waist. This allows selectors to use both hands when lifting product.
- Provide clipboard on pallet jack to hold sticker sheets that frees employees' hands while lifting.

Improper Footwear

Much of the work done in a warehouse environment requires selectors to be on their feet for long periods of time. This commonly causes fatigue in the leg muscles that must continually support the body. Employees are also required to work on hard surfaces, which can create contact trauma or tendon and muscle problems if proper footwear is not worn. Solutions to this problem include:

- Educating employees about proper footwear. Proper shoes maintain foot support and provide shock absorption while walking on hard surfaces
- Provide employees with padded shoe inserts that support the foot and cushion against foot strike. Shoes with non-skid soles are important, especially where surfaces are potentially slippery.

For additional information on footwear, see chapter 6.4 of this manual.

Utilizing Medical Programs

Without a medical management program, the presence of musculoskeletal disorders would probably be underestimated. With reduced awareness of musculoskeletal disorders, symptoms may go undetected until they become disabling injuries. Injured employees are less likely to get timely and appropriate care and restricted duty programs may not be established or utilized if proper medical management is not in place. Solutions to this problem include:

- Consulting with a medical specialist who has experience in and is familiar with work-related musculoskeletal disorders. This person may be a physician, a nurse, or other healthcare provider that is familiar with causes of musculoskeletal injuries. They should be allotted time to track injury trends, coordinate injured employees' visits to healthcare facilities, interact with the treating physicians, and interact with the ergonomic committee regarding return-to-work activities and restricted work jobs. This person can also act as the principle contact person for Workers' Compensation issues, and the liaison between management, healthcare and employees.
- A relationship should be developed with a local medical clinic if an on-site specialist is not an option. It is imperative that the healthcare professionals be familiar with the type of tasks the employees perform. This will assist in diagnosis and the return-to-work process after an injury. If a clinic is used, it is important to have a responsible party on-site to act as a liaison with the medical provider.
- A return-to-work program should be developed for placement of injured workers into jobs consistent with their medical restrictions. A well-constructed plan allows employees to return to work sooner and increases the chance that they will eventually return to their original job. The challenge of such a plan is to develop and categorize jobs within a facility that do not violate the restrictions given by the physician. Care should be taken to develop such a program in cooperation with any workers' unions, medical staff and contractors.
- Symptoms should be reported as soon as they start to develop. Early reporting can help address potential problems before they become serious and costly lost-time injuries.

New Employee Training:

Newly hired employees may not recognize ergonomic hazards or understand effective techniques used to minimize these hazards. Therefore, employers should:

- Provide general ergonomics training and work-task specific training at the time of new-hire orientation. Explain the risk factors and proper work techniques to minimize these hazards.
- Provide appropriate videotapes of proper work practice for employees to review on a regular basis. In addition to regularly scheduled refresher training, injured employees should be retrained regarding ergonomic risks pertinent to their injuries. Provide Post Incident Refresher Training after injuries.
- Mentor new employees with an experienced worker who can provide insights on the proper and most efficient methods to perform their tasks.

- Explain the medical management system to new-hires. This will let employees understand how to report an injury and how the company prefers its employees to seek medical attention. This can expedite assistance, reduce costs, and improve lines of communication.

The Following Checklists are provided in Appendix 8 of this Manual:

- 8.5 Material Handling Safety Checklist
- 8.6 Docks & Elevated Surfaces Checklist
- 8.7 Ergonomics Checklist

3 Effective Shipping Practices

3.1 Shipping Practices

Effective shipping practices are important aspects of successful warehousing. Shipping involves both the front office staff as well as warehouse personnel to effectively collect and coordinate outbound products. Assuming that the put away and storage process was properly managed, the act of picking and shipping orders is relatively simple and efficient.

A shipping checklist is provided in Chapter 8 of this manual.

Front Office Activities

The shipping process is generally initiated by the customer, who contacts the warehouse and authorizes the release of certain products, generally by item codes listed on a purchase order or release number. The contact is made by various means, the most common of which are Internet or Electronic Data Interchange (EDI), facsimile, or third-party mailbox. It should be noted that some warehouses accept telephone releases from valued customers. This is generally not encouraged and should be done only with great care and under special circumstances. If the warehouse does not receive a Purchase Order (PO) or release number from the customer, front office personnel should generate a release number that the customer is willing to use. The PO or release number is a control number used to verify that the truck driver is authorized to pick up the product. If the driver fails to provide the proper PO or release number, the outbound load should be held until the driver is able to produce the correct number. Generally, having the driver call the dispatcher clears up this problem.

Scheduling Appointments & Data Collection

If the customer uses its own transportation department or brokers the load to a third-party or outside carrier, an appointment schedule time is negotiated with the customer and this data is recorded on the applicable warehouse scheduling form or entered into the computer system. It is also common for customers to "roll down" the task of obtaining an appointment time to the carrier they select to handle the freight, meaning that the carrier or third-party transportation company is responsible for contacting the warehouse to schedule a pick up time or appointment. It is important to stress to customers and third-party transportation companies the importance of scheduling pick up times, which significantly impact and improve shipping procedures, customer service and warehouse efficiency. When the customer

or carrier calls the warehouse for a pick up appointment the front office staff should gather information about the delivery, including but not limited to:

- Name of carrier
- Purchase order or release number
- Number of cases/units to be shipped
- Number of different items
- Type of loading (pallets, slip sheets, floor loaded)
- Temperature of the trailer (chilled or frozen)
- Participating in a pallet exchange program?
- Loading diagram or configuration
- Estimated arrival time at the facility

Data Entry & Shipping Dock Notification

Front office personnel should initiate the paperwork necessary, perhaps including a shipping form, for documenting the outbound load. Available loading weight and any special loading instructions should be requested from the driver. If paperless tools are used, information should be transferred to dock personnel when appropriate so that preparations on the dock are made. Once all of the necessary information has been gathered and entered into the warehouse system, the appropriate information or paperwork can be sent to the shipping dock supervisor.

Signing Out the Driver

When loading has been completed, the front office should review the shipping documents (i.e., the bill of lading, shipping manifest or similar) with the driver. Items to review include destination, load weights and set temperature for the refrigeration unit. The driver is to sign the shipping documents to indicate that the driver has taken responsibility for the load and its condition.

Some warehouses will provide the driver with seals at this time for the driver to apply; in some cases a warehouse customer's procedures require that the warehouse apply the seals either from the loading dock (if the dock design allows closing the doors while the trailer is still at the door) or by sending a warehouse team member outdoors to apply the seals. In all cases, seal numbers must be recorded on the shipping paperwork. Additional seals may be provided to the driver if the load is multi-stop.

Note: Most public warehouse shipping documents indicate that the driver is signing for "carrier count and seal" to indicate that the driver has had the opportunity to review the load as it was being loaded, that the driver has approved the physical loading, the condition of the product and the product count. In order for the carrier to be held responsible for "carrier count and seal," the driver as the carrier's representative must have been afforded an

opportunity to access the warehouse loading dock and review the loading process and cargo. (See the "Driver Counts" section of this chapter below.)

Shipping Dock Activities

When the carrier arrives at the warehouse and checks in with shipping dock personnel the time of arrival should be noted on the shipping form. After verifying the driver's information and determining that he or she is the proper person to receive the shipment, a shipping dock door is assigned to the driver, if one is available. If this is a scheduled pickup and the driver arrives at the appropriate time, the next available door opening is normally assigned. It is important to use common sense when assigning dock doors for shipping. For example, if the product to be shipped is coming out of a freezer room located by door #1, and door #40 is currently available, assigning this door to the driver would result in warehouseman transporting the product an inordinate distance on the shipping dock in order to bring the product from the freezer to the trailer. Therefore, the above "rule" should be modified to assigning the next available door opening in close proximity to the shipment. Proper planning by the warehouse should generally result in doors being made available to drivers close to the where the product is being staged.

Trailer Inspection

All storage and shipping trailers should be maintained in a sanitary manner as well as in good repair. Properly maintained trailers will reduce the potential for product damage and/or adulteration and will reduce the opportunity for claims and food safety risk. Records should indicate compliance and/or non-compliance for each of the inspections. The Quality Assurance (QA) Department should be notified of any non-compliance, so that the transportation service provider and/or the customer may be contacted.

All trailers should be inspected by the warehouse prior to loading, specifically including the following areas of emphasis:

Transportation Refrigeration Unit (TRU)

1. Prior to loading, the refrigeration unit must be used to pre-cool the trailer or container to a minimum of 40° F or 4.4°C for chilled shipments. The unit must be capable of achieving this prior to loading.
2. Once the unit has pre-cooled the trailer or container to the desired temperature, the unit should be shut off to prevent the refrigeration unit from freezing. If the units are running during the loading process, the opportunity exists for warm air to be pulled into the unit from the dock or outside, forcing the units to work harder to remove moisture from the air and potentially resulting in ice build-up on the coils. It is therefore recommended that once the unit has successfully pre-chilled the

trailer or container, the driver be requested to shut it off during the loading process. This practice will also create a more worker-friendly environment since workers will not be working directly under the cooling fans.

3. Trailer or container doors should be closed immediately after the loading is completed, and the refrigeration units turned back on.
4. When loading has been completed, the driver should set the thermostat on the unit per the customer's instructions (as relayed by the front office in the shipping documents) to maintain product temperature throughout transport, typically 10° F below the targeted receiving product temperature.

Cleanliness

1. The interior of the trailer should be free from excessive build-up and odor.
2. The floor of the trailer should be clean, and it should be free from rubbish, product residue, insects and odor.
3. Floor drains in the front and back of the trailer must allow free flow.
4. Walls and ceiling should be free of product residue, tape and odor.

While it is the warehouse's responsibility to inspect the trailer for cleanliness before loading, it is the driver's responsibility to have a clean trailer for loading. If the trailer is dirty, the driver has the responsibility to clean the trailer prior to the warehouseman releasing product for loading. If the driver refuses to clean the trailer, advise your supervisor or the proper customer service representative, who should report this information to the customer. If the customer agrees with your decision, it can authorize payment to the warehouse for cleaning the trailer, or it may elect to have the warehouse load the trailer even if it is dirty. If the customer wants the warehouse to load the trailer without cleaning, obtain the name of the customer's representative and record the name, phone number, and the time of the call on the shipping documentation. If possible, obtain a fax or email from the customer authorizing the warehouse to load the product under the noted situation, otherwise send a fax or email to the customer in confirmation. In either case, no product should be loaded on a trailer or container that could result in the USDA, FDA or CFIA considering the product to be adulterated.

Odors

Odors in the trailer may be transferred into the product being shipped, especially high fat refrigerated items, thereby resulting in potential damage, loss, complaints or claims. If a strong odor is evident in the trailer, it is recommended that the loading be suspended until the customer can be contacted. Similar to the situation with cleanliness, customer authorization or direction should be gained before continuing with the loading process.

Condition

1. Door seals should completely surround all openings and be in good repair.
2. The floor should be free of temporary repairs, have no evidence of potential insect harborage and allow water to completely drain.
3. Insulation in walls and ceiling should not be exposed to allow insect harborage.
4. The ceiling curtain used to distribute cool air should be in place and in good repair.

It is important to note any damage to the inside or outside of the trailer, including but not limited to sidewall damage that may impact the insulation of the trailer, doors that do not properly seal, or improperly functioning floor drains. Any or all of these defects can negatively impact the cold environment inside the trailer, creating warm air infiltrations, hot spots, fluctuations in temperature or dirt and dust infiltration during transit.

A trailer inspection checklist is provided in Chapter 8 of this manual.

Securing the Trailer

Once the appropriate information has been collected and the interior and exterior of the trailer visually inspected, warehouse personnel should ensure that the trailer is properly positioned at the dock and that appropriate safety procedures, including but not limited to wheel chocks, International Code Council (ICC) locking bars and door locks, are properly placed to prevent injury. It is important to be absolutely certain that the trailer is properly secured before allowing warehouse personnel to enter the trailer and begin loading.

Pallet Management & Exchange

If pallets are to be exchanged, warehouse personnel should count and inspect the pallets, noting the number of acceptable pallets to be received through the pallet

exchange program. Warehouse employees should be trained to identify pallets that are unacceptable, and these pallets should be returned to the driver before loading. The warehouseman should record the number of acceptable pallets received on the pallet exchange form and have the driver sign the form. If the driver refuses to accept the defective pallets, he or she forfeits the pallets and will receive no credit or compensation for the defective wood left behind. It should be made clear that the warehouse will not hold the pallets for pickup at a later date.

Additional information about pallet exchange programs and pallet management is provided in section 2.2 of this manual.

Picking Products

When the forklift operator obtains the product for shipment, the source operating document used is either a pick ticket, delivery ticket or via a radio frequency (RF) terminal. The picking documents identify, among other things, the lot number and the location where the product is stored. The warehouseman who will obtain this product is directed to the location appearing on the document where he or she will physically remove the number of units required for the shipment. If only a portion of the units are removed from the pallet, the remaining inventory will be returned to the location where the product was originally stored. An exception to this rule occurs when the remaining product is relocated for space consideration or to reduce honeycombing. Under these circumstances, the warehouseman should complete a relocation sheet identifying the new location used to store the remainder of the product. The relocation sheet is turned into the office where the location file is updated reflecting the change made by the warehouseman.

If the warehouseman goes to the proper location and cannot locate product to be retrieved, he or she must notify the supervisor and report this information to the office. The office staff will provide an alternate location from which the product can be retrieved. If the product is in the alternate location, it should be pulled for shipment; the location on the delivery ticket should be changed to agree with the proper location; and the original location should be deleted from the file. If the product is elsewhere, the problem can sometimes be corrected by looking for the item and adjusting the location file when the product is found.

If the product is not found, the warehouseman or in some warehouses an inventory control warehouseman may have to analyze the lot history reports to determine if the entire lot was previously shipped. If that is the case, the product was probably picked incorrectly and another lot was substituted for the lot appearing on the picking document. The result of this oversight may be mis-rotation of products, which may be indicative of a serious operational issue.

Additional information about effective order picking is provided in section 2.3 of this manual.

Staging of Loads

Warehouse operations are made more efficient and profitable when loads and shipments are properly staged prior to the loading process. This procedure allows management and warehousemen to check and double-check "pick tickets", purchase orders (PO), lot numbers, case counts, and other details associated with efficient delivery functions. If advance notice is provided to shipping dock personnel, loads can be pre-selected and staged in advance of the arrival of the truck.

The warehouse must have absolute control over the staging area as well as the location and identification of each pallet. Without these controls, errors could easily result which will defeat the intent of the staging process. If the warehouse has the proper controls in place, staged products can be loaded directly into the trailer either by the warehouseman or the driver.

The ideal place to stage outbound products is in the cooler or freezer, close to the door in a dedicated staging area. Consider the following when staging products for shipment:

1. Locate the staging area at the front of the room, as close to the door as possible.
2. Provide adequate space for workers to check load details, (case counts, lot numbers, product codes, etc.).
3. Locate the staging area in a secure area in order to minimize or prevent product damage or loss. High traffic areas and aisle ways should be avoided.
4. Stretch-wrap pallets after checking to accelerate the loading process and reduce damage to cases and improve loading time.

Extended Time on the Shipping Dock

Staging products on the shipping dock is discouraged. While most docks are refrigerated or cooled, they are normally not held at a consistent enough temperature for refrigerated products and are not held at a low enough temperature for frozen products. Most refrigerated docks are held at 40 F, or 4.4 C, which is adequate for holding chilled products but above the desired holding threshold for frozen products. As a result, frozen products begin to warm on the dock, perhaps creating a food safety risk as well as potentially reducing product quality of temperature-sensitive products. In addition, temperature fluctuation can result in condensation build up on the boxes and stretch wrap during extended time on the dock; which can negatively impact appearance, image and box strength, thereby potentially leading to additional issues and damage later.

Aside from the quality and safety aspects of staging products on the dock, efficiency can be severely impacted by this procedure. Loads staged on shipping docks consume valuable working and moving space, add to congestion, and diminish

worker efficiency. There is no assurance that the driver will arrive on time, further reducing the incentive and efficiency associated with staging loads on the shipping dock.

Product Counts

The single most important activity when shipping is product counting; with proper product rotation a very close second. When the product is being counted, if any doubt exists about the case count, the warehouseman ***must*** double check the counts to verify that the quantities agree to the data on the delivery or pick ticket, if one is used. When the warehouseman counts the product scheduled for shipment, he or she must verify that the proper number of cases, by item and lot number, agree to the information on the delivery ticket. This verification will enable the warehouse to have proper control of the inventory, and proper product rotation. If the lot numbers do not agree with the delivery ticket or pick ticket lot numbers, it may be due to the warehouseman ignoring proper lot rotation. This also creates a shortage in the lot the warehouseman picked from, and an overage in the lot the product should have been removed from. The counts by lot number and item description must be accurate. If they are not, mis-shipments and improper product rotation may occur. Mis-shipments translate into costs for which the warehouse will be held responsible. Equally important is the cost resulting from lost business suffered by customers due to warehouse errors. The reputation of the warehouse company also suffers badly if it does not properly control the inventory entrusted to it.

Product Weights:

An accurate accounting of gross loaded weight may be required by the driver. If shipments are exported from the United States by ocean vessel, accurate weights are essential for compliance with Safety of Life at Sea (SOLAS) regulations.

When weights are identical across all cases of a SKU, so-called "even weight," the calculation is simple. In some instances, the warehouse may be required to perform a function defined as taking "catch weights" or "take weights." This activity occurs when the same SKU has varying case weights. The warehouse customer may use the reported net weight for invoicing purposes; the gross weight (which is the total of the caught net weights plus the tare) will be needed for SOLAS. Numerous ways exist for performing this function. If, for example, the cases have a bar code label, the warehouse could scan the weights and print the document that identifies the individual case weight, as well as total weight by lot and SKU. Irrespective of the manner used to pick products, workers should palletize the products in such a way that the take weight label of each case appears on the outside of the pallet. When the product is brought to the dock, another associate records the weight information on a special form, which is sent to the office where the weights are totaled by lot. If the cases being selected are small and cannot be stacked on a pallet where the weights can be seen, a calculator can be used to enter the weight information in

tenths of a pound. This approach is slow and is the least desirable. Regardless of the method used, at least **three** copies of the take weight data are required. One copy ships with the order and is given to the customer receiving the product, one copy is maintained in the warehouse file, and the original copy goes to the warehouse customer.

Labeling Services

In some instances, the warehouse may be asked to perform a value-added labeling service. This generally occurs when shipping generic product that require a label to be affixed to the product before shipment. When product is shipped, the warehouseman affixes a label which may show the brand number of the customer purchasing the product. The label could appear on the container or, on occasion, on each inner pack. If the information is not available to the warehouse at time of receipt, it must be available prior to the release of the picking document or delivery ticket. Ideally, the labeling requirements will be made available to the warehouse as soon as the customer has the appropriate information. Doing so will enable the warehouse to perform this function well before the shipping date, which translates into better customer service. It should be noted that the warehouse should check with the USDA, CFIA or other regulatory agency in charge before re-labeling or affixing labels to products being shipped out of an approved facility.

Driver Counts

The driver is responsible for counting the product submitted to him or her for shipment. The driver's clean signature on the delivery ticket should relieve the warehouse of any claim related to Over, Short & Damaged (OS&D) issues since the driver counted and accepted the product. This is not the case with a "shipper load and count" scenario, under which the warehouse assumes liability if the receiving destination has shortages or visible damage not attributable to transit. To attempt to limit this liability, the shipping warehouse will seal all trailer doors, and the first question asked of a receiving warehouse which claims a shortage is whether or not the seals were attached and what serial numbers were on the seals. The shipping warehouse will compare the serial numbers reported to the serial numbers recorded at the time the trailer was secured. The receiving warehouse does not place blame. All it knows is that a shortage was discovered when the product was counted on its dock. If the receiving warehouse received the shipment with seals intact and the proper serial numbers, it can only assume an error was made at the originating warehouse. If the originating warehouse is advised of a shortage, it must count its inventory to determine if the proper number of cases is on hand. If the count confirms that the originating warehouse has the correct quantity on hand, it indicates that it did not ship short and can request the receiving warehouse to verify its count. At some point the parties will arrive at a conclusion to settle the issue, which means the warehouse will either pay the cost of the shortage or refuse to pay the damages.

Loading Trailers

As a general rule, when loading a trailer with palletized products load the first pallet against the left side of the trailer and completely against the front of the trailer. Do not leave any gaps between the front of the trailer and first pallets. Place the second pallet next to the first pallet, also against the front of the truck. Do not allow any gap between the pallets. Depending on the make and model of the trailer, there may be a gap between the edge of the second pallet and the right side of the trailer. The third pallet will be in the second row and should start against the right side of the trailer and be placed against the first row. The fourth pallet should be placed next to the third, in the second row of the trailer. Do not allow gaps between the rows of pallets. Alternate the rows, between starting on the left side and then the right side until the trailer is completely loaded. Single pallets should be stretch wrapped. The final row of pallets should also be stretch wrapped for stability.

If the order does not completely fill the trailer, a "Load Bar" should be used to stabilize the load. The load bar should be placed between the wall of the truck and the palletized products, directly behind the last pallets loaded onto the trailer. Care should be taken not to damage the truck wall or the product by over applying pressure to the load bar. It should be noted that unless the trailer is owned by the warehouse it is most likely the responsibility of the driver to secure the load with load bars and not the responsibility of the warehouse.

Care should be taken to ensure that the top cases in the trailer do not inhibit air flow from the reefer unit in the trailer. It is important to maintain proper and unobstructed air flow around the pallets in the trailer to prevent temperature variations or abuse.

If the trailer is to be floor loaded, using a slip sheet system or manual loading, calculate the width and height of the load using the dimensions of the cases being loaded. Unless instructed otherwise by the driver, the height of the load should be level for the entire length of the truck. Care should be taken to ensure that the top cases in the trailer do not inhibit air flow from the reefer unit in the trailer.

Trailers with ribbed floors are ideal for floor loaded products, since the ribbing provides channels for cold air to circulate under the floor-loaded cases.

Drop Trailers

The preceding sections of this chapter have been written for the circumstance of live loading; that is, when the driver arrives with a trailer and is present through the loading and shipping process. Many of the procedures described for both the front office and the loading dock can be affected when the warehouse, customer and carrier have chosen to maintain a supply of drop trailers in the warehouse yard. In

those cases, the warehouse is frequently loading trailers in the absence of a driver or other representative of the carrier. This can raise issues including:

- The use of "carrier count and seal"
- Application of load seals
- Operation of the refrigeration unit
- Fueling, yard checks to see that units are running
- Yard security and concerns regarding theft of or from loaded trailers

These and other relevant matters must be discussed and agreed to by the affected parties, which may include the warehouse, its customers, yard management services and participating carriers.

Regardless of the agreement regarding this and other related matters there should be no doubt that once a carrier has signed for a loaded trailer and departed the warehouse yard, that carrier has then assumed responsibility for proper operation of all equipment and preservation of cargo in its custody in accordance with the instructions set out in the shipping documents provided by the warehouse.

4 Information Technology (IT) Basics

4.1 Management Software

Warehouse Management Systems (WMS)

Warehouse management systems are an integral part of the integrated supply chain for refrigerated foods and serve the primary function of maximizing the effective movement and storage of materials within a warehouse. In addition to this most basic function of tracking inventory from receiving to shipping, WMS can facilitate additional services such as put away, order picking, and tracking of lots, dates, weights or case numbers. Effective WMS direct and optimize inventory on the basis of real-time information and location within the warehouse. Furthermore, effective use of WMS will not only maximize the use of space, labor and equipment, but will enhance customer relations and exceed expectations.

It should be noted that there are two types of WMS software; **public** and **private**. The primary difference between the two systems is with regard to multi-client and billing capabilities. WMS for public refrigerated warehouses allows for multi-client billing and has a billing engine that enables the warehouse to invoice customers for storage and handling charges as well as for other value-added services such as freezing and cross-docking.

WMS offer the user the option to run a paperless operation, using a combination of radio frequency (RF) terminals with integrated or attached bar code scanners, or to run a paper-based system with pick sheets and paper reports. Most systems also provide a range of site, partner, consignee, zone, location and item specific settings or rules, which allow the user to customize the system to define how a number of operations will be performed in each case.

The use of WMS can improve logistical control within the warehouse, primarily by reducing operating costs and allowing the warehouse to operate in real time mode. WMS software is capable of reducing the travel times associated with specific tasks, such as picking and put away, thereby improving employee productivity. Likewise, employee productivity is enhanced with an effective WMS program that accurately tracks product location, thereby eliminating unproductive steps in the process and reducing hunt and search times. The real time capability of WMS effectively reduces traditional lead times for order processing and inventory management, thereby providing the opportunity to

exceed customer expectations and enhancing customer service between the warehouse and the customer.

WMS software can improve efficiency associated with order entry and order scheduling by recording special customer requirements, including but not limited to packaging, palletizing, labeling and/or documentation requirements for each item. The system can manage available inventory as close to real time as possible, thereby reducing lead times and turnaround. The WMS can even anticipate shipping dates on the basis of inventory rotations and data collected on inventoried items. For more efficient shipping functions, WMS help plan daily activities, including but not limited to allocating labor for daily activities, including pending work, work in the queue, work in progress, work completed and emergency order generation.

WMS improves efficiency during receiving by properly identifying and tracking products coming in to the warehouse. Accurate receipt information, receipt validation, and receipt confirmation all contribute to a shorter receiving process and more efficient dock operation. In addition, the WMS manages discrepancies, including over/under counts, wrong or missing items, and shortens the time products remain on the receiving dock.

During the put away and storage process, WMS improves the functional operation of the warehouse by tracking product location, determining available and proper location for put away, reducing honeycombing, maximizing space utilization, counting inventory by storage location and conducing a total on-hand inventory. This information is maintained on a real time basis.

Picking and shipping functions are also streamlined by WMS technology, with the system optimizing picking paths, reducing travel times, managing lot numbers and ensuring proper product rotations (by FIFO or production date), and recording inventory on hand, allocated or quarantined. Once picked, the WMS determines the proper routing of products to the staging area or lane, automatically generates a bill of lading (BOL) and updates the customer inventory file.

In order for a warehouse management system to operate, data must somehow be inputted into the system. Data is most commonly gathered using some form of Auto ID Data Capture technologies (AIDC, see below) such as barcode scanners, mobile computers, wireless Local Area Networks (LAN's) or Radio Frequency Identification systems (RFID). Once data has been collected it must be transferred to the WMS, either through a batch synchronization process or with a real-time wireless transmission, depending on the level of sophistication of the systems. Once in the central system, the WMS can generate useful reports pertaining to the status of products in the warehouse.

Warehouses using WMS in conjunction with RF capability have the option of utilizing either RF-based data collection or fully directed functions, whereby everything from receiving and put away to stock movement, picking, loading, shipping and even cycle counting are directed by the system via RF terminals.

Transportation Management Systems (TMS)

Transportation management systems are a category of operations software that assists with logistics management and carrier selection. TMS software can allow the public refrigerated warehouse (PRW) to calculate freight rates and select the least-cost or most profitable carrier, with the TMS helping the warehouse manage the complicated duty of buying and selling of freight.

Most TMS software functions fall into one of the five basic categories: Planning, Carrier Performance, Trailer Loading, Highway Mileage Freight Payment Auditing, and Transportation.

Common functions and features of TMS include but are not limited to managing shipping units; shipment scheduling through inbound, outbound and intra-company shipments; modeling and benchmarking; rate management; database maintenance; generating bills of lading; load planning and optimization; carrier or mode selection; posting and tendering; freight bill auditing and payment; loss and damage claims processing; labor planning and building; documentation management (especially when international shipping is involved); cold chain management; and third party logistics management. Most TMS also have the ability to capture shipment information and track shipment status based on Electronic Data Interface (EDI) feedback from carriers.

The demand for TMS software is still underdeveloped but rapidly expanding, mostly due to the growth of load consolidation or freight management services commonly offered by refrigerated warehouses as value added services. In order to operate an effective freight management service, a powerful TMS is required. As such, warehouses have discovered the potential benefits of TMS, including lowered freight costs through optimized load planning; increased productivity of auto-tendering and shipment tracking; as well as increased management visibility and control through executive information systems. It is estimated that TMS freight savings can range between 2 and 6 percent for a high-volume Truck Load (TL) shipper and between 12 and 15 percent for a Less than Truckload (LTL) or mixed mode (LTL/TL) shipper.

LABOR MANAGEMENT SYSTEMS (LMS)

Labor management systems address labor costs, which represent one of the two largest single components of operating costs for a refrigerated warehouse,

ranging from 25% to as much as 50% or more. Labor management systems (LMS) have been developed to help refrigerated warehouse companies control labor costs by managing labor utilization and productivity. Labor management software can help improve efficiency and reduce operating costs by performing the following functions:

- Recording all activities while an employee is on the clock, including direct and indirect labor compared to historical data
- Monitoring performance levels on a real time basis
- Reporting labor activity against engineered labor standards
- Providing visibility to fair performance targets
- Viewing workload across functional areas and zones
- Measuring actual productivity against expected performance norms
- Calculating pay-for-performance data
- Providing productivity reports based on supervisor, employee, warehouse or team performance
- Apply activity-based compensation criteria to align hourly pay rates and incentives with performance results
- Providing key input into the labor planning process

In order to reduce labor costs and improve efficiency, existing labor costs are necessary for comparison purposes. There are two common ways of tracking labor. The first method uses Historical Averages to forecast labor requirements and to track and analyze the relative productivity of each employee. The second method, Engineered Labor Management, uses carefully defined labor standards to precisely predict the time required for individual units or work and then to record and compare each employee's results against the standard.

Historical Averaging

Historical averaging is the simplest and easiest to implement. It requires no engineering work, although it is normally only possible if you are using a sophisticated warehouse management system (WMS), since the WMS gathers transaction data that can be analyzed. Historical averaging can provide a reasonably good forecast of labor time required to complete certain work. The downside with historical averaging is that it cannot be used as the basis for productivity assessment and for taking action with poor performers.

Engineered Labor Management

Engineered labor management (ELM) systems use modern engineering techniques to set time standards based on distance, time and other factors, in such a way that a "standard" time can be calculated for individual duties and an employee's performance can be assessed against the standard time. In cases

where the standards are carefully set, and the employees agree that the standards are fair and accurate, significant increases in productivity can result.

Order picking measures include time for aisle travel, dock travel, walking, bending and case handling based on cube, weight and level. Measures for other jobs include time for trailers, pallets, items, pieces and distance.

The standards are based upon the motions to accomplish the task using the prescribed tools. The Standards Generator uses Master Standard Data (MSD), which is a pre-determined system based on Methods Time Measurement (MTM). MSD has been widely used in the warehousing industry since 1981 and can be found in the Industrial Engineering Handbook. MSD is a system based on an average individual between the ages of 18 to 65, five feet nine inches in height, 165 pounds with a 30-inch step. Thousands of individuals were studied back in the 1940's and a time was assigned to each movement. Two examples are a walking rate of 2.8 miles per hour and a bend rate of 2.2 seconds per bend. When observations are being made, the observer does not care how fast an employee works. All he or she observes are the prescribed methods and what motions are required to complete the work.

Once calculated and verified, the standards are converted to a database that is loaded into the ELM software. The software provides the functions to:

- Calculate goal times for all receiving; put away, replenishment and picking duties
- Perform various planning and forecasting tasks
- Edit work assignments and insert manual and lunch breaks
- Monitor employee performance
- Define system configurations and file settings
- Prepare various costing and productivity reports

The main operational data used by the system is retrieved from the host WMS. The data available from RF based systems is much more accurate. If the WMS in use is a paper-based system, employees usually log on and off work sets directly in the ELM software, in order to accurately capture actual start and finish times. The ELM system is normally interfaced with the WMS in use in the warehouse.

Labor cost savings are realized as a result of three factors:

1. **The Focus Factor.** ELM systems provide a uniquely objective means for management to focus attention on each employee's individual performance. Quite simply, employees stay focused on their work when they know their work is being tracked and measured against a fair and accurate standard.

The focus factor alone has achieved direct labor cost reductions of 5% to 10%.

2. **Forecasting.** Further labor cost savings can be realized by using the ELM to forecast labor requirements at the beginning of a shift or day. Used properly, such a forecast can make the difference between calling in extra people at regular wages or paying overtime wages. Forecasts can also help supervisors re-deploy employees where they are needed most, again avoiding paying extra hours when the needed work is not finished on time.

3. **Efficient Methods and Procedures.** The engineering process itself often highlights practices that are inefficient. As a part of the work to set standards, the engineer will review inefficient practices with managers, supervisors and employees, pointing out more productive ways to accomplish the same result. Once a Labor Management system is implemented, employees continue this process of identifying inefficient methods and changing them, in their new found drive for higher productivity.

It should be noted that The Focus Factor and Forecasting generally require a LMS, but it is nonetheless believed that the engineering standards increase the potential outcomes.

Studies have shown that incentive plans used in conjunction with LMS will achieve even higher gains. Companies that have used their LMS to establish a bonus plan for high performing employees have reported the highest levels of cost savings. An ELM system typically generates labor cost savings of 10% to 15%. An incentive plan that is based on ELM can increase the labor cost savings by as much as 5%, thereby providing a potential costs savings from engineered labor and incentive of 15% to 20%.

Dashboard Systems & Event Monitoring

If a warehouse is paperless and using Radio Frequency (RF) systems to transfer data on a real-time basis, there are several systems that can be integrated and customized to provide instant access to data and information. These real time event monitoring systems, sometimes called an alert system, is displayed on a dashboard. One of the newest ideas in enterprise systems is called a dashboard, event monitor or alert system. A dashboard system operates similar to the dashboard in an automobile, displaying a limited amount of important and updated information. A good dashboard system displays a low number of significant inputs, customized for the particular needs of each facility. Since a dashboard displays frequently viewed pieces of significant information, it must be customized or configured for individual installations or even users, taking into

account and defining key performance indicators (KPI's) that are measurable and meaningful to the company.

An extension of the dashboard system is called Event Monitoring. Event monitoring is designed to run behind the scenes, and reports errors or exceptions to proper operating conditions. Event monitors ring alarms the instant there is a problem, by sending out e-mails or pages to specific people when specific events occur or fail to occur. Like the dashboard function, event monitors must be configured or customized to meet the individual needs of one company or person. It should be noted that event monitors are completely dependent on accurate, real time information. An event monitor can not be effectively tied to on-time delivery if the warehouse does not capture proof of delivery information real time. Likewise, event monitoring can not monitor order fulfillment if the warehouse picks with paper. Unlike the dashboard, the event monitor will not be displayed often. In fact, if the warehouse system is operating as planned, no one will even know that the event monitoring system is running. The only indication that the system is active will be if there is a problem and the system sends an e-mail or page.

Business Intelligence is a new name for software with the ability to store current and historical data on a separate server, providing the ability to run ad hoc inquiries and reports that analyze business questions, without impacting the performance of day-to-day operations.

Management reporting is rapidly moving away from "hard coded" reports to flexible, user-created or user-defined information sets. The idea of printed reports is also fading out, as people realize that printed reports are to real time and are therefore obsolete as soon as they are printed.

4 Information Technology (IT) Basics

4.2 Radio Frequency Systems

Automatic Identification and Data Capture (AIDC or Auto ID)

Auto ID refers to the various methods of automatically identifying objects, collecting data about them, and entering that data directly into computer systems. AIDC systems range from fully automated and without the need for human interaction to human-assist programs (such as bar code readers) that capture data and upload information as part of a human effort in the warehouse. The most common AIDC technologies used in the industry today include but are not limited to bar codes, Radio Frequency Identification (RFID), magnetic stripes, and voice recognition systems. AIDC systems capture data through analysis of images, sounds or videos. As part of the capture process, a transducer within the system converts the actual image or a sound into a digital file. The file is then stored and at a later time it can be analyzed by a computer or compared with other files in a database to verify identity or to provide authorization to enter a secured system. Once captured, the data is uploaded into a master system through electronic means, such as wireless computer terminals or batch-synchronization.

Bar Codes are a popular and common form of ADIC, and contain data stored on the label in a series of lines, dots, concentric circles and/or text codes hidden within images. Bar codes are found on almost any commercial item in the supply chain. Bar codes do not require physical contact but do require line of sight. Bar code reading technology works by moving a thin, controlled light source across the bar code and then measuring the amount of reflected light. As the scanner compares the relative width of the peaks and valleys in the bar code pattern, it uses software to decode the unique set of data contained on the label. Data contained in bar code labels is extremely accurate due to the specific language associated with the bars and spaces on the label. This feature, combined with the technology that allows for high speed machine-reading, make bar coding simple, cost effective and very accurate.

In spite of the widespread popularity, use and affordability of bar code technology and systems, not all products are shipped with bar codes. If products arrive at a refrigerated warehouse without bar codes, the warehouse operator must make some important decisions pertaining to these items in order to properly manage and move the inventory internally. Issues associated with traceability, food security, identification, recalls, label compliance and inventory

management are all complicated when inbound products are not properly bar coded. It is recommended that warehouse operators put their own bar code on each incoming pallet, irrespective if the incoming pallet was shipped with or without a bar code. However, if the shipper is utilizing a "smart ticket" or Advanced Shipping Notice (ASN), the warehouse may not need to use an internal bar code or license plate number (LPN) to track the shipment.

When inbound products arrive at the receiving dock it is recommended that each pallet be assigned a plant-issued (internal) bar code license plate. This license plate will allow for a computer record to be created, listing the item number, quantity, lot number, production date, expiry date, tracking number and any other important information associated with the inbound product. The license plate number (LPN) should be affixed to one or more sides of the pallet and should remain on the product while it remains in the warehouse. Accurately identifying the product that has arrived is an important step in managing the throughput of the product in the warehouse. Efforts to accurately identify the product should involve the customer so that enough information is exchanged to clearly identify and track the products while in the warehouse.

Using RF technology, the license plate is used for every inventory transaction such as receiving, put away, re-warehousing, order picking and shipping. This allows the warehouse operator to increase not only the inventory accuracy but also the traceability within the warehouse.

Bar code technology also enables to capture critical information about the customer's product such as production dates, catch weight, serial numbers and other important information.

Radio-Frequency identification (RFID)

RFID is a modern form of AIDC and utilizes RFID tags or transponders to store and/or remotely retrieve data. Developed in the 1980's, RFID acts as a base in automated data collection, identification and analysis systems worldwide. The RFID tag or transponder can be applied to or incorporated into a product and can be read automatically from several yards away using different types of RF technology. Most RFID tags contain an integrated circuit for storing and processing information through a modulating and demodulating radio frequency (RF) signal as well as an antenna for receiving and transmitting the signal. These components allow the product with the RFID tag or transponder to be tracked at all times, using localized detection equipment or satellite technology. Lower cost RFID tags may lack the integrated circuit and are only able to detect location.

The concept behind effective use of RFID systems is to attach these small electronic tags to items, cases, pallets, re-usable containers, lift trucks and an endless array of other permanent or high-value items. The RFID tag is then read or interrogated by a "scanner" and the tag's license plate number or other data is recorded. These scanners can be handheld, like a bar code scanner, or mounted around a doorway. These doorway scanners or portal readers can theoretically read hundreds of tags as a pallet moves through the door, thereby allowing the warehouse and read all case and pallet tags as stock is moved into and out of the warehouse. However, it is possible that the doorway RFID scanner may not pick up all RFID tags on a given pallet, especially those tags that are on boxes buried deep inside the pallet. In this case, it may be more practical to utilize a system to scan the case tags as they are loaded onto the pallet, and then affix a pallet tag. The pallet tag will then be read by the doorway scanner, thereby effectively tracking product movement within the warehouse.

Within the integrated supply chain, the potential benefits of RFID technology are fairly straightforward. RFID tags containing an electronic record of the manufacture, item code or serial number can be placed on every case or pallet of product within the supply chain. This represents the basis of fully integrated product traceability, and can potentially improve performance, accuracy and improve labor efficiency.

Unfortunately, the application of RFID in the warehouse and supply chain has been slow to gain momentum, primarily due to a few lingering problems. RFID tags and tag reading technology are still relatively expensive. RFID tags can cost between $0.50 and $0.75, making them a considerable investment. The cost of RFID tags can be justified on an expensive item but is a difficult cost justification on lower value items. Another problem is that the RFID tags cannot be read easily or reliably when they are affixed to metal or fluids, due to the absorption of the radio waves, sent from the reader, by those materials. As frozen foods usually contain fluids at their solid state which can prevent the tags to be read, this technology still has to improve in order to be beneficial for a refrigerated warehouse and not only for its customers.

Within the refrigerated warehouse industry, companies stand to benefit greatly from RFID. As major retailers force manufacturers to apply RFID tags, refrigerated warehouse companies will be easily able to justify the costs associated with the scanning equipment against the cost savings they can realize. RFID can reduce the time to receive shipments into the warehouse and to pick, load and ship. One scan of a pallet could record the pallet number, tying into an electronic record of the individual cases on the pallet, thereby immediately tracking case numbers, catch weights, items, production dates, and other information contained on the RFID data chip. Since the refrigerated warehouse is not likely to be responsible for covering the initial cost of the tag,

which was most likely applied "upstream" in the supply chain at manufacturing, the potential payback to the warehouse is great if they utilize the data contained on the pallet or case.

In time, it is conceivable that RFID will replace bar coding altogether in the supply chain, but it will be a long slow transition. It is true that retailers would like to eventually use RFID tags at checkout instead of bar codes, and this process will likely start with high value items over the next few years. However, traditional bar-coding systems are here to stay for quite some time yet. As new facilities are built or existing facilities upgraded, it is recommended that bar code systems be used throughout the operation, or that dual-scan systems that read both bar codes and RFID be attached to existing RF terminals.

Magnetic Stripes are capable of storing data by using magnetized iron-based particles on a band of magnetic material. The magnetic stripe contains data that can not be changed without reprogramming the card. Line of sight and physical contact is required to collect the data, since a reading head must collect the data contained on the card through swiping the magnetic strip on the card. Additionally, magnetic strip cards are susceptible to environmental conditions and de-magnetization by coming into contact with a strong magnetic field or other magnetic cards. One of the most common uses for magnetic stripe cards in the refrigerated warehouse if for employee and labor tracking. Newer technology in magnetic strips allows the card to contain an RFID tag, transponder device and/or microchip.

Voice Recognition is an advanced AIDC system whereby computer systems extract features from speech, model them and use them to recognize the person from his or her voice.

Voice systems technology has come a long way over the last few years and is now a widespread technology. The technology uses an RF backbone and an RF terminal and an attached headset. Special software on the base computer and the terminal itself allows each user to "train" the system to interpret his or her voice for numbers, alpha characters and commands. The software interprets the user's voice and talks back to the user via a voice synthesizer.

Voice technology has been proven to improve productivity in picking, since it allows workers to have both hands free, thereby wasting very little time recording transactions in the system. Voice technology provides the ability for the user to interact in real time with the WMS without the use of a bar code scanner or keyboard. In the typical voice picking application, the picker logs on to the terminal, then speaks a command to begin work. The terminal responds with the address of the first pick location. At the location, the picker reads a two-digit check code on the location to verify he or she has arrived at the right

location and product. The voice responds with the number of cases to be picked. The picker completes the pick and answers "go," prompting the voice to direct him to another location.

However, voice systems do not deliver as great a benefit when case and product tracking is required, such as with catch weight product picking. Properly applied, voice systems can improve productivity without any loss in accuracy. It should be noted that voice systems are not limited in application to order picking, since they can be used for any function that is traditionally performed with bar codes.

4 Information Technology (IT) Basics

4.3 Business to Business Communications

Electronic Data Interchange (EDI)

EDI is a system designed to allow the electronic exchange of information between businesses. Generally speaking, EDI is considered to be a technical representation of a business conversation between two entities, either internal or external. This sharing of electronic documents between companies can utilize a wide variety of technologies, including but not limited to modem, VAN, FTP, E-mail, HTTP or AS1 and AS2 methods. EDI reduces, if not eliminates, the need to manually input data from customers or partners.

EDI documents generally contain the same information that would normally be found in a paper document. For example, if a customer uses EDI to authorize a warehouse to ship product(s) to a retailer, the EDI document would contain the relevant information, including but not limited to the ship to address, bill to address, a list of product numbers (usually a UPC code) and quantities. It may have other information if the parties agree to include it. If the warehouse is required to submit an Advance Shipment Notice (ASN) to the trading partner, EDI systems allow for this function to be performed electronically and with less lead time.

Organizations that send or receive documents from each other are referred to as "trading partners" in EDI terminology. The trading partners agree on the specific information to be transmitted and how it should be used. Trading partners are free to use any method for the transmission of documents. In the past one of the more popular methods was the usage of a modem to communicate through a Value-Added Network (VAN). Value Added Network systems receive transactions, examine the 'From' and the 'To' information, and route the transaction to the final recipient. In addition to these basic features, VAN's provide a number of additional services including retransmitting documents, providing third party audit information, acting as a gateway for different transmission methods, and handling telecommunications support. Despite their name, Value Added Networks are usually expensive; therefore, many trading partners exchange EDI documents directly by using the internet through FTP, VPN and/or AS2 protocol.

One of the potential advantages of EDI is the opportunity to save money by providing an alternative to, or replacing, information flows that require a great

deal of human interaction and materials such as paper documents, meetings, faxes, or E-mail. Even if paper documents can be maintained in parallel with EDI exchange, handling costs of sorting, distributing, organizing, and searching paper documents is reduced. EDI and similar technologies allow a company to save a significant amount of time and money for both parties, while greatly reducing the risk of error associated with manual data entry.

Within the refrigerated warehouse industry, documents that are typically traded via EDI include the following:

DOCUMENT NAME	USE	DIRECTION
EDI-943	Stock transfer	Customer ⇒ PRW
EDI-944	Receiving confirmation	PRW ⇒ customer
EDI-940	Order request	Customer ⇒ PRW
EDI-945	Shipping confirmation	PRW ⇒ customer
EDI-947	Inventory adjustment	PRW ⇒ customer
EDI-846	Inventory status	PRW ⇒ customer

Upon receiving of a shipping confirmation from the refrigerated warehouse, it is possible for the customer's systems to print an invoice through a specific printer located directly at the warehouse or send the same invoice by e-mail to the warehouse. This allows the carrier to deliver the order with the customer's invoice in hands.

However, there are barriers to adopting EDI. The speed with which EDI systems operate, including the almost-instant exchange of information, invoices and data, may create problems for companies established using a paper-based system. Another significant barrier to EDI systems is the cost in time and money in the initial set-up. The preliminary expenses and time that arise from the implementation, customization and training can be costly and therefore may discourage some businesses. The key is to determine what method of integration is right for each company and then to compare with the proposed cost of implementation.

Successful implementation and support of EDI systems can be a challenge. Since EDI is a system for exchanging business documents with external entities and integrating the data from those documents into the company's internal systems, success and support is predicated upon understanding the effect that this external data can have on an internal system. Providing too much visibility to outside operators can be a risk and supporting systems that interface and share data can be costly.

Increased efficiency and cost savings drive the adoption of EDI for most trading partners. But even if a company would not choose to use EDI on their own,

pressures from larger trading partners (called hubs) often force smaller trading partners to use EDI.

Enterprise Application Interface (EAI)

EAI is a relatively new concept designed to improve upon EDI technology. Electronic Data Interchange (EDI) was once considered to be of the greatest booms to the refrigerated warehouse industry a number of years ago, because it allowed refrigerated warehouse companies to use one system, of their own choosing, to run a multi-client operation and still communicate electronically with their customers. Today, the tables have turned, and EDI can be a considerable burden to refrigerated warehouse growth and expansion. EDI exchange, using EDI value added networks (VAN's) is expensive to use and expensive to support.

Recently developed software systems, called Enterprise Application Interface (EAI), are successfully addressing the issues associated with EDI costs and support. EAI software provides the ability to map and relate any system to any other system while interface standards such as EDI and XML have continued to struggle with this aspect of data sharing programs. One of the primary issues with traditional EDI systems is the need to standardize record layouts or data set contents, resulting in limited flexibility (a required component of EDI). EDI has struggled because users are not able to meet all of their needs within a narrowly defined record set. As a result, the record sets were opened up to the point where there is no such thing as a standard record. Since no two supply chain partners (any two companies that exchange goods and services) have "standard" relationships with all of their partners, non-standard relationships expand very quickly, even in a small supply chain. As a result, interface standards such as EDI are difficult to operate and support.

EAI software has now been developed to interface anything to anything and new supply chain systems are being delivered with these integration tools built right in. These tools provide standard interface libraries, like a set of EDI records, and allow the user to create an unlimited number of subsets, each for a specific trading partner or other system. The best EAI tools also include security controls, monitoring tools and reports, making them capable of being used as an Internet-based EDI exchange engine. As a result, the internet can be used to exchange information with suppliers at a fraction of the cost of conventional VAN's, and EAI software can reduce or eliminate the cost of EDI interface, support and maintenance.

Internet Based Systems continue to grow as the backbone for business to business communication. As internet usage grows, the traditional use of fax, modem, and customer service departments will continue to decline or be displaced. The Internet can save refrigerated warehouses money while

generating extra income. Effective use of the Internet can reduce operating costs through effective data transfer and offering the customer a "self service" environment. Value-added services can be generated through on-line shipment tracking, shipment proof of delivery, access to historical records for instantaneous recall tracking and customizable reports and planning tools.

Value added Internet applications that the refrigerated warehouse can offer for additional revenue include, but are not limited to:

Consignee and/or customer order entry. This should be the number one priority of a warehouse that has customers who call orders in to the warehouse customer service office or fax in orders. Providing the customer with Internet access to the internal warehouse order entry system will allow for the customer to enter their own orders, thereby speeding up the process and reducing customer service costs. However, it should be noted that customers that either fax or e-mail orders to the warehouse will be less inclined to re-enter their orders on the warehouse web site.

Customer access to information. If the warehouse has real time RF capability, it is possible to provide the customer with Internet access to order status information, inventory records and historical shipment records. This feature will give the customer detailed information on the exact order status and where the order is in the warehouse. However, it is important to note that new, browser software can easily control access to information based on the user's profile so that the warehouse can control exactly which records and functions customer can enter. This feature is a very strong customer service tool and can further reduce customer service costs while improving relations.

Carrier access to information. Using Web-based systems, it is possible to allow carriers to access the warehouses traffic planning function, thereby allowing them to create loads and load sequences. This feature will allow the warehouse to pick and stage loads in the specified loading sequence, avoiding the slow process of letting the driver configure the load when he or she arrives to pick up the load. This will significantly improve dock management at the warehouse and shorten trailer in and out times.

Remote data center services. The low cost and high-speed communication of the Internet enables a warehouse to run from a remote server, based in a robust data center instead of the front office at the site, resulting in greater stability, maintenance support and problem recovery capabilities.

Information exchange between trading partners. The Internet allows a warehouse to maintain a high level of communication and data sharing

between trading partners, including but not limited to direct customers, the customer's customer and trucking companies. Using the internet, along with Enterprise Application Interface (EAI) software, will allow the warehouse to eliminate VAN costs and extend EDI or other interface options to customers who do not currently pay VAN fees.

Shipment tracking and proof of delivery. Shipment tracking, potentially including scanned delivery documents, order status files and electronic proof of delivery signatures, can be implemented on the internet with limited software upgrades and effort.

Invoicing and payment processing. While receipt of funds from customers may be commonplace, electronic invoicing across the Internet may further speed up account receivables.

Carrier freight bill audit and payment processing. Rather than input invoices from carriers, it is possible to use a Transportation Management System (TMS) to send rated, completed shipments to the warehouse accounts payable system, then provide electronic funds transfer to the carrier's account. Using assistance from a bank, it is possible to process payments to the supplier across the Internet, and then to send the freight bill and rate details electronically or by e-mail and let the carrier perform the audit routine.

Consignee returns and Over, Short & Damage (OS&D). Using the Internet, it provides a web-based self-service kiosk function for customers or even customer's customers to enter damage reports, to request pick ups for returns and create make up orders or adjustments for shortages.

5 Warehouse Security & Risk Management

5.1 Managing Internal & External Security Risks

Warehouse security is a total program approach to minimizing or reducing losses from both internal and external sources. Warehouse security requires participation from employees throughout the entire facility, including but not limited to management, sanitation, operations and maintenance departments.

The most common security issues from internal sources are theft of product, company assets (equipment, tools) and customer assets. Additionally, internal damage to the facility can effectively be managed and minimized with warehouse security tools such as cameras and restricted access areas. These tools will also help to reduce claims associated with employee injuries and safety risks.

External threats to a warehouse can include bioterrorism, theft and/or vandalism, and environmental factors. Bioterrorism has become a primary concern of the general public as well as regulatory authorities and must be managed on an ongoing basis. Theft and vandalism from external sources, whether of product, supplies (such as ammonia), tools, equipment or the facility represents a source of significant economic loss for the warehouse. Environmental risks, including severe weather and natural disasters, are an ongoing threat to security, stability and profitability.

Bioterrorism

Bioterrorism has emerged as one of the leading concerns of the general public and regulators. Surveys of the general public have indicated that over 55 percent of consumers list a contaminated food supply, from bioterrorism, as one of their greatest concern. As a result, the U.S. Department of Agriculture (USDA), including the Food & Drug Administration (FDA) and the Food Safety & Inspection Service (FSIS), along with the Department of Homeland Security (DHS) have made biosecurity a primary initiative, and passed a Bioterrorism Act in 2002. This act provides regulators with the authority to inspect records and detain potentially dangerous foods, and requires most facilities within the food chain, including food storage warehouses, to register with the FDA and maintain a minimum level of recordkeeping. A primary component of the new act is product traceability and source verification.

Theft

Workplace theft remains one of the greatest sources of financial loss for the warehouse and can come from internal and/or external sources. The majority of theft is reported to be from current employees rather than outside sources and represents

an estimated $40 billion in losses annually. Employee theft can include products, hand-held equipment, stationary equipment, tools or other assets such as ammonia. External theft can be similar, except that unrestricted access from outside of the warehouse, or a warehouse breech, has taken place which raises additional concern for warehouse security. It is recommended that a perimeter fence be established and maintained around the facility to prohibit unauthorized access to the grounds.

Vandalism & Damage

Vandalism or facility damage, whether intentional or accidental, can result in rapid depreciation of asset value and financial loss to the warehouse. Effective security monitoring systems are effective deterrents of incidental damage, and effective tools to identify the source of vandalism or intentional damage.

Tools designed to enhance warehouse security while minimizing losses due to theft, vandalism and/or damage include, but are not limited to:

- Surveillance cameras
- Key card entry systems
- Guards on duty
- Sign in sheets
- Visitor escorts
- Employee awareness training

Employee Safety & Protection

Employee safety and protection, from physical accidents or workplace violence, remains a significant source of financial loss and liability. Warehouse security, including camera use, can help reduce potential injury or violence in the workplace. Violence in the workplace was the third leading cause of workplace fatalities in 2004, with 551 reported homicides.

Protecting employees also includes minimizing potential exposure to hazardous materials or equipment. Ammonia sensors and/or alarms are useful tools to provide early warning of environmental contaminants. Likewise, effective and consistent use of lock-out, tag-out procedures can significantly reduce workplace injuries involving equipment.

Pre-employment drug screening, physicals and background checks are recommended to facilitate the hiring of qualified employees, thereby enhancing the overall safety of the working atmosphere.

Environmental Risk

Environmental risk is both regional and seasonal. Certain areas are more prone to earthquakes than others, whereas hurricanes or heavy snow loads are likewise

concentrated on a regional basis. Environmental risk can be anticipated, but not always prevented or controlled. Nonetheless, a risk management and warehouse security plan, designed to account for the potential for environmental hazards, is necessary for effective warehouse operation.

Establishing a Facility & Food Security Team

Risk management with regard to warehouse security is a team approach, involves individuals from various departments in a warehouse. Members of the Facility & Food Safety Security Team are responsible for ensuring that a functional security plan is developed and implemented; ensuring that the physical security is appropriate to the existing threat level; and ensuring that company standards and policies are consistently followed. Effective management teams may include the following personnel and responsibilities:

- Facility Manager or Designated Representative:
  - Provides support to overall facility security initiative
  - Approves appropriate recommendations for physical security
  - Remains up-to-date on Security Team activities
  - Ensures that all team members are involved in incident investigation

- Security Coordinator or Designated Representative:
  - Directly oversees implementation of physical security measures
  - Ensures the effectiveness of all aspects of the security system
  - Periodically briefs upper management on security issues
  - Manages security personnel or guards
  - Conducts periodic security audits

- Human Resources Manager or Designated Representative:
  - Ensures that Human Resources policies are enforced regarding harassment and unacceptable behavior
  - Ensures that supervisors document security issues in employee files
  - Ensures that new employee screening efforts, including background checks, are conducted prior to employee start date
  - Counsels with the Security Team during incidents

- Operations Manager or Designated Representative:
  - Ensures that supervisors and employees follow company established security policies
  - Provides information to Security Team from supervisors and others involved in security situations
  - Counsels with the Security Team during incidents

The key to success for a Facility & Food Security team is to identify the greatest potential risks at the warehouse, and then determine the appropriate level of

security necessary to mitigate those risks. Over-aggressive security is costly and unnecessary, whereas inadequate security could place the company at significant financial and legal risk. Once policies and procedures have been developed, it is the collective responsibility of the Security Team to determine that the security solutions are effective, and that they are properly and consistently implemented throughout the facility, eliminating any potential security breeches from either internal or external sources. Two of the greatest tools available to a warehouse are *prevention* and *early detection*. Likewise, response measures should be adequate to the situation and not potentially make the security issue worse.

A security "Self Audit" questionnaire is provided in Section 8 of this manual. It is recommended that warehouse management conduct a self audit of security risk areas, perhaps applying a quantitative ranking scale to prioritize and weight the risk associated with the various components of the audit.

5 Warehouse Security & Risk Management

5.2 Operational Risk Management (ORM)

Prior to managing or minimizing risk associated with warehouse security, warehouse personnel should attempt to anticipate areas and degrees of risk. Using Operational Risk Management (ORM) systems, warehouse personnel can potentially avoid or reduce potential hazards through a strategic analysis of risk, thereby reducing potential for losses. ORM systems are systematic, methodical and proactive rather than traditional "reactive" or "compliance driven" procedures.

ORM systems utilize the following six-step procedure:

1. Identification of potential hazards
2. Assessing the risk
3. Analyzing potential risk control measures
4. Making risk control decisions
5. Implementing risk control measures
6. Supervising and program review procedures

Identifying Potential Hazards

Potential hazards at warehouse locations generally come from **personnel**, **machinery**, **environmental** and/or **structural** sources.

Personnel who are uninformed, improperly trained, or apathetic can create serious potential hazards to themselves, the customers product and the facility. Human error remains one of the greatest causes of risk, loss and claims. Potential hazards resulting from humans should be identified, if possible, and may include unrestricted access to the facility or areas within the facility, improperly trained personnel with access to hazardous materials, or ineffective control systems for employees working on or with equipment.

Machinery represents a significant source of risk and potential injury, with poor design, poor performance and/or poor maintenance contributing to potential injury or loss. Employee errors in using equipment, including improper use or not using equipment as intended can further enhance risk.

Environmental and structural sources of risk are many, with weak or poor facility design; structural integrity of racks, floors and walls; poor lighting; excessive noise;

temperature extremes; poor ventilation; and possible contamination contributing to potential hazards within a warehouse.

The Facility & Food Security Team should evaluate the entire facility, using the aforementioned categories, in an attempt to list potential sources of warehouse security risk.

Assessing the Risk

Once potential hazards and security risks have been identified, it is useful to quantify the level of risk through an analysis of both the severity and probability of the risk.

The *severity* of risk can be classified into one of four primary categories:

Catastrophic: Resulting in complete business failure or closure

Critical: Resulting in major business impairment, severe injury/death

Moderate: Resulting in minor business impairment, minor injury/illness

Negligible: Resulting in less than minor problems

The *probability* of risk can be classified into one of five primary categories:

Frequent: Situation occurs often or is continuous

Likely: Situation occurs on a regular basis

Occasional: Situation occurs sporadically

Seldom: Situation may occur

Unlikely: Situation is so unlikely that it may never occur

Severity and probability of risk can be combined in a matrix to determine an overall risk level. Severity of risk can be assigned numerical categories I to IV, whereas probability of risk can be assigned to categories A through E, as shown in the sample table below:

			Probability of Occurring				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
Severity	Catastrophic	I	Extremely High				
	Critical	II		High			
	Moderate	III		Medium			
	Negligible	IV		Low			
			Risk Levels				

Risk levels can then be assigned a number for easy identification and action, using the table below, with higher numbers representing higher levels of overall risk and lower numbers representing lower levels of risk:

			Probability of Occurring				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
Severity	Catastrophic	I	1	2	6	8	12
	Critical	II	3	4	7	11	15
	Moderate	III	5	9	10	14	16
	Negligible	IV	13	17	18	19	20
			Risk Levels				

It is important to note that each type of hazard may have different consequences, and therefore different risk levels. For example, unauthorized access to the facility by visitors is one type of hazard, but the access could result in several types of risk. Each potential risk could have a different level of importance, using the numbering system above, as illustrated in the table below:

Type of Hazard	Type of Risk	Probability of Occurring	Severity of Occurrence	Risk Level
Unauthorized Access to Warehouse	Threat to facility	Seldom	Moderate	14
	Potential to contaminate product	Seldom	Critical	11
	Theft of product, tools or equipment	Occasional	Moderate	10
	Theft or release of ammonia	Unlikely	Critical	15

By contrast, likelihood of environmental risk can result in a considerably different range of risk levels, and would therefore require different response or risk mitigation actions, as illustrated in the table below:

Type of Hazard	Type of Risk	Probability of Occurring	Severity of Occurrence	Risk Level
Severe Weather	Chance of hurricane	Likely	Catastrophic	2
	Heavy snow build-up on roof	Unlikely	Critical	15

Analyzing Potential Risk Control Measures

Risk control measures should be established for each type of hazard, and ranked on the basis of feasibility, cost and possible effectiveness.

Potential risk control measures should focus on either reducing the likelihood of the hazard or eliminating the risk completely. For obvious reasons, some risk categories or hazards, such as environmental hazards (hurricanes, severe weather) can not be eliminated or avoided, whereas other hazards, such as unauthorized access, can be effectively reduced and/or eliminated with control measures.

When considering reducing risk with control measures, the idea is to plan an integrated system without a hazard, including incorporating safety devices to prevent the hazard; providing warning devices, including early warning systems; and establishing proper procedures and adequate training to prevent the hazard. Personnel and equipment risk categories are most effectively addressed using these methods.

For each hazard, determine the types of control measures that are available, affordable and effective in the warehouse environment, and then rank them on the basis of priority and effectiveness. For example, to prevent or minimize unauthorized access, the following control measures may be available:

- Guard on Duty
- Sign in Sheets
- Identification Badges
- Visitor Escorts

Making Risk Control Decisions

On the basis of the warehouse budget, location and risk assessment, warehouse management should prioritize the identified risk control measures. For example, circumstances at the warehouse may render sign in sheets impossible to manage, and it may be determined that visitor escorts are a more effective intervention system. As a result, the list of potential interventions should be prioritized and re-ordered, as listed below:

1. Guard on Duty
2. Visitor Escorts
3. Identification Badges
4. Sign in Sheets

Implementing Risk Control Measures

Once risk control measures have been identified, prioritized and selected, they should be implemented in the warehouse. Senior management, who are part of the Security Team, should make the necessary resources available for proper implementation, and should provide management support of the initiative(s). Proper implementation involves establishing a sustainable program, effective awareness and training of employees. As new policies, procedures and tools are implemented, it is important to make employees aware of the new systems in place, so that the entire warehouse team is on board with the program.

Supervising & Program Review

Risk control measures should be periodically reviewed for efficacy and cost effectiveness, with feedback provided to the Security Team. Control measures for reviewing data, frequency of checks and audits should be established and implemented. ORM systems are organic and must be managed on an ongoing basis to remain effective as deterrents and preventative measures.

A Risk Assessment Template is provided in Chapter 8 of this manual.

5 Warehouse Security & Risk Management

5.3 Understanding Categories of Risk

Effective warehouse operations strive to satisfy customer needs and operate efficiently while minimizing damage to personnel, facilities and products that could possibly result in claims and losses. In order to avoid product losses and to minimize the potential impact of losses that do occur, warehouse operators should consider proper management and maintenance of the following categories of potential risk:

Personnel

Personnel represent a critical component of an effective and successful warehouse operation. Human error remains one of the main causes of damage, losses and claims. Hiring of experienced and qualified personnel is a key step in minimizing potential losses. Conducting background checks, physicals, drug testing and reference checks will help warehouse operators avoid bringing unqualified and ineffective personnel into the facility.

After personnel have been hired, it is important that they are properly trained in the jobs they will be performing. Training programs, either internally organized and conducted or attended at external meetings or venues, is an effective way to continually upgrade and standardize worker performance and competency.

All workers, whether trained or not, should be properly supervised to ensure that company policies, standard operating procedures, safety rules and directives are properly implemented within the facility. Management, including supervisors, must take an active role in maintaining a consistent standard of performance in the warehouse, which is enhanced by proper oversight and evaluation of employees.

Facilities

Properly maintained facilities contribute to lower claims, damage and risk. The exterior grounds should be clean, well lit and maintained. Furthermore, seasonal upkeep and Preventative Maintenance (PM), including but not limited to timely snow removal, drain cleaning and perimeter repair can help reduce potential damage and loss. Internal areas should be monitored and well maintained to reduce the potential for employee, structural or product damage and injury.

Warehouse operators should be aware of local code requirements and strive to remain compliant with codes and regulatory directives.

Properly inspected and maintained refrigeration systems, representing the basic building block of the integrated cold chain, will enhance productivity and minimize damage to products resulting in losses or claims. Warehouse operators should consider contingency plans, perhaps including auxiliary equipment, back up generators and response plans in the event of a catastrophic event, power loss or emergency shut down of refrigeration systems.

Electrical system inspection and maintenance is also an important component of a fully functional system. Back-up electrical supply and contingency plans for electrical loss is critical for maintaining product integrity and safety.

Fire suppression tools, including fire doors that remain free to close at any time, are effective tools to minimize exposure to large-scale losses from fire and/or smoke.

Maintaining adequate capacity while avoiding over-capacity is an ongoing challenge for operators who are always looking for additional revenue opportunities. It is important to consider the potential impact of loading coolers and freezers beyond carrying capacity, which may result in temperature fluctuations and potential product damage.

Monitoring Systems

Proper monitoring systems are useful in preventing losses, damage or theft.

Security systems, including but not limited to guards, cameras, identification (key cards) and visitor escorts are useful in controlling unrestricted access to the facility. Security is also a useful internal tool to minimize facility damage and losses due to theft, vandalism or violence.

Other systems, including fire detection and/or suppression, and ammonia detection are additional safeguards against loss, damage and claims.

Warehouse Operations

Basic operations, including proper receiving, put away, storage, picking and shipping are critical to effective warehouse management. Understanding the proper storage temperatures, avoiding contamination of products in storage, storing compatible products and minimizing handling, storage and receiving damage will significantly reduce claims and potential loss. Taking temperatures on a frequent and regular basis, complete with accurate record keeping and equipment calibration, will reduce potential claims and losses due to product becoming spoiled or off condition.

Claims from improper storage of materials can be prevented with proper research and information pertaining to which products can be stored in close proximity. Storing incompatible products together may present safety problems or provide the

opportunity for contamination or damage. Consult the Commodity Storage Manual to determine which items are compatible in storage areas.

Product & Personnel Safety Procedures

An early indicator of potential losses and claims is often an increased level of employee and/or product injury. Effective warehouse operators monitor the trends in employee injury claims as well as product damage reports. If these categories are trending up, the implementation of internal systems should be evaluated and monitored until systems come back into control.

Crisis Management

Effective crisis management is a must for minimizing liability and loss. Severe weather, environmental or terrorist events can significantly damage facilities and product, and effective pre-planning for likely events is a useful way to minimize potential impact. It is highly recommended that all facilities develop a Crisis Management plan and supporting manual. Consult the **IARW Crisis Management Manual** for additional information and support. As part of an effective crisis management strategy, it is recommended that the crisis management team organize meetings with regulatory authorities, including but not limited to fire and health agencies.

Documentation

Proper documentation, including accurate warehouse receipts, storage agreements, bills of lading, transportation-related documents, receiving checklists, shipping checklists, trailer inspection forms, sanitation checklists, maintenance checklists, temperature control forms and product recall forms are key elements of an effective warehouse operation, and represent a solid paper trail for management.

Insurance Coverage

Consider maintaining adequate insurance coverage on the operation, including:

- Warehouse legal liability
- Equipment breakdown (boiler & machinery)
- Property
- Liability
- General Employers Liability
- Transportation & cargo

It is recommended that warehouse management consult with insurance professionals to fully understand the interaction between these types of insurance coverage, and that the warehouse validates insurance needs prior to undertaking insurance coverage.

Use of Available Resources

Industry resources, including IARW's wide array of resource manuals, WFLO's Scientific Advisory Committee (SAC) and training institutes provide a warehouse operator with access to the latest information and professional expertise.

5 Warehouse Security & Risk Management

5.4 Fire Prevention

Fire **prevention**, **protection**, **suppression** and **control** are critical components of effective warehouse management. It is estimated that a warehouse fire occurs in the United States once every 24 hours, resulting in loss. Losses from fire are not limited to structural damage but can include minor to catastrophic loss of the facility, direct loss of products to the fire, as well as collateral damage due to smoke and water.

Our primary efforts should be focused on fire prevention, followed by efforts to protect facilities or products from damage if a fire occurs, and should also include efforts to suppress fires if they get started in order to minimize damage. Even a small fire can result in significant and substantial loss from smoke damage. Food products are very susceptible to smoke damage, and every effort should be made to minimize risk associated with product damage from fire or the resulting smoke.

Fire Prevention & Protection

A key component to preventing fires is a full understanding of the dynamics of fire. It is common knowledge that for fire to burn in requires fuel and oxygen. Refrigerated warehouses are full of both. Preventing fires involves understanding the type of fuel, or commodity, stored in the warehouse since some storage materials are more combustible than others. Additionally, the presence of fire suppression systems will prevent the spread of fires, thereby limiting exposure and damage within the warehouse.

There are four common classes of fires, including:

Class	Components	Treatment
A	Ordinary materials, such as paper	Extinguished by water, water with antifreeze, or soda-acid
B	Flammable gasses and liquids, such as oil	Extinguished with potassium carbonate and CO_2
C	Electrical equipment	Extinguished with foam especially designed with non-conductive materials
D	Combustible metals, such as sodium and potassium	Extinguished with metal-specific fire extinguishers

Fire protection applies to the warehouse, products and employees, and is based on taking steps to prevent fires from getting started. Injury to employees most generally occurs from smoke and gas inhalation or suffocation rather than burns. The key to protecting employees, products and the warehouse lies with identifying and eliminating fire hazards, monitoring smoking and establishing proper response plans.

Emergency action plans should be reviewed by all employees, and should include the following elements:

- Emergency escape routes and assignments
- Evacuation procedures for critical operations personnel
- A system to account for all employees after completing an evacuation
- Triage duties and assignments
- Methods for reporting emergencies
- Names of facility employees who have additional information pertaining to the emergency plan

It is recommended that a copy of all emergency action plans be kept off site, perhaps even in the truck of a manager's car. When an emergency occurs, it is possible that key personnel will not be at the plant, and that a copy of the emergency plans in the main office are not easily accessible.

In addition, proper equipment for fire prevention, suppression and control should be on site and properly serviced.

Fire Suppression

Generally speaking, fires progress quickly through three (3) stages of suppression, with each stage requiring additional fuel and oxygen.

> **Stage 1:** Fires in the first suppression stage are steady, maintaining a consistent shape and space. These fires can generally be controlled with portable suppression equipment such as fire extinguishers.
>
> Damage from Stage 1 fires is generally limited to the original point of origin and is considered minimal is scope.
>
> **Stage 2:** As the fire progresses into the second stage, it grows beyond its original borders to vaporize solids and liquids in its path. The fire is now on the move through the warehouse and requires advanced suppression equipment such as overhead sprinkler systems or water hoses. Damage from the original fire is now spread to other commodities and areas of the structure and can be moderate to severe.

Stage 3: If the fire accelerates to Stage 3, materials and surfaces in the path of the fire reach "flashover", wherein they have achieved ignition temperatures and burn readily on their own. Warehouse fire suppression equipment can easily become overwhelmed at this stage, resulting in catastrophic losses of product and structures.

It is important to note that fire suppression equipment can also present a danger if not properly designed and/or installed. Fire suppression equipment, especially overhead sprinklers, should have double interlocking systems to prevent water damage if a head is knocked off or damaged.

6 Safety Management

6.1 Process Safety Management (PSM)

Process Safety Management (PSM)

On February 24, 1992, the Occupational Safety and Health Administration (OSHA) issued into law its standard (57 FR 6356), *29 CFR 1910.119 Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents,* commonly known as Process Safety Management (PSM) which took effect on May 26, 1992.

OSHA's Process Safety Management standard was the first federal "Chemical Accident Prevention Program" or "chemical safety program" in the United States. This program contains requirements for the management of Highly Hazardous Chemical associated with various chemical processes.

In the PSM standard OSHA has a "List of Highly Hazardous Chemicals" that can be found in Appendix A. The list also contains the threshold quantity of the chemical in question. Meaning you need more than just the given chemical, you need to have a given amount to activate the PSM standard requirement. This amount is commonly known as the "threshold quantity".

On that list, Anhydrous Ammonia is listed with a threshold quantity of 10,000 pounds (lbs.). Meaning if your facility has 10,000 lbs or more of Anhydrous Ammonia then you will need a active PSM program in place.

If you are new to the Public Refrigerated Warehouse (PRW) industry, you might be thinking; why would you have 10,000 lbs or more of Anhydrous Ammonia, commonly known as ammonia? In the industrial refrigeration industry ammonia is the chemical of choice and is wildly used throughout the world as a refrigerant. Ammonia is what keeps everything cold!

The PSM standard establishes procedures to safely manage your industrial refrigeration system with acomprehensive or systematic evaluation of the facility industrial refrigeration system. Using a systematic approach: All industrial refrigeration elements within the facility are covered, including anything that may potentially affect the operation of our refrigeration system during our initial evaluation and any modifications thereafter. Per the PSM requirements a systematic evaluation should include, but may not be limited to:

- Review of refrigeration system design
- Review and understanding of technology used

- Operational changes or modifications to the system
- Maintenance changes or modifications to the system
- Evaluation of routine activities
- Evaluation of non-routine activities
- Review of emergency planning and response plans
- Evaluation of training programs

Process Safety Information:

The first task of developing a PSM program is to collect and compile all written Process Safety Information (PSI). It is explicitly required to collect this information and that this information be made available during performance of a Process Hazard Analysis (PHA). PHA is covered elsewhere in this section. The PSI essentially describes anything physical about the facility and includes both explicit and implicit requirements. Explicit information, including but not limited to a detailed review of the design and basis of the pressure relief systems, is a line item requirement which must be present with the PSM documentation. Implicit information would be extraordinary information that, while descriptive of the system, is not specifically named in the regulations. An example of an implicit requirement may be an individual equipment drawing. For auditing purposes, it is recommended that all of the explicit information be maintained separate from the additional implicit information. The PSI is the foundation of the PSM program, and the warehouse operator must ensure that all of the information is correct and true as the system ages and/or is modified. Since the entire PSM program is contingent upon accurate PSI, any errors in the initial collection of PSI data can create significant problems with the resulting PSM program.

Process safety information should include information pertaining to the hazards associated with the chemical that is being used, information pertaining to the technology of the process, as well as information pertaining to the equipment used in the process. Each of these generic items identified by the regulations explicitly requires very specific information as described below.

Chemical Hazard Information:

If a refrigerated warehouse is using ammonia as the primary or most common chemicals, the following type of information pertaining to the hazards of ammonia in refrigeration systems should be gathered:

1) Toxicity
2) Permissible exposure limits
3) Physical data
4) Reactivity data
5) Corrosivity data

6) Thermal and chemical stability data
7) Hazardous effects of inadvertent mixing of different materials

It should be noted that a current Safety Data Sheets (SDS) meeting the requirements of OSHA's Hazard Communication Standard (20 CFR 1910.1200) may be used to comply with much of this requirement; however, it may not cover all information. It is also recommended that this be supplemented with information from the International Institute of Ammonia Refrigeration (IIAR) Ammonia Data Handbook which provides more detailed information about anhydrous ammonia.

Technology of the Process Information:

Information pertaining to the technology of the process should include, but may not be limited to:

1) Simplified Block Flow Diagram or simplified process flow diagram
2) Process chemistry
3) Maximum intended inventory
4) Safe upper and lower limits for
    a. Temperatures
    b. Pressures
    c. Flows or compositions
5) An evaluation of the consequences of deviations, affecting the safety and health of co-workers

OSHA encourages the use diagrams that will help teach others to understand the refrigeration process. A ***block flow diagram*** is a simplified diagram used to show the major process equipment and interconnecting piping and physical state of the refrigerant, temperatures, and pressures when necessary for clarity.

However, the ***process flow diagrams*** are more complex than block flow diagrams, although not as detailed as the Piping and Instrument Diagrams (P&ID). Process flow diagrams show all main piping, including valves, to enhance the understanding of the process. Additionally, process flow diagrams identify the pressures and temperatures within the system, all major vessels and in and out of headers and heat exchangers, and points of pressure and temperature control including information on construction materials, pump capacities and pressure heads. Compressor horsepower and vessel design pressures and temperatures are shown when necessary for clarity.

It is important to note that block flow or process flow diagrams are not the same thing as the Piping and Instrument Diagrams (P&ID). A P&ID diagram is an actual representation of your refrigeration system. Meaning your P&IDs must show every

line and component. If your P&IDs is missing a line or valve, then you do not have accurate drawings.

Process chemistry was originally aimed more for a petro-chemical industry environment. It should include a complete discussion of the chemicals in the process and their purpose in the process. In the case of an ammonia refrigeration system, there is only one main chemical of importance, anhydrous ammonia. To fulfill this requirement, many facilities simply discuss the refrigeration cycle as it pertains to their facility (either discussing single stage, two stage, or cascaded system). In addition, a discussion of the various states of ammonia in the system should be identified, including but not limited to High Pressure Liquid (HPL), High Temperature Suction (HTS), or High Stage Discharge (HSD) and tabulated with the various pressure and temperature ranges seen in the system. It is also recommended that it states "there are no process chemistry" within your refrigeration system.

Maximum intended inventory can be maintained by one of two methods, either an itemized listing or actual receipts from chemical suppliers. The itemized listing should be in detail and should include an itemized listing of the ammonia charge of each piece of equipment or vessel as well as the estimated piping ammonia charge. It is highly recommended that an itemized listing be generated even if the chosen method of maintaining inventory is through supplier receipts. This itemized list can easily be updated as necessary during facility modifications. It is also highly recommended that a log be kept of all additions and losses of ammonia be recorded using a log book in a manner similar to balancing a checkbook. Any additions, changes or losses in ammonia from year to year should be noted, including but not limited to:

1) An estimate of leaks through packing and seals
2) An estimate of ammonia lost annually by purging air from the system
3) Any ammonia lost during an incident
4) Any ammonia lost during oil draining operations
5) Any ammonia pumped out during system modifications and maintenance

The purpose of this log is to be able to adequately identify why additional ammonia charge may be required, especially when facility modifications have NOT occurred. For example, an auto-purger is designed to discharge a small amount of ammonia down the water drain each time it cycles. Over a period of months or years and when combined with other minor sources of ammonia loss these small depletions may require a warehouse to purchase additional ammonia.

Safe upper and lower operating limits describe the set points and general expected operating range for various parameters in the system. Detailing the ammonia pressures and temperatures, where applicable, as seen at each type of

equipment assists employees to better understand when the system may be operating under upset condition. With this, the requirement to identify what the consequences of deviation from these normal parameters must be identified and how that will affect the ammonia refrigeration system as well as the employees. This information should be similar or even identical to similar information required in the operating procedures; however, the operating procedures also require the facility to identify the steps operators or maintenance personnel should take in the event that the system deviates from the normal conditions.

Equipment of the Process Information:

Information on the equipment in the process should include, but may not be limited to:

1) Piping and instrument diagrams (P&lD)
2) Materials of construction
3) Electrical classification
4) Relief system design and design basis
5) Ventilation system design
6) Design codes and standards employed
7) Material and energy balances for facilities built after May 26, 1992
8) Safety systems (i.e. interlocks, detection or suppression systems)

Piping and Instrument Diagrams (P&ID) are the most detailed diagrams in the facility and are designed to show some of the above details as well as display the information for our maintenance personnel. The P&ID may also be used to describe the relationships between equipment and instrumentation as well as other relevant information that will enhance clarity during the hazard analysis. Other information that would not normally appear on the P&ID pertaining to refrigeration equipment design should be documented elsewhere. In other words, what codes and standards were relied on to establish good engineering practice?

Materials of construction should be a listing of acceptable materials for use in the refrigeration system, including equipment and piping, with which the ammonia will come in contact. This should also identify materials with which the ammonia system should NOT be constructed, such as copper and copper alloys.

Electrical classification should be identified and is based on the explicit facility design issues. This classification identifies whether the facility is considered explosion-proof or not.

Relief design and design basis is a listing of which codes or standards to which the relief system was designed and constructed, and includes all calculations verifying that the system meets those standards. It is exceptionally important that

the appropriate revision of the standard be identified as modifications to standards (such as ANSI/ASHRAE 15) have changed the means by which calculations are performed. It is also important to understand that systems constructed to an older standard are 'grandfathered' as long as the relief system is not modified. However, modification of any relief system (beyond a replacement in kind) will likely forfeit the grandfathering of that system.

Ventilation system design and design basis must be detailed for continuous and emergency ventilation. This will include identification of the current ventilation system and system capacities and also the required ventilation. Equations used must be listed and the results of the evaluation should be included.

A listing of *design codes and standards employed* in the design and construction of the ammonia refrigeration system must be included. This can simply be an itemized listing of the code along with the title of the document.

Material and energy balances were originally intended to be included for highly hazardous chemicals used in production and not for close loop or refrigeration systems. Recent modifications have been made, and the material and energy balance has been replaced by a system load balance review. In a load balance review, the system equipment loads is identified to determine whether compressor capacity can handle such loads. In addition, the compressor capacity is weighed against the evaporative condensing capacity. By having this information, a facility can quickly determine whether the system has enough capacity to handle the given loads. This is especially important when considering facility expansions.

A listing of *safety systems* is required and can be a tabulated listing of all safety features as appropriate to the various types of equipment at the facility. An example of this would be to identify the various alarms and cutouts for a compressor (temperatures and pressures) as well as relief valve set points and information. This should be performed for each unique type of equipment at the facility including compressors, each uniquely piped vessel, each uniquely piped evaporator, and each uniquely piped heat exchanger. In addition, remember to list other safety devices and data associated with those devices. Such information could include, but is not limited to, settings and locations of ammonia detectors, location and number of self-contained breathing apparatuses (SCBA), and location of fire extinguishers.

In some of the older refrigerated warehouse facilities, where original technical information no longer exists, P&ID information may be developed in conjunction with the process hazard analysis in sufficient detail to support the analysis. In this circumstance, it is important to document that the equipment complies with recognized and generally accepted good engineering practices. Older facilities

should document that the equipment is designed, maintained, inspected, tested, and operated in a safe manner.

The position of OSHA is that the collection of the above process safety information provides the basis for identifying and understanding the hazards of our refrigeration system and is a necessary resource for a variety of users including the team performing the Process Hazard Analysis (PHA) as required by PSM; those developing the training programs and the operating procedures; contractors whose employees will be working with the process; those conducting the pre-startup reviews; as well as local emergency preparedness planners, and insurance and enforcement officials.

Process Hazards Analysis:

A Process Hazard Analysis (PHA) for refrigeration systems is one of the most important elements of the PSM program. A PHA is an organized and systematic effort to identify any potential hazards associated with the operation. A properly chosen and executed PHA will provide information that will assist warehouse management in making decisions for improving safety and eliminating or reducing potential consequences of an accidental release of ammonia from refrigeration system.

The OSHA recommends the following possible methodologies for conducting a PHA:

1) What-if
2) Checklist
3) What-if/checklist
4) Hazard and perability study (HAZOP)
5) Failure mode and effects analysis (FMEA)
6) Fault tree (or an equivalent) analysis

Selecting the type of PHA for an ammonia refrigeration system could be very difficult for the refrigerated warehouse industry due to a lack of understanding pertaining to all of the PHA methodologies and their limitations. However, OSHA has made it simple for the industry by recommending that a simple "generic PHA, evolved from a checklist or "what-if" questions, could be developed and effectively used by employers to reflect their particular process" for ammonia refrigeration systems. OSHA understands that the less complex methodologies could be used to meet the process hazard analysis criteria in the PSM standard, and that process hazard analyses can be done in less time and with fewer people being involved. A less complex process generally means that less data, P&ID, and process information are needed to perform a process hazard analysis.

A "What-If"/checklist study is a series of questions that requires specific answers in columns, including but not limited to hazard, consequences, safeguards, severity,

likelihood and risk ranking. The risk ranking column of the "what if"/checklist study is the key element, and the primary reason for the PHA. Depending on the outcome of the risk ranking, warehouse management may need to correct the hazard immediately or have the time to design, budget, schedule and execute the fix over time.

Regardless of which method of analysis is used, the PHA is required to address the following:

1) Hazards of the process
2) Previous hazardous incidents
3) Engineering and administrative controls
4) Consequences of failure of engineering and administrative controls
5) Facility sitting
6) Human factors
7) Evaluation of effects of failure of controls on employees

A PHA team must be formed and it is recommended that it consist of three persons: one (1) employee with experience and knowledge specific to ammonia refrigeration (this individual represents the operations aspect of systems), one (1) individual or employee with experience in refrigeration system design/construction, and one (1) individual knowledgeable in the specific process hazard analysis methodology used by the team. It is highly recommended that outside sources be consulted in the performance of a hazard analysis, especially in regard to refrigeration system design and hazard analysis leaders. The purpose for these is to give an outside perspective on design issues that may not be readily noticeable to an employee that sees the system every day. The warehouse must also have a system in place to address hazard analysis findings and recommendations, as well as to assure that timely repairs or fixes are made. Regulatory agencies routinely request 'tracking' information to determine what actions have been taken, by whom, and when. It is recommended that these recommendations be maintained using a continuous number system that does not 'restart'. This ensures that recommendations do not fall through the cracks or disappear (the gap in numbering will identify where information has been lost). Warehouse management should document and complete these actions as soon as possible in accordance with a written schedule. In addition, affected operating, maintenance and other employees should be notified of the plan of action.

PHA plans should be updated and re-validated at least every five (5) years, and records of the most recent analyses should be maintained and made readily available for those applicable persons that the PHA results/actions are expected to protect.

Employee Participation:

Employee participation in the PSM plan requires warehouse management to develop a written plan of action regarding how employees will participate in the development of the other elements of the PSM programs. In addition, it is a requirement that applicable employees be aware of and participate in the performance of a PHA. This element of the PSM program is straightforward and requires that people who are directly involved with the refrigeration systems be involved in the execution of the PSM plan. Properly establishing employee participation action plans may involve additional training and education efforts with maintenance employees in order to help develop other elements and to inform potentially affected employees of the PSM programs. This may also include incident investigations or relevant safety and health issues. It is recommended that a PSM committee be formed to help maintain and implement the PSM plan within the warehouse. In order to show that this program is properly being observed, it is recommended that some form of documentation be created that would identify when significant actions have taken place regarding employees and the PSM program.

Key areas where employee participation and subsequent documentation are important include, but not limited to, participation in performance of the PHA, safety meetings discussing the PSM program, review and modification of the operating procedures, creation of a Management of Change (MOC) and Pre-Startup Safety Review (PSSR), and completion of annual equipment inspections.

It is important to note that contractors on site who work on or around the ammonia system should be provided access to the PSM documentation as if they were employees at the facility.

Operating Procedures:

The regulatory text for documenting operating procedures is fairly simple; and dictates that operating procedures must be in writing and provide clear instructions for safely operating refrigeration systems within the warehouse. It is important to start off by identifying what constitutes an operating procedure as many facilities mistakenly confuse operating procedures with maintenance procedures, such as how to fix or maintain a piece of equipment. While maintenance procedures are implicitly required in the Mechanical Integrity Program, operating procedures must include the following: steps for each operating phase, operating limits, safety and health considerations, and all safety systems. Operating procedures must be readily accessible refrigeration operations employees and must be reviewed as often as necessary to assure they are up to date and must cover special circumstances such as lockout/tag-out and confined space entry. These procedures must be updated annually and certified for accuracy. Regulatory agencies routinely request information that would identify the dates for these annual reviews.

Operating phases must include the following components:

1) Initial start-up
2) Normal operations
3) Temporary operations
4) Emergency shutdown
5) Emergency operations
6) Normal shutdown
7) Start-up after an emergency shutdown

It should be noted that regulatory reviews suggest that all of the aforementioned sections be included in the documents. If a section does not apply to particular equipment, simply list "Not Applicable" in the document.

OSHA also believes that operating procedures should provide specific instructions or details pertaining to what steps are to be taken or followed in carrying out a specific procedure. The specific instructions should include the applicable safety precautions and appropriate information on safety implications. For example, the operating procedures addressing operating parameters will contain operating instructions about pressure limits, temperature ranges, and what to do when an upset condition occurs; what alarms and instruments are pertinent if an upset condition occurs. Emergency shutdown may not be the same as an upset condition and should spell-out the conditions under which we should have an emergency shutdown.

Another example of using operating instructions to properly implement operating procedures is in starting up or shutting down our compressors, vessels or systems. In these cases, different parameters will be required from those of normal operation. Again, these operating instructions need to clearly indicate the distinctions between start-up and normal operations, such as the appropriate time required for the levels in our refrigeration vessels to reach the normal operating levels. Also, the operating instructions need to describe the proper method for increasing the temperature of the unit until the normal operating temperatures are reached.

With regard to computerized control systems, OSHA believes that they add complexity to operating instructions. Therefore, these operating instructions need to describe the logic of the software as well as the relationship between the equipment and the control system; otherwise, it may not be apparent to the operator of the refrigeration system.

Operating procedures and instructions are important for training operating personnel. The operating procedures are often viewed as the "Standard Operating Practices" or Standard Operating Procedures (SOP) for operations. In addition, operating procedures need to be changed if there is a change in the refrigeration system that required a pressure, temperature or control action different than what is

established in writing. For example, mechanical changes to the refrigeration system, such as changing a suction stop valve from a CK-2 to a CK-5, should be evaluated in order to determine whether operating procedures and practices also need to be changed. All Management of Changes (MOC) must be coordinated and integrated with current operating procedures, and operating personnel must be trained to the changes in procedures before the change is made.

Training:

Employee training is a critical component of a functional PSM program, especially with regard to workers who service or operate refrigeration systems. When training is conducted, it is imperative that warehouse management maintain a record of the training event, including the identity of the person trained, the date of the training, and how it was determined or verified that the employee understood the training. Training programs MUST clearly the subjects to be covered, and the desired goals and objectives of the training. The learning goals or objectives should be written in clear measurable terms before training is initiated. It is important that training programs, including goals and objectives, are tailored to each of the specific training levels, including identifying the important actions and conditions under which the trainees will demonstrate their knowledge as well as what is acceptable and is NOT acceptable performance.

Training methods should be customized to maximize the impact of the learning, including a mixture of classroom, video, and hands-on instruction. Using a combination of training methods is an effective way to ensure learning and comprehension. Training programs, curriculum and instructors should be periodically evaluated to determine if the necessary skills, knowledge, and routines are being properly understood and implemented. The methods for evaluating the training should be developed along with the training program goals and objectives. As part of the overall training effort, certification of trained employees is necessary to validate that employees operating or maintaining refrigeration systems has the required knowledge, skills and abilities to safely perform their responsibilities specified in the operating procedures. PSM plans also calls for refresher training at least every three years and again requires written documentation of the training.

An additional component of effective PSM training also includes emergency or contingency training, including what to do in emergencies such as pump seal failures or a pipeline break. Communication among operating people and contractors within the facilities performing non-routine tasks should also be maintained.

It is important to note, however, that training and documenting is not enough. Warehouse management must ensure that whoever is trained fully understands the training. This should be verified by either verbal or written testing and/or by observing the task being performed by the worker.

As in all PSM program, documentation is key to proving that individuals are qualified to operate the systems.

Outside Contractors:

Before an outside contractor works in a refrigerated warehouse on refrigeration systems, the warehouse should have established procedures in place to determine that the contractor is the appropriate expert or specialist to work on or near the refrigeration systems. OSHA requires the warehouse to review the outside contractor's training procedures and consider their safety records. Before the contractor is allowed to start working in the facility, they must be informed about the potential process hazards and have the facility's emergency action plan explained to them. Additionally, safe work practices for the contractor while working in the facility should be developed.

It is important to also consider which contractors must be qualified. Essentially, if the contractor is working on the ammonia refrigeration system **OR** is working NEAR the system in a manner that could endanger the system, they must be qualified.

While the outside contractor is on the job in the warehouse, their safety performance should be evaluated, and appropriate injury and/or illness logs maintained. It is also the responsibility of the warehouse to determine that the outside contractors have properly trained their employees in safe work practices and documented that training. Furthermore, the contractor's employees should be informed of any potential process hazards that they may be exposed to, and the appropriate emergency action plans. Efforts to assure that outside contractor's employees follow the safety rules of the facility are paramount. Documentation of the contractors working on or around the system is a must.

Pre-Start Up Safety Review:

The pre-start up safety review (PSSR) mandates that the warehouse has a safety review procedure in place for new and modified refrigeration systems to ensure the mechanical integrity of the refrigeration equipment. This includes assurances before any start-up that the appropriate safety, operating, maintenance and emergency procedures are in place; and most importantly to verify that a process hazard analysis has been performed for new facilities and what issues have or have not been addressed.

The start-up and operation of any new facility can only be enhanced by making sure that the PHA recommendations are addressed before the "start" button is pressed. This includes making any necessary corrections to the P&ID, ensuring that the operating procedures are read and understood and that employees are trained to run the system prior to start-up. As part of pre-start up procedures it is important

to review all initial start-up procedures and normal operating procedures to ensure a safe transfer into the normal operating mode.

If the existing refrigeration plant is to be modified, the PSSR should ensure that any changes other than "replacement in kind" made to our refrigeration system go through the Management of Change (MOC) procedures.

Creation of a PSSR form or checklist is imperative to ensuring that all aspects of design and safety have been reviewed satisfactorily prior to starting or restarting the system.

Mechanical Integrity:

Mechanical Integrity requires the warehouse to have written procedures to ensure the integrity of refrigeration systems. With regard to this, it is important to consider what could affect 'the integrity' of the system to better understand the purpose of this program. Examples of activities (or lack thereof) that could negatively affect the integrity of the system could include, but not limited to:

- If preventative maintenance is not being performed on the equipment
- If the equipment is not being inspected
- If the equipment is not being operated by a qualified person
- If operating/maintenance procedures do not exist or are inadequate
- If an unqualified contractor works on the system

For new as well as older facilities this involves having written specifications for refrigeration piping and insulation. It is important to ensure that the people supervising new installations are qualified to inspect new equipment such as pressure vessels and piping. Older facilities should have procedures for inspection of the refrigeration vessels, piping, and insulation systems.

Mechanical integrity requires the warehouse to correct equipment deficiencies and assure that new equipment and maintenance materials such as spare parts are suitable for the components that are being repaired.

A well-developed mechanical integrity program should include identifying and categorizing equipment and instrumentation, inspections and tests and their frequency; maintenance procedures; documentation of test and inspection results; and documentation of manufacturer recommendations for equipment and instrumentation.

Documentation is the key to a fully functional mechanical integrity program.

Hot Work:

The hot work section of the PSM program requires the warehouse to have a permit system in place for all hot work operations conducted on or near the refrigeration system. The standard simply tells the warehouse to conform to the requirements in 29 CFR 1910.252(a) and that the permit system must be written. Although it is not required it is recommended that copies of all hot work permits be retained for audit purposes, including work conducted by outside contractors.

It should be noted that the insurance company covering the facility may have a hot work program that they recommend.

Management of Change:

Management of change (MoC) requires the warehouse to have a written program in place to ensure that any modification made to the refrigeration system is performed in a safe manner. This program works in conjunction with the Pre-Startup Safety Review (PSSR) program. The MOC program essentially reviews all aspects pertaining to how a change may affect the facility and to ensure that all necessary reviews are performed prior to moving forward. The PSSR program is put in place to ensure that all designed changes have been accounted for and that all appropriate reviews are performed prior to introducing ammonia to new equipment.

The MOC mandates that the following considerations are addressed:

1) The technical basis for the proposed change
2) Impact of the change on employee safety and health
3) Modifications to operating procedures
4) Necessary time period for the change
5) Authorization requirements for the proposed change

To manage changes to the refrigeration systems it is important to know what a change is and what will trigger a MOC. The PSM standard states that change includes any "modifications to process chemicals, technology, equipment and procedures." Included in the language is an OSHA reference to a new term, "replacement in kind."

OSHA's definition for "Replacement in kind" is "a replacement which satisfies the design specification." It is important to understand that OSHA is referencing the original designed specification not the new specification. Thus, if the original design specification is changed, the warehouse is required to do a MOC. For example, when changing a motor on screw compressors, if the motor is replaced with the same horsepower, then no MOC is required. However, if the new motor has greater or lesser horsepower, then a MOC is required. It is important to understand that, even

if work is considered to be a replacement in kind, there may be areas of the PSM that could change still. Specifically, even though a piece of equipment may be replace with a direct exchange from the same manufacture and model (or of similar design from another manufacturer), differences may exist in the following areas, including but not limited to:

- Manufacturer, model, and serial numbers on inspection forms or in other documentation (PSI, Operating Procedures, Mechanical Integrity Program listings, etc).
- Capacity of equipment may vary for load balance calculations
- Inventory of ammonia may vary (if inventory estimates are itemized)

Incident investigation:

Incident investigation is the process of identifying the underlying causes of accidents or near misses and setting in place procedures to prevent similar accidents and/or near misses. OSHA expects the warehouse to be able to recognize and investigate all types of incidents "that resulted in or could reasonably have resulted in a catastrophic release" of ammonia.

OSHA requires the warehouse to investigate incidents as soon as possible, within 48 hours, which did result or could have resulted in catastrophic releases. The warehouse must be able to address and document the findings and most importantly the recommendations. The results of the investigation should be reviewed with affected employees as well as outside contractor employees, and records should be retained for five years.

Compliance Audits:

A refrigerated warehouse must be able to certify that they have evaluated compliance with OSHA's PSM programs at least every three (3) years and maintained the last two audits on file, including OSHA's report findings and the warehouse's response to the findings.

It is recommended that warehouse management obtain the EPA's latest guidance for auditing their risk management program or plan. This document will contain all the requirements of the PSM and RMP for both the OSHA and EPA agencies. It is important to note, however, that conducting a self audit on a system developed internally is not always the best course of action. It is recommended that audits be performed by third party service providers, or by experts from another facility, perhaps even a sister warehouse. Nonetheless, it is important to obtain an objective and un-biased review of the program.

Emergency Planning and Response:

OSHA's PSM program simply requires the refrigerated warehouse to develop and implement an emergency action plan (EAP). The EAP is different than an "Emergency Response Plan" (ERP). An emergency action plan can be part of the emergency response plan or just simply be the warehouse's primary response.

Additional information about EAP can be located under OSHA's 1910.38 - Employee emergency plans and 1910.39 Employee Fire Prevention Plan. The emergency response plan is OSHA's 1910.120 - Hazardous Waste Operation and Emergency Response (HAZWOPER). Under the HAZWOPER standard a warehouse would fall under paragraph (q). Emergency response program to hazardous substance releases.

Emergency response requirements under the EPA's risk management program can be found under 40 CFR Part 68 paragraph 68.95 Emergency response programs.

Trade Secrets Program:

While the refrigerated warehouse industry does not generally consider the ammonia refrigeration system applicable to 'trade secrets', inspectors have requested that a 'program' be identified that essentially states that there are no trade secrets regarding the system and that a trade secret program is not applicable.

6 Safety Management

6.2 Risk Management Program

Risk Management Programs (RMP) are designed to protect the environment and the surrounding community from hazardous chemicals. The United States Environmental Protection Agency (EPA) manages RMP compliance, using the authority provided by the Clean Air Act (CAA) in 1990. The RMP rule was first published in 1996 and took effect in 1999. The EPA mandate requires a refrigerated warehouse to develop a systematic approach to evaluating the complete chemical process in the facility. In the case of refrigerated warehouses, this generally applies to the ammonia refrigeration systems. Under the RMP law, the EPA was directed to create a chemical safety program(s) relating to specific chemicals, and to identify other chemicals that may create chemical hazards to the environment, surrounding communities and to the employees that work within these facilities.

It is important to note that submitting an RMP to the EPA does not constitute an active plan. For an RMP to be valid it must contain all of the elements of the OSHA requirements, along with other elements, including a management system and proper implementation.

A key element of any RMP is the comprehensive or systematic evaluation of the facility. Using a systematic approach, all elements within the facility are covered, including anything that may potentially affect the operation of our refrigeration system during our initial evaluation and any modifications thereafter. By utilizing a systematic approach, the warehouse can address all elements that affect the operation of the refrigeration system during the initial evaluation and any modifications thereafter. The warehouse should systematically review the refrigeration system design, the technology used, and changes, both operational and maintenance along with non-routine activities such as emergency planning and response plans. It is important to note that all training programs relating to the refrigeration systems should fall under this process.

In an effort to reduce the costs for implementing the RMP, the EPA adopted a three-tier concept. It should be noted that while the EPA often uses the term "tier" in official language, the term "program" has been commonly used to define the levels and requirements of RMP.

RMP Program 1:

RMP program 1 is the least stringent of the EPA programs, and applies only to chemical processes that have experienced no accidental releases with offsite consequences in the previous five years and do not have public receptors within the

hazard zone. To define the hazard zone, a facility must consider the worst-case scenario, excluding releases that involved evacuations and "sheltering-in-place", but had no other consequences. The hazard zone is the maximum circular distance where up to 200 ppm of the chemical can be detected. Additionally, the facility must have coordinated their emergency response procedures with local emergency planning and response organizations.

It should be noted that very few, if any, Public Refrigerated Warehouses (PRW) will qualify for a program 1 classification due to the nature of the chemicals used in the refrigeration process.

Eligibility for RMP programs 2 and 3 is more complex and are based on Standard Industrial Classification (SIC) codes, changed to North American Industry Classification System (NAICS) codes in 1999. These codes are used to classify the hazardous materials in a facility and determine whether the facility is eligible for RMP program 2 or 3. The refrigerated warehouse SIC code is 4222, and the corresponding NAICS code is 493120. Both codes 4222 and 493120 do not fall under the Standard Industrial Classification (SIC) clause, which would require that all refrigerated warehouses, irrespective of the amount of ammonia on hand, would be required to perform the same RMP functions. It is also important to understand that the Standard Industrial Classification system has gone away and that the North American Industry Classification System (NAICS) has replace said system. Only use the NAICS classification number 493120.

RMP Program 2:

Eligibility for Program 2 is fairly simple, in that if a warehouse is not eligible for Programs 1 or 3, then it falls under the jurisdiction of Program 2. Program 2 has a more streamlined, less complex prevention program than Program 3 and is more suited for the refrigerated warehouse industry. However, the USEPA does not allow facilities with a NASIC code of 493120 to participate in RMP program 2. As such, refrigerated warehouses most commonly fall into RMP program 3, which is the most stringent of the RMP classifications.

RMP Program 3:

Facilities participating in Program 3 must submit a Risk Management Plan that consists of:

1) Executive summary
2) Registration
3) Worst case scenario
4) Alternative case scenario

5) 5-year accident history
6) Prevention program
7) Emergency response program
8) Certification letter

A few of the key elements of the RMP Program 3 are described below:

Worst Case & Alternative Case Scenarios:

A hazard assessment is used to evaluate the worst case and alternative case scenarios. Hazard assessment contains several key components, including:

1) Identify the hazards associated with the process and chemicals
2) Opportunities for equipment malfunctions or human error
3) Safeguards which control the hazards
4) Steps needed to detect and monitor releases

It should be noted that the Process Hazard Analysis (PHA) is fairly detailed if done properly and requires persons familiar with the methodology and engineering of the process, as well as familiarity or experience with the operation of the refrigeration system. Simply put, the warehouse needs to develop a hazard assessment based on various release scenarios and the quantity of the ammonia released to determine how far the release cloud will go downwind in order to determine who might be affected within the "Hazard Zone." The hazard zone is a circle around the facility. The radius of the circle around the facility is based on Appendix A of the risk management rule entitled, "Appendix A - Toxic Endpoints" and lists the acceptable modeling endpoint to use for each of the regulated chemicals. Ammonia has a "toxic endpoint" of 200 ppm., meaning that is where the ammonia is no longer a threat to human life and health, and a person will be able to take action to evade the threat. According to the EPA "environmental receptors" are natural areas, such as national parks, state parks, monuments, or forests. They also include officially designated wildlife sanctuaries, preserves, refuges and federal wilderness areas.

Determining the population that is potentially within the hazard zone is accomplished by reviewing census data for the local or surrounding residential areas. Warehouses with schools, hospitals, prisons, public recreation areas or major commercial and/or industrial areas within their hazard zone will need to note that information in the RMP plan as well as define the off-site impacts on populations and the environment.

The definition of a "worst-case release" for ammonia is defined as a release over a 10-minute period of time of the largest quantity of ammonia from a vessel or pipe

that would result in the greatest distance off of the site. It is important to note that the EPA is most concerned with the combination of the largest quantity of chemical that will travel the greatest distance off site, and presumably into residential or commercial areas. In some cases, the largest vessel inside a facility may not represent the worst-case scenario, since a smaller vessel or pipeline located outside of the facility may release chemicals further off site to the toxic endpoint of 200 ppm. It is important to note that the EPA has specific conditions for the off-site consequence analysis, including wind speed, temperature and humidity.

The alternative release scenario is commonly called the "more likely" release scenario and must also be included in the hazard assessment. Since this is considered a "most likely" event, the warehouse should develop a real emergency response. It is this plan that is used when discussion issues with the general public. After these "worst-case" and "more likely" release scenarios have been identified, they should be submitted in the Risk Management Plan. Warehouse management should be prepared to defend both scenarios. If the EPA or the Implementing Agency believes that the hazard zone circle is too small, they may develop their own worst-case scenario for your facility.

Five-Year Accident History:

As part of the hazard assessment a five-year accident history is required and must be included in the Risk Management Plan. Only those accidents that resulted in the following need to be included:

1) Deaths
2) Injuries
3) Significant property damage onsite
4) Known offsite deaths
5) Known offsite injuries
6) Evacuations
7) Sheltering-in-place
8) Property damage
9) Environmental damage

It is important to note that there is no minimum release amount for the accidents listed above. If the facility has an emergency response and any of the above conditions occur, then it must report the accident in the facility's Risk Management Plan.

The owner or operator shall report the following data for each accidental release:

1) Date, time and approximate duration of the release
2) Chemical(s) released
3) Estimated quantity released, in pounds
4) Type of release event, and its source
5) Weather conditions, if known
6) On-site impacts
7) Known off-site impacts
8) Initiating event and contributing factors, if known
9) Whether off-site responders were notified, if known
10) Operational or process changes that resulted from the investigation

Emergency Planning and Response:

Additional information about emergency action plans (EAP) can be located under OSHA's 1910.38 - Employee emergency plans and 1910.39 Employee Fire Prevention Plan. The emergency response plan is OSHA's 1910.120 - Hazardous Waste Operation and Emergency Response (HAZWOPER). Under the HAZWOPER standard a warehouse would fall under paragraph (q). Emergency response program to hazardous substance releases.

It should be noted that a key part of the facilities emergency response plan is coordination with the Local Emergency Planning Committee (LEPC).

The LEPC is govern under the Emergency Planning and Community Right-to-Know Act (EPCRA). Under EPCRA the LEPCs must develop an emergency response plan, review the plan at least annually, and provide information about chemicals in the community to citizens. Plans are developed by LEPCs with stakeholder participation. There is one LEPC for each of the more than 3,000 designated local emergency planning districts. The LEPC membership must include (at a minimum):

- Elected state and local officials
- Police, fire, civil defense, and public health professionals
- Environment, transportation, and hospital officials
- Facility representatives
- Representatives from community groups and the media

Emergency response requirements under the USEPA's risk management program can be found under 40 CFR Part 68 paragraph 68.95 Emergency response program.

Chemical Accident Prevention Program:

Chemical accident prevention program elements are identical to OSHA's PSM with a few minor language changes. The EPA believes if you have an active PSM program then your RMP is almost completed. The chemical accident prevention program of the RMP is synonymous with the PSM plan of the OSHA. USEPA has clearly stated that if a refrigerated warehouse has an active PSM program in place, then the warehouse will be in compliance with their prevention program. See Chapter 6.1 Process Safety Management (PSM)

The key elements of the Chemical Accident Prevention Program are:

1) Process safety information
2) Process hazard analysis
3) Operating procedures
4) Training
5) Mechanical integrity
6) Incident investigation
7) Compliance audit
8) Management of change
9) Pre-start up safety review
10) Contractor qualification
11) Employee participation
12) Safe work practices (hot work, lock out/tag out, confined space)

6 Safety Management

6.3 Forklift Safety

Operation of Power Industrial Trucks (PIT) or the material handling equipment (MHE) is a significant source of injury in materials handling industries. According to the Occupational Safety and Health Administration (OSHA) estimates, 35,000 serious injuries and 62,000 minor injuries occur annually in the United States. Overturning due to overload, incorrect load positioning, operator errors and poor/lack of forklift maintenance are the leading causes of injuries from forklift operation. Safe material handling requires focus on training, vehicle maintenance and vehicle inspection.

Important aspects of MHE operation to consider include but are not limited to the environment in which the material handling equipment is operating, type of tires on the equipment, and the material handling equipment turning radius. The MHE age, power source and the type of controls that operates the equipment may also be additional items to review.

Environments:

MHE operation may vary widely depending on the operation type, location and facilities available. Material handling operation commonly occurs on warehouse floors, outdoor terrain or a combination of both. Outdoor operation may require additional skills and equipment due to the presence of dips, slopes, narrow holes and rollover threats. If any of these conditions exist, the area may need to be made safer.

Tires:

Indoor and outdoor operations may require different types of tires. Tire choice is affected by the type of lifting and forklift being used. Pneumatic tires are very durable and are the best for heavy lift operations whereas solid tires are best for interior warehouse operations. Solid tires like Polyurethane are used for smooth indoor operation and specialized material handling applications.

Turning Radius:

The forklift turning radii in relation to the width of aisles in warehouses must be considered. In densely packed warehouses with narrow-aisles, forklifts with narrow turning radii are required.

Additional Factors to Consider:

The age of the forklift, forklift power source and forklift control types are also important considerations when maximizing forklift safety. Age of forklift impacts operations mainly through maintenance cost and performance. Newer forklifts may have more advanced safety features than older models. The costs of maintaining an older forklift versus acquiring new forklift is an important factor for consideration.

The United States Occupational Safety and Health Administration (OSHA) requires extensive training and should never be assume that a forklift operator is able to operate all types of material handling equipment without proper training. Improper use by an untrained operator can lead to severe accidents, possibly causing death.

6.3.1 Best Practice Principles for Safe Forklift Operation

Best Practice Principles can and should be drawn from industry and government sources as well as organizational history. Industry Best Practices include, but are not limited to:

1. Safety Training
2. Equipment Checks
3. Knowledge of the Rules and Machinery
4. Understanding the 'stability triangle'
5. Understanding load basics

Safety Training

Employers should ensure that forklift and power truck operators are competent to safely operate forklifts. They should conduct training and evaluation programs, send employees to appropriate training, or employ operators certified in forklift operations. OSHA requires training programs to require written materials, lectures and practical training combined with an on-site workplace evaluation. Employers and managers must also ensure that operators have demonstrated competency on the actual machines that are used in the forklift operation and not just assume that if an operator is competent on one machine type that he or she will be competent on all of them.

Equipment Checks

Pre-operation inspection of forklifts and powered industrial trucks prevents hazards by identifying problems before the machine is in operation. At a minimum, pre-operation checkups should include inspection of seat belts, tires, lights, horn, brakes, backup alarms, fluid levels and inspection of the moving and load-supporting parts of the forklift.

Knowledge of the Rules & Machinery

Forklift type, environmental factors including warehouse or outdoor operations, tire types, forklift turning radii, forklift age, power source and forklift controls all affect safety. Certain tire machine types may also be regulated by law, determining under what circumstances they may or may not be used. Forklift types vary on a range of characteristics that affect how they are most safely operated. Among the differences are

- Open structure; driver is not completely enclosed
- Weights ranging from 9,000 to 30,000 pounds, with rough-terrain lift trucks at the heavier end
- Traveling speeds of less than 20 mph, closer to a walking pace
- Three-point suspension
- More prone to tipping over – loaded or not – and varying stability
- Tighter turning radius for operating in tight spots

Understanding the 'Stability Triangle'

Lift trucks are built on three-point suspensions systems that provide support for the forklift load on two points of the front axle and one point of the rear axle. As long as the combined center of gravity of the load plus the forklift are supported within this 'stability triangle', the load will be handled safely, and the forklift will not be in danger or overturning. Slippery conditions, loosely positioned loads that can shift during movement, loads held too highly on the lifting apparatus, and presence of slopes can move the center of gravity outside of the stability triangle leading to accidents. To prevent this, it is important to:

- Ensure a load is completely stable and secured on the forks
- Keep loads low to the ground during operation
- Keep loads uphill when climbing or descending an incline
- Drive slowly in wet or slippery conditions
- Slow down during turns and honk the horn upon encountering traffic

Understanding Load Basics

Operators should understand how loads affect forklift operation in each stage of forklift operation including traveling, docking, porting, and stacking. Operators must check loads before picking them up with the forks, ensuring the load's stability and dimensions will allow for safe transport. When loading, the operator should move squarely in front of the load and move the forks apart as far as possible before driving them under the load. Ensure that there is no overload and that the load is centered. Slightly tilt the forklift mast backward before lifting. Lift the load enough to clear the floor or rack.

For stacking, the load should be above the lower stack by about 10 centimeters. When placing a load, operators should be squarely in front of the placement destination. Make sure the area is flat and stable, and don't place heavy loads on top of light ones. Lower the forks upon placing the load, and then back the forklift away. As always, ensure the load is stable

6.3.2 Best Practice Techniques for Safe Forklift Operation

Safe forklift operation requires planning. Managers and operators must identify hazards in the workplace and operate in a way that eliminates hazards or at a minimum, mitigates risk. Operators and managers must also plan for pre-operation inspection and maintenance of power operated trucks and forklifts. Principles of basic forklift operation are as follows:

Common Sense Operation

The following common-sense rules should be considered when operating PIT:

- Only trained and licensed operators shall be permitted to operate a forklift.
- Operators must never operate a forklift while under the influence of drugs or alcohol, or if severely mental and/or physical strain would impair their ability to safely operate the vehicle.
- Check each truck at the beginning of each shift before starting work, utilizing the pre-checklist. The document is to be signed by the person responsible for operation of the forklift.
- Report all equipment trouble and unsafe conditions to your supervisor. The operator shall never try to repair any vehicle without supervisor permission and/or oversight. The use of a defective vehicle should be prohibited.
- Accidents involving injury, damage to property, product or equipment, shall be reported immediately to the operators' supervisor.
- Never damage, distort, disconnect, or bypass any safety switches on the PIT.
- The operator must report any malfunctioning equipment to his/her supervisor.
- Counter-weights must not be alter or added to any material handling equipment.
- Do not sit on the back guard of stand-up type trucks.
- Never use defective pallets.
- Always stack bins, pallets, and other loads safely.
- Never overload the PIT. Check the weight of each unfamiliar load to avoid overloading or exceeding the PIT capacity.
- The operator shall never allow anyone to stand on the forks. A standard safety platform secured to the lofting carriage, in accordance with national or local safety provisions, must be used when it is necessary to lift someone.
- Forks should only be removed by qualified, trained, and authorized professionals.
- Never allow anyone to stand within ten (10) feet of elevated forks, loads, or platforms, including "cherry pickers" and other types of lifts. NOTE: Consult

equipment manufacturers to determine the appropriate 'safe distance' from high-reach PITs.

- Never reach through the mast uprights or reach mechanism for any reason.
- Know the load limits of any floor and stay within those limits.
- The operator must not place empty pallets on their edges.
- Keep forks centered on all loads.
- Avoid rapid start/stop or jerky operation of the PIT or load mechanism.
- When attachments are used on the PIT, particular care should be taken in securing, manipulating, positioning, and transporting the load. PITs equipped with attachments shall include the weight of the attachment plus the load itself. Never exceed the capacity of the PIT.
- Extreme care shall be used when tilting the load forward or backward, particularly when high-tiering. Tilting forward with a load elevated is dangerous and prohibited except to pick up a load.
- Exercise caution when positioning a PIT at a charging station.
- The operator shall never permit an unauthorized driver to use his/her PIT.
- Ensure the weight of the load does not exceed the capacity of the racking system.
- Consider using flooring position on all unstable loads
- Eating, drinking, or smoking while operating a forklift is prohibited.
- Climbing or riding on a forklift in any position other than the standard operating position is prohibited.
- The use of mirrors on PITs is prohibited, unless provided as standard equipment.
- Electric PITs should not be driven outdoors when there is rain, or the ground is wet, or snow covered.
- The ignition key must be removed from the ignition of any parked vehicle.

Mounting and Dismounting

Potential Hazards include hitting your head on overhead cage, slips, trips and falls, especially feet slipping off of the step.

Recommended Best Practices:

- Be sure that your hands are clean and dry to prevent slipping when grabbing handhold.
- Check your shoes for grease before entering the vehicle.

- Grasp handhold and get a good grip. Never grab the steering wheel because it could cause you to lose balance if it moves.
- Always be careful with your footing when mounting and dismounting vehicle.
- Pull or lower your body carefully into or out of cab. Dismounting is the opposite of mounting -- do not jump.
- Wear appropriate footwear to prevent skids.

Starting

Before using any material-handling equipment be sure to conduct a pre-operation inspection. In addition, consider conduct an operational check after starting the engine. Examples of these checklists are provided elsewhere in this document.

Stopping

Recommended Best Practices:

- Select an area to park. Do not park in an unauthorized area. Do not block an aisle or exits. Follow your company's parking procedures.
- Apply brake slowly to stop so the load does not tip or spill.
- Neutralize the controls.
- Set the parking brake.
- Turn off the ignition.
- If the PIT is parked on an incline, block the wheels.

Operating at Speed

Potential Hazards include tip-over caused by driving too fast and collisions with pedestrians and obstacles caused by inattention and not being able to stop in time.

Recommended Best Practices:

- Be aware of the travel conditions along your planned route.
- Under all travel conditions the PIT must operate at a speed that will permit it to be brought to a stop in a safe manner.
- The driver must slow down for wet and slippery floors.
- The driver must look in the direction of, and keep a clear view of, the path of travel.
- The driver must slow down and sound the horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view, the driver shall be required to travel with the load trailing.
- While negotiating turns, speed shall be reduced to a safe level by turning the steering wheel in a smooth, sweeping motion.
- Grades shall be ascended or descended slowly.

- When ascending or descending grades in excess of ten (10) percent, loaded PITs shall be driven with the load up-grade in both direction if the view is clear and safe to operate the equipment.
- Running over loose objects shall be avoided.

Changing Direction

Potential Hazards include tip-over caused by driving too fast and collision with pedestrians and obstacles caused by inattention and not being able to stop in time.

Recommended Best Practices:

- Come to a complete stop before changing directions.
- Use a horn or warning light to warn pedestrians of moving equipment.

Reversing

Potential Hazards include collision with pedestrians and obstacles caused by inattention and not being able to stop in time as well as collision with other forklifts or racking systems.

Recommended Best Practices:

- Keep a clear view.
- Look in the direction of travel. When reversing, look behind you.
- Be aware of limited visibility and use extreme caution when driving in reverse.
- Consider using MOE when planning to use ground guides, rear-view mirrors, spotters, or other aids to increase visibility.
- Consider the noise level in your workplace. Do not assume pedestrians or bystanders are able to hear a back-up alarm.
- Allow plenty of room for pedestrians. You cannot anticipate what people will do. Many have no idea how quickly forklifts accelerate and how sharply they turn.
- Never assume pedestrians or bystanders are aware of the presence of heavy equipment and the intended direction of travel.
- Always keep your body including feet and hands inside the "running lines" of the equipment being used.

Turning and Steering

Potential Hazards include tip-over, falling load after a collision and collision with pedestrians or objects due to the forklift's tail swinging to the side opposite the direction of the turn.

Recommended Best Practices:

- When turning, reduce speed to a safe level.

- Proceed with caution when making turns, especially when working in confined areas or narrow aisles. When the lift truck turns a corner, the rear of the lift truck swings (out) in the opposite direction of the turn.
- Anticipate the rear-end swing and start the turn as close to the inside corner as possible. Plan your route and anticipate turns.
- Never travel or turn with forks elevated.

Traveling on Inclines

Potential Hazards include tip-over and falling load after a collision.

Recommended Best Practices:

- Follow your company policy when going up or down a ramp with a load.
- Always drive unloaded trucks with the forks down-grade.
- Never turn any handling equipment on a grade.

Traveling

Recommended Best Practices:

- Sound the horn when approaching pedestrians and give the right of way to all pedestrians.
- Give the right of way to operators of walking, manual or powered, transporters.
- Never ride on or permit others to ride on a walking type PIT, unless it is designed for riding.
- Ascend and descend grades slowly.
- Keep to the right of aisles.
- Yield the right of way to emergency vehicles.
- Keep a minimum distance of three fork-truck lengths between PITs traveling in the same direction.
- Give the right of way to a vehicle entering the building when leaving the building by the same door.
- Give the right of way to the vehicle on the right at an uncontrolled intersection.
- Slow down at all intersections and look in both directions.
- Sound the horn when approaching blind intersections.
- Come to a full stop, sound the horn, and proceed cautiously when passing through a doorway.
- Cross railroad tracks diagonally, at a very slow speed.

- Tilt load back slightly when traveling on tilt-model trucks.
- Drive in reverse and look to the rear when forward view is impeded.
- Never pass another vehicle going in the same direction, until it has stopped, and the operator is aware of your intentions.
- Avoid sudden starts and stops, never spin or slide the drive wheel.
- Properly balance all loads.
- Never drive the PIT with the forks elevated or extended except when storing or retrieving a load or in a guided aisle.
- Never operate any PIT controls from any position except the normal operating position, or attempt to carry material in other than the normal provided location.
- Operate unloaded forklifts on all grades or inclines, with the forks or platforms facing downward.
- Keep the load on the high end of the forks or platform of the truck when going up or down an incline.
- Keep the forks or load approximately three (3) inches from the floor or as close to the floor as the load will permit.
- Never carry two loads at once if the top one extends above the top of the carriage, unless both loads are banded or similarly secured.
- Never start, brake, or turn suddenly, especially when the load is elevated.
- Never allow others to ride on the PIT, except for forklifts designed to transport more than one person.
- Never drive up to another person standing in front of an object against which he/she may be pinned.
- Never drive with wet or greasy hands.
- Never maneuver a load on or off a rack if another person is within a ten (10) foot radius of the PIT.
- Never drive over wet or greasy floors unless it cannot be avoided, then drive slowly and carefully.
- Always slow down when turning.
- Never run over any debris or obstruction on the floor. The shock may cause the steering wheel to spin or may cause the load to spill. Stop and safely pick the obstruction up.
- Never start a PIT with pedestrians in the line of travel (approximately 25 feet).
- Watch overhead side clearances at all times.
- Be careful not to allow hands, feet, or head to overhang the PIT cage.

- Know the load capacity and free-lift measurements of the PIT.
- Stop when leaving a side or storage aisle before entering main aisle.
- Never steer vehicles by spokes or allow hand to dangle inside the steering wheel. This is to prevent injury to hands in case of sudden spinning of steering wheel from hitting an object on the floor

Plugging

Plugging is a means of slowing or stopping, by moving the control handle in the opposite direction of travel. The operator SHALL NOT use plugging as a means of slowing or stopping the PIT unless the truck is designed for this type of operation.

Dock Operation

Recommended Best Practices:

- Never drive inside a highway trailer or railroad car without first checking that the brakes are set, the wheels chocked and jacks properly placed if the tractor has been removed.
- Never drive onto a dock-board or bridging plate without first checking that the stay pins or other retaining devices are secured.
- Don't use a damaged dock-board.
- When working in a boxcar with an engine-powered truck the operator shall open the door opposite the entrance for ventilation, but not wide enough for the truck to pass through, only about two to two and a half feet (2.5').
- Maneuver as little as possible on a narrow dock. When backing out of a freight car onto a narrow dock, continue in reverse across the dock and do any necessary turning inside the building.
- Check the flooring of trucks, trailers, and railroad cars for breaks and weaknesses before driving onto them.
- Drive over dock-boards or bridge plates carefully and slowly and their rated capacity should never be exceeded.
- Material handling equipment should only enter trailers with flooring rated for fork truck usage.
- The forklift operator should never use forks of a truck other than what they were designed to do.
- Utilize auxiliary lighting where provided.
- Never use" Spot" lights in place of "flood" light for auxiliary lighting.
- Sound the horn when approaching pedestrians.

Parking

Recommended Best Practices:

- The operator shall avoid parking on an incline. If unavoidable, be certain to chock wheels and set the emergency brake.
- Park so as to not block aisles, doors, or fire apparatus.
- When parking, the forks shall be lowered to rest on the floor, the brakes set, the controls returned to neutral, and the ignition or master switch turned off.
- Parking closer than eight (8) feet from the center of a railroad track is prohibited.
- A vehicle is considered to be parked (unattended) when the operator is out of sight of the vehicle or more than 25 feet away.
- Apply the vehicle parking brakes, lower the forks or load to the floor, and put the controls in neutral when getting off a vehicle for any reason.

Visibility

Blocked or limited visibility is a major hazard in forklift operations and is a contributing factor in most forklift and powered truck accidents. Blocked visibility, including partially blocked visibility, increases the risk of accidents.

Recommended Best Practices:

- Keep a clear view.
- Look in the direction of travel. When reversing, look behind you. Use spotters, rear view mirrors, or other aids to increase visibility.
- Where available, use concave mirrors when entering buildings or aisles.
- Equip forklifts with headlights where general lighting is less than five (5) Foot-Candles at floor level. In general, forklifts should have headlights if working at night, outdoors or in any area where additional lighting would improve quality.
- Drive slowly into and out of warehouses or other buildings. Going from bright daylight into a darkened warehouse impair the vision of drivers just long enough to hit another worker, vehicle or object.
- Be especially careful on loading docks; stay away from the edge.
- Add physical barriers such as ramps, raised concrete staging areas and heavy-gauge safety chains in front of dock openings. Use protective guard rails.
- Add a "warning track" of yellow paint on the floor near dock openings.
- Slow down and sound the horn at cross aisles and other locations where vision is obstructed.

Tip Over

There are two basic types of tip overs in a forklift: 1) a forward tip or longitudinal tip; and 2) a lateral or side tip. The procedure to follow in the event of tip over when using a "sit-down" forklift varies depending on the type of tip over and the class of forklifts that you may use in your facility. Prevention is the best way to prevent tip over hazards. Once tip overs happen injury may be reduced using the following recommended practices and always use your seatbelt:

Recommended Best Practices:

- Don't jump. Stay in the forklift.
- Hold tight to the steering wheel.
- Brace feet.
- Lean AWAY from the impact.

A Forklift Inspection Checklist is provided in Appendix 8:

6 Safety Management

6.4 Forklift Safety

Worker productivity, safety and comfort are all critical components of a healthy workforce and successful business. Today's challenges in finding, training, and retaining good warehouse employees in a competitive economy are exasperated by challenging requirements associated with working in coolers, freezers and blast cells.

It is important to understand that blast cells or blast freezer should never be on when employees are working in these areas. Blast freezer areas are not like holding freezer that are typical held between -1°F AND -4°F. Typically blast freezer run from -30°F and -40°F.

This chapter provides some helpful hints and information about outfitting and training workers to be comfortable and productive in cold rooms.

6.4.1 Heat Loss in Cold Work Environments

Understanding how exposure to cold environments affects workers is an important step in providing proper training, attire, work and warm-up schedules to the workers.

How Cold Affects Productivity

Cold does not only cause discomfort to the workers, but also seriously impact their productivity. Performance of the workers/employees is negatively-affected in a number of ways. Employees' ability to concentrate and remain alert is decreased, which brings about decreases in efficiency and productivity. Exposure to cold leads to loss of coordination and dexterity, further impacting productivity. If employees are not protected, their focus will be on staying warm, rather than the tasks at hand.

Any reduction in alertness and comfort can result in an increase in safety hazards. When the worker is not adequately protected from the cold, the body shivers to generate heat. Shivering causes unsteady hands – hands that are responsible for carrying out complex and important tasks. In addition, a study from the National Institute of Health (NIH) showed that reaction time is slower during exposure to cold temperatures, and that this effect is still evident 60 minutes after removal from the cold. For those operating machinery, a reduction in reaction time, coupled with loss of coordination, dexterity, and alertness could result in an accident that involves not only product loss but also injuries that keep your employees out of the workforce for an extended time.

How to Combat Heat Loss

Each form of heat loss can be combated with the appropriate Personal Protective Equipment (PPE). The easiest forms of heat loss to battle are convection and radiation. Jackets, pants, overalls, and other clothing designed for cold environments protect against heat loss due to convection. It is important to bear in mind activity level when

choosing these garments – a person that is moving their entire body or exerting themselves will generate more body heat and may not need as warm a jacket. Hats, gloves, scarves and other accessories will reduce heat loss through radiation by covering skin not protected by jackets and pants.

Figure 1: Types of Heat Loss

Heat loss via conduction is often overlooked, but combating it is vital to remaining warm, especially in work environments where everything from the products to the floor and the walls are cold. Choose footwear with outer soles built for cold temperatures; the outer sole should fight conduction and prevent break down due to temperature. Boots should also offer insulation, moisture wicking and ankle protection to further combat the cold. When choosing gloves, select a pair that will handle the temperature and also provide some wrist protection if it is really cold. Insulated gloves are common with performance or leather gloves, and you can also supplement with a liner in extreme temperatures.

To fight heat loss via evaporation and respiration, make sure your employees stay well hydrated while working, especially in positions with frequent movement that may cause sweating. Keeping the core warm with base layers and jackets helps keep the lungs warm, but in cold environments, help reduce the amount of cold air they breathe in with a face mask, gaiter or balaclava that covers the nose and mouth.

Proper Protection Increases Productivity

To protect your employees properly examine your work environment and the specific job duties of each position. For those on their feet on a freezer floor, make sure their footwear resists cold transfer. For those operating machinery that creates wind-chills, factor in the further drop in temperature. The better protected your employees are from the cold, the less time they will spend dwelling on getting warm, and the more they can concentrate on the tasks at hand.

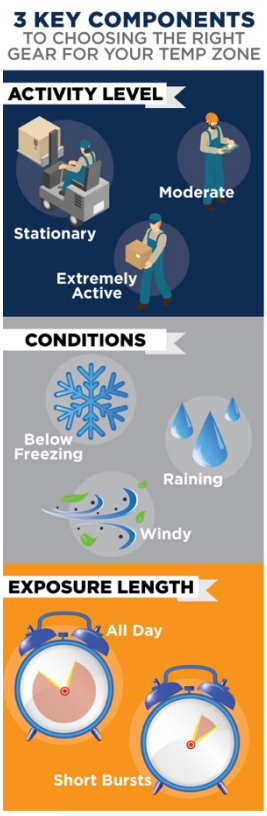
6.4.2 Overdressing

It is common for people to believe jackets are interchangeable – they think "if it is good for -30° it must be even better for 0°!" Or "this coat is thicker than that one – it must be better!" Unfortunately, not only are these untrue, they can lead to the purchase of personal protective equipment that hurts productivity rather than helps it.

Beyond Cold Protection

You know that the cold can adversely affect your employees – everything from reducing performance and impairing ability to operate machinery to increased safety concerns and loss of concentration. However, too many layers or a garment that is too thick can be counterproductive. You can make employees overheat or restrict their movements and ability to work.

The Risks of Overheating



Just as conditions that are too cold negatively impact productivity, an employee that is too warm will be less productive. Concentration will be lost as their focus splits between their discomfort and their duties. As internal body temperature rises, fatigue sets in, drastically reducing performance and increasing the chance of safety risks. Exhaustion also comes more quickly when the body is not at ideal temperatures. When an employee is exhausted and experiencing muscle fatigue, they are more likely to make costly mistakes, injure themselves or others, or mishandle equipment.

Sweat also plays a role in comfort, and therefore productivity. If gear is too warm for the conditions, the employee will sweat more. When you sweat, your clothing gets wet and it takes additional body heat to evaporate that moisture. If the sweat doesn't evaporate, the moisture will remain against the skin, cooling you, eventually leading to an uncomfortable chill. A jacket that at first overheats and causes sweat eventually cannot protect against the cold caused by the moisture, subjecting the person to two uncomfortable extremes rather than constant protection and comfort.

Figure 2: Gear Considerations

Restricting Movements

A thicker garment will create extra bulk as well as heaviness. For job duties that require a large range of motion in the arms, frequent turns of the torso or other movement, a thick jacket will hinder movement and therefore the ability of someone to do their job. Consider how much range of motion a job requires and select a garment that meets the needs of the environment plus the person's need for maneuverability.

Insulation

The main protection against cold in a jacket is the insulation; air gets caught in the spaces between insulation fibers, creating a barrier against the cold and keeping warmth from escaping. The insulation also accounts for much of the garment's thickness and bulkiness. So, when choosing a garment, make sure you understand how the insulation affects the warmth and thickness.

Synthetic insulation is rated in gram weights — 60 grams (g) means a one (1) meter by one (1) meter piece of the insulation weighs that much. The heavier the weight, the warmer the insulation. Synthetic insulation is often denser and less lofty, creating less bulk but often just as much weight. Down insulation, or even synthesized down, will be measured in ounces. Again, the more ounces of insulation, the thicker the loft and the more insulating power. With down or synthesized down, the loft increases with the ounces, so 11oz of insulation will be thicker and bulkier than 6oz of insulation.

Outershell and Lining Count More Than You Know

People often focus on insulation for warmth, but the outershell and inner lining provide warmth as well. For example, a jacket with thinner insulation but a silver lining that reflects heat back and an outershell that protects against the wind can provide more warmth than a jacket with thick insulation but poor outershell and inner lining materials. As a result, you can sometimes find lighter jackets with the same insulating power as thicker jackets.

When looking at the outershell and inner lining of a cold temperature jacket you will likely find nylon, micro-fiber, polyester or micro-fleece. What is important is that the materials of the jacket you choose meet your requirements. Fleece or silver reflective linings will be added factors for warmth. For the outershell, you can find water-resistant or waterproof outershells if condensation is a factor.

6.4.3 Dress Correctly for the Work Environment Temperature Zone

Having the proper outerwear and protective gear in work environments with low temperatures is vital for staying safe and maintaining high productivity. More than just the temperature when choosing the proper protective gear.

Protective Clothing and Activity Levels in Climate Controlled Environments

If you are in a temperature-controlled warehouse with the temperature set at 25°F, gear with a rating at that temperature might not be the best for you. If you are very active in your job duties – constantly walking, lifting and otherwise moving and producing more body heat – you will probably need gear rated for higher temperatures, so you don't overheat. Layering will also be key, so you can be warm when you first enter the low temperature environment and adjust as your body acclimates.

If you spend all day on equipment like a forklift, you are creating wind chill that will make it feel colder. In addition, in a stationary position, you are not moving your entire body as much. As a result, you will generate less body heat. Increased wind chill and less full-body movement means that you may need to choose outerwear that is rated for lower temperatures than surrounding air temperatures.

Exposure Time to the Cold Matters for Cold Temperature Gear

Did you know that you can experience hypothermia even in 50°F weather? Or if combined with wind and rain, hypothermia conditions can accelerate? The main factor in hypothermia is body temperature and not the temperature of your surroundings, meaning that unprotected exposure time to adverse conditions really matters in protecting yourself.

If you are going to be in cooler temperatures for a long period of time (e.g., more than 1-2 hours), then you need protective apparel. The colder or wetter the conditions and the longer the time you will be exposed, the more protection and insulation you will need. Your activity level always matters, but increased exposure without protective apparel, especially in sub-freezing temperatures, is risky no matter how active you are.

Recommendations for Dressing Correctly for Cold Environments

These recommendations are based on what the temperature feels like to you. Remember to take into account all other conditions – job duties, weather, exposure time and any other factors. These exact products will not always be the best fit, but they are a good baseline to start from for making your final decision.

Temperature feels like it is between -60°F and -30°F

Winter coats designed for extreme subzero temperatures paired with the proper base layers work when the temperature feels this low. If you have minimal physical movement in situations with wind chill, you want to look for added insulation. If you are very physically active, you want jackets that don't hinder your movements.

Work boots similar need to offer protection from the cold as well as anti-slip and electrical hazard compliance. Pair with socks that offer moisture wicking capabilities to protect against sweat.

For headwear, concentrate on items like masks and balaclavas that will protect as much of your head and face as possible.

For gloves, mitts are great if you don't need much dexterity, as mitts are warmer than regular gloves. When dexterity and warmth matter, hand protection similar to performance gloves are your best bet.

Temperature feels like it is between -30°F and 0°F

Warm jackets and pants with insulation and a softshell outershell work great in subzero temperatures. Softshell materials are stretchy and less bulky, meaning you get a higher level of flexibility than in other materials. It is water-resistant (sometimes water-proof), exceptionally durable and very breathable, all key features for hard-working cold weather gear.

Leather boots or crossover boots (that combine work and hiker style boots) not only offer insulation to keep you warm, they also offer ankle and toe protection, anti-slip soles and waterproof uppers, among other features.

Leather gloves offer warmth and durability.

Knit caps paired with gaiters offer head, face and neck protection.

Temperature feels like it is between 0°F and 30°F

Temperatures below freezing don't require as much insulation as subzero temperatures, but you still need something insulated. Lighter jackets can be used here, and options that offer the additional protection of a hood are great for when it feels like it is below freezing.

Leather work boots offer durable leather uppers, anti-slip soles, plus insulation to keep you warm – in addition to other features.

Knit caps keep your ears and head protected.

Liners help gloves provide additional warmth. If your job requires additional safety, there are also options like impact protection and cut resistance offered in many insulated gloves.

Temperature feels like it is above 30°F

It might be above freezing but that doesn't mean it isn't still cold. You still need protection but layering and not over insulating is key. Moisture makes you colder, so sweating from overdressing makes you colder. A moisture wicking base layer paired with a sweatshirt or fleece, with a rain and/or wind-repelling jacket for backup against the elements if you work outside, work great at these temperature levels.

Make sure your boots don't have too much insulation – sweaty feet are uncomfortable feet, and uncomfortable feet means the rest of you is uncomfortable and productivity plummets.

Knit gloves, especially those with added grips or coatings, keep your hands warm without overheating while still allowing you to maintain performance.

Headbands keep vulnerable areas like your ears warm without overheating.

6.4.4 How to Properly Layer in Cold Work Environments

Layering is the best way to make sure you are always prepared for conditions and have the flexibility to perform your job functions. There are three basic layer types, but within each of those are multiple options best suited to the job duties and climate of temperature-controlled environments.

Layering – What You Need to Know

With the wide-ranging fabrics and differing garment types available in each layer category, it is possible to create a wide range of combinations to best suit your needs. Sometimes you will need the heaviest of all three layers, other times a light base layer and mid-layer vest will do. These are the factors to consider when choosing layers.

Base Layer

This layer is the first you put on and often rests against your skin. Fabric is the most important consideration here. If you'll be moving frequently and sweating, or in a damp or wet environment, cotton should be avoided as it retains moisture. Instead, choose fabrics designed to wick moisture away from the skin to evaporate. Activity level is also important for determining how warm you need your base layer to be. Stationary activity – like driving a forklift – means you want a base layer set of top and bottom, with a lining for extra comfort and warmth. And don't forget - base layers aren't just for your upper body; your lower half needs protection too.

Base Layer Examples

Short- and long-sleeve shirts based on active wear with moisture wicking properties, long underwear, flexible and light shirts, and lined tops/pants all work well as base layers.

Mid-Layer

The mid-layer is an extra insulation layer. It is meant to trap heat against the body, providing warmth and protection from low temperatures. Keeping your core warm is essential to overall body warmth – the warmer your core is, the more your body can pump blood to your extremities to avoid frostbite or, at the very least, a reduction in the tactile use of your hands. Vests are versatile layer options for a range of temperatures and job duties to keep your core warm while retaining a full range of motion for your arms. Fleece is often used in warmer environments or with more active duties; insulated vests or mid-layer jackets are better suited for colder environments or more sedentary duties.

Mid-Layer Examples

Flexible, light jackets with insulation, vests and fleece jackets are great mid-layers that can also function as your top layer in milder temps.

Outer Layer

The outer layer provides protection from the elements – wind, water and extreme low temperatures. You might search for winter coats or insulated jackets to find the most common outer layer garments.

When job duties include operating equipment that creates a wind stream, your outer layer needs to be wind-tight to prevent the additional chill from reaching you. In environments with frequent contact with condensation, your outer layer needs to be waterproof. Remember - moisture is the enemy of warmth and comfort. In extreme low temperatures, the outer layer should be an insulated jacket for extra warmth. It is important not to pick an outer layer that is too warm, as overdressing can severely impact productivity.

Outer Layer Examples

Winter coats, rain gear, windbreakers, 3-in-1 jackets that provide the options of insulation, waterproof shell or both, and more all make great outer layers for differing conditions and temperatures.

Accessories

Don't forget about gloves, hats, socks and footwear to protect those areas that your jackets and pants don't cover. The role of these accessories can be critical in very cold conditions because they will protect your extremities from frostbite and loss of function.

6.4.5 Avoiding Slips, Trips and Falls

There are many costs that go into running a business, but one of the highest costs is injuries caused by slips, trips and falls although they are the most preventable. Injuries caused by slips, trips and falls cost over $70 Billion dollars each year – with 95 million work days being missed due to slip, trip and fall accidents. Yet, with better preparation and policies, many of these accidents could be avoided, saving costs and preventing productivity dips.

Considering Footwear Options

A key component of a complete protective outfit, proper footwear is the strongest line of defense against slip, trip and fall accidents. Non-slip soles should be a requirement of all footwear worn in environments prone to hazardous walking conditions. Non-slip soles combine special materials with tread in specific designs to allow material to slip through while the soles "grip" the ground.

In cold environments, however, not all outsoles are equal. Materials used to make outsoles for traditional non-slip environments, such as restaurants, will not have the same effectiveness in cold environments. This is because the material hardens, losing the gripping powers, or cracks, allowing hazards to get caught and creating more risk. It is important to use footwear with outsoles specifically designed to perform in even extreme cold temperatures – outsoles that won't harden or crack, so they continue to provide protection against accidents.

Slips, trips and falls will never be completely eradicated as a cost, but steps can be taken to reduce the impact. Though specialized footwear can represent a larger upfront investment than other footwear, the savings from workplace accidents they provide is much higher than their additional cost. The better the footwear worn by your employees, the lower the risk of slip, trip and fall accidents and the costs they bring.

6.4.6 Guide to Selecting Gloves

Working in a cold environment presents unique challenges. Not only do you need protection for standard job duties, you also need protection from the cold. So how do you know what kind of glove offers the best protection and features for you? The key factors you must always consider when choosing a glove: what temperature does your work environment feel like (based on air temp and activity) and what activities do you do that may require additional protection (like impact protection or cut resistance).

Performance Gloves

Performance Gloves offer the latest advancements in protective hand wear, with a range of features such as high dexterity, additional gripping power and impact protection. These features are designed to keep you protected from the cold while keeping your performance high, so your productivity doesn't suffer. When dexterity matters for your job duties, Performance Gloves are the best option.

Hybrid Gloves

Hybrid Gloves offer the versatility necessary for multiple job functions, combining high durability and dexterity with other advanced features. This is because they combine materials, such as synthetic leather, leather, neoprene, spandex or others, to create better performance. These gloves let you easily tackle multiple job duties that have different requirements and hazards. When you go from picking boxes to driving a lift and wrapping pallets, or from laying foundation to hammering frames, you need a combination of toughness and dexterity. Hybrid Gloves let you move easily between duties without changing out your protective hand wear.

Leather Gloves

Leather Gloves are classic work gloves that have proven they can provide excellent protection against abrasion, making them tough, durable and long-lasting for most job functions. Different leather types offer different benefits, while additions like palm grips or a dipped coating assist with different job duties, protection, warmth and water repelling. Great on docks, for wood handling, product stacking, and more, Leather Gloves are a great option for heavy-duty tasks.

Mitts

Mitts provide more warmth than gloves because the fingers are kept together to radiate heat. There are a number of different mitt types: insulated, convertible, and 3-finger are just a few. When dexterity isn't a priority, but warmth is, such as when driving a forklift or other machinery, mitts are a perfect choice.

Wool Gloves

Wool Gloves offer natural warmth and wicking ability. No other natural material can compete with wool for warmth and comfort. Features like silicone or leather on the palm make wool even more functional. Excellent for those with active jobs where moisture-wicking is needed.

Palm Coated Gloves

Palm Coated Gloves offer all the beneficial features of our high-quality knit gloves with the added benefits of additional grip and are pre-curved for a more ergonomic fit to reduce hand fatigue. Superb for positions that deal with condensation or other moisture and need additional grip assistance.

Specialty Gloves

Specialty Gloves are specifically designed for unique situations, providing solutions like impact protection and extreme grip, along with cut-resistant options for extra protection. These are great for a range of job duties that require additional protection. For example, impact protection not only helps with possible drop impact, but the repeated impact of grabbing boxes or product.

Knit Gloves

Knit Gloves are constructed to allow more breathability and warmth. Many have various types of coatings to provide abrasion protection, make gripping items easier and also reduce hand fatigue. This is a good choice for active jobs where additional grip assistance is needed.

Glove Liners

Glove Liners can be used alone when you need lightweight protection or worn under another glove when you need added warmth. Glove liners are a very economical way to enhance warmth without choosing a fully insulated glove and are often used with leather gloves. Liners make it easy to have protection in milder temps, or adjust warmth as you become acclimated to colder temps

Each glove type offers its own unique features that make them well suited to a number of different activities. Along with the added features mentioned above, such as impact protection and cut resistance, many offer other helpful features designed to tackle unique problems encountered when working in the cold - touch screen capability, for example. Whatever the unique conditions and activities you face are, there is a glove that is a perfect fit.

6.4.7 Choosing High-Visibility Apparel & Best Practices for Use

Protecting your employees is a top concern of every manager. This means more than safety glasses, protective gloves, and gear appropriate for the temperature. When you have vehicle traffic of any kind, like forklifts or pallet jacks, it is important that your employees be seen by the workers operating equipment. High Visibility (HiVis) apparel

addresses this need; however, often managers and employees aren't clear on exactly who needs HiVis clothing and what kind needs to be worn.

Use in Different Environments

Figure 3: High Visibility Classes

ANSI Requirements

Standards for HiVis apparel are set by the American National Standards Institute (ANSI) and enforced by OSHA. There are three (3) ANSI classes for HiVis standards, covering differing work environments and job duties. Manufacturers have to meet specific guidelines when producing HiVis apparel to be considered ANSI compliant.

Determining the Class for Your Employees and Environment

Because of varying job duties and work zones, different employees will require apparel compliant with different classes. Though most warehouse workers fall into Class 1, it is also a traffic equipment as well. For example, you should always do a hazard assessment – often Class 2 is sufficient even in high activity areas.

Important factors to consider when choosing ANSI compliant HiVis clothing

If you have a large fleet of forklifts and other work equipment moving quickly through your warehouse, where employees are focused on their tasks and not the traffic, those employees are better suited to Class 2 than Class 1.

Equipment operators aren't always operating their equipment – consideration needs to be taken for when they are on foot in a work zone.

If the lighting conditions on your dock or in your warehouse are closer to night conditions than daylight, Class 3 compliant garments might be best for those employees.

Delivery drivers are subjected to a number of conditions, so you should consider outfitting them in Class 2 or Class 3.

It is often easiest to outfit all employees in the highest class required. For example, if you have areas requiring Class 1 and others requiring Class 2 compliance, providing Class 2 compliant gear to all workers means they are visible in all scenarios.

Best Practices

Types of Apparel

There are many types of ANSI complaint HiVis apparel, from vests and jackets to pant sets, overalls and coveralls. When doing a hazard assessment to determine the proper

HiVis apparel, it is helpful to consider other necessary protections as well, and then determine the best solution of gear for your employees. For example, in conditions that require waterproof gear, a waterproof jacket that is ANSI compliant is a better choice than a waterproof jacket paired with an ANSI compliant vest. Workers who only enter the warehouse occasionally, on the other hand, can utilize an ANSI compliant vest over their other gear.

You might also consider accessories, like gloves and headwear, or footwear that features visibility-enhancing features. Many of these items will have reflective piping or accents that may make a user more visible head-to-foot.

HiVis Apparel in Low Temperature Environments

In environments that require HiVis apparel but also have added safety concerns such as low temperatures, what is the best way to address all safety needs? One solution is to have employees wear the proper ANSI compliant vest over their insulated clothing. But vests can be lost and may need to be replaced often, and if you require ANSI Class 2 or Class 3 compliance, those vests can start affecting movement and productivity when placed over heavier insulated gear. Requiring gear that both protects from temperature and is ANSI compliant reduces the risk of lost or misplaced HiVis vests, increases the longevity of gear, and helps with productivity, as employees are not wearing unnecessary layers. It is also important to note that Class E compliant items, such as pants, bibs and overalls, make an outfit Class 3 compliant when paired with a Class 2 jacket or vest.

"X" on the Back for Enhanced Safety

Selecting apparel with the reflective tape in an alternate shape enhances safety in low-visibility environments. Reflective tape can be used to signal to a driver if a worker they are driving towards is facing them or not. By utilizing a different pattern of tape on the front (an H shape) than on the back (an X shape), other workers will know if the person they are nearing might see the approaching vehicle. Canada's standards for safety, CSA Z96, require the X shape in tape on the back for compliance. If you need to meet both ANSI and CSA standards, you need garments with the added X-Back feature.

Contrasting Background

When choosing HiVis apparel, it is important to consider the background your workers will be seen against. Is the majority of the equipment you use yellow? If so, then you should choose orange protective gear to assist with contrast. Do workers deal frequently with orange shipping containers? If so, the gear they wear should be yellow to prevent blending. Compare different HiVis materials to the background your workers are in to find the best contrast for your environment.

Work Safely

Not all work environments require HiVis apparel, but when it is required it is important to consider all the factors of the environment and job duties before selecting gear for your employees. Check federal and state OSHA guidelines for your work conditions, and

make sure your vendor's HiVis gear is not just labeled "High Visibility" but is ANSI compliant for your specific needs.

6.4.8 Warm Up Schedules

The table below provides some guidelines for worker warm-up schedules when working in cold environments. While this table references outside work, the same principles apply within a refrigerated warehouse.

ACGIH Recommended Guidelines

TLVs Work/Warm-up Schedule for Outside Workers based on a Four-Hour Shift*

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx)	°F (approx)	Max. work Period	No. of Breaks **	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm breaks) 1		(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29°to -31°	-20°to -24°	(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25°to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5	Non-emergency work should cease					
-40° to -42°	-40°to -44°	30 min.	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

Table applies only if workers are wearing dry clothing and doing moderate to heavy work activity. For light to moderate work activity, move down one line to decrease maximum work period and increase the number of breaks.

*2007 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati : American Conference of Governmental Industrial Hygienists (ACGIH), 2007 p. 202

6.4.9 Cold Tips

Your clothing keeps you warm, safe and productive in cold environments but choosing the right clothing is only part of the picture. To make it simple, here are some cold facts that can help you stay warm.

Choose clothes according to your activity level.

More active = less insulation needed.

Less active = more insulation needed.

Avoid perspiration build-up.

Stay dry to maintain warmth. Moisture can prevent you from staying warm so look for moisture wicking layers.

Layer clothing.

A good inner layer insulates and wicks moisture away from the skin. The outer layer continues the wicking process and insulates by preventing body heat from escaping.

Drink more water, less caffeine.

Caffeine can cause dehydration, so you need lots of water to stay warm.

Don't wear clothing that is too tight or too loose.

Insulated clothing or layers should fit comfortably and also helps seal out drafts.

Protect bare skin.

Cover all areas that will be exposed to cold temperature or wind.

Don't smoke or drink alcohol.

Nicotine and alcohol dangerously affect the body's ability to regulate and conserve heat, especially in your extremities.

Eat more.

When working in cold temperatures, you should average at least 2,400 calories and up to 4,000 calories per day.

Pay attention to your body.

Get out of the cold if you experience extreme drowsiness, loss of balance, extreme shivering or slower breathing.

GCCA is indebted to RefrigiWear, Inc. for technical content and images used in this chapter

7 Warehouse Sanitation

7.1 Master Cleaning Schedule

It is difficult to determine the overall status of cleaning in larger warehouses, especially those with complex cleaning systems, without a comprehensive schedule and inspection checklist. A Master Cleaning Schedule (MCS) is a scheduling-tool designed to manage supervision of cleaning functions, provide records of cleaning activities, and provide management with information pertaining to which jobs have been completed and which jobs remain to be done. In smaller warehouses, or those with only a few cleaning tasks, a simpler process can be utilized. The MCS should include all structures and equipment, including but not limited to overhead areas, walls, lights, outside areas, bulk receiving areas, compactor areas, trash cans, under-dock leveler plates, catwalks, and safety cages. The frequency of cleaning of each of these areas or items should be determined and specifically listed on the MCS forms. Likewise, the responsible party for conducting the cleaning should be noted, and completion of the task and post cleaning follow-up should be documented. It is recommended that both the supervisor and employee sign off on the satisfactory completion of the task within a reasonable amount of time.

There are numerous software programs and spreadsheets available for this purpose, and the key to success is to develop and implement a tool that is flexible and simple enough to be easily explained, audited and supported by personnel.

A few sample MCS cleaning forms are provided in Chapter 8 of this manual. These forms should be customized for each warehouse:

When conducting cleaning within the warehouse, consider the following guidelines:

Detailed Cleaning

- The use of air hoses for cleaning is permitted only for inaccessible equipment, and only in conjunction with detailed cleaning functions. It is recommended that the use of Personal Protective Equipment (PPE), including safety glasses and hearing protection, be properly observed. The preferred method of detailed cleaning is with vacuum and sweeping functions.

- In compliance with Federal and State laws or regulations, all equipment guards, trims, and panels should be removed for inspection and cleaning of the interior of the equipment.

- Equipment and structural "overheads", including lights, pipes, beams, or vent grids should be scheduled for detailed cleaning on the basis of the MCS to prevent the development of insect harborage, mold or the accumulation of foreign material.

Maintenance Cleaning

- Non-sealed electrical panels and boxes should be cleaned and/or inspected every four (4) weeks in order to disrupt the lifecycle of insects. Common "stored product" insects have a 21 to 28-day lifecycle, from egg to larva to pupa to adult to egg, which must be interrupted to prevent build up or infestation.

- Maintenance debris created during repairs should be promptly removed, with an emphasis on a full accounting of nuts, bolts, washers, wire pieces, tape, welding rods and other small items that can potentially contaminate food.

- Grease smears and excessive lubricants of any sort should be promptly removed from equipment surfaces, floors and walls.

- Maintenance personnel should observe proper hygienic practices when working in product zones, taking care to use clean tools and wipes. The use of wire brushes or sponges should be prohibited.

Cleaning duties should be distributed according to **daily**, **weekly**, **monthly** or **periodic** need. Examples of typical duties include, but are not limited to:

Daily:

- Sweeping of docks, including receiving, shipping and dry docks
- Cleaning restrooms
- Removing waste food

Weekly:

- Cleaning salvage areas
- Removing damaged stock from storage
- Cleaning waste barrels and trash receptacles
- Cleaning office & reception areas
- Rotational cleaning of dock plates
- Cleaning floor-wall junctions
- Pick up around facility perimeter
- Checking & cleaning floor drains
- Checking rodent traps

Monthly:

- Clean bait stations
- Record fogging or residual spray use
- Clean overhead lights and/or fans
- Clean air handling systems
- Pressure wash tractor trailers

Periodic:

- Clean walls
- Clean overhead fixtures
- Clean upper level racks
- Repaint 18” “Vegetation Free” border at perimeter of warehouse
- Clean refrigeration unit catch pans

7 Warehouse Sanitation

7.2 Warehouse Sanitation

Sanitation systems are a critical function of any effective warehouse operation and contribute not only to an attractive and sanitary site, but reduce product losses, potential claims and health risks. Sanitation systems should be established, reviewed and implemented on a frequent basis to establish and maintain a healthy, productive work environment that will satisfy customers, employees, management and regulatory authorities.

General sanitation efforts should be focused **internally** and **externally**, taking into account the entire site. There are many checklists available for monitoring facility sanitation, including an official form from the Food and Drug Administration (FDA) of the United States Department of Health & Human Services (USDHHS). The FDA form contains interactive fields for on-line use. The FDA Food Warehouse Inspection Report, form 2697, is available on the FDA website at:

https://www.fda.gov/AboutFDA/ReportsManualsForms/Forms/ListFormsNumerically/default.htm - forms are listed numerically. Note: most browsers will not allow you to directly open this document from the FDA database and will require you to follow steps similar to this:

1. Scroll down to find form 2679.
2. Right click the link and choose 'Save target as', or 'Save as' depending on the version of your browser. Save the file to your computer.
3. Once saved to your computer, you can open it directly from your computer.

You can also use the following link to scroll through the forms until you find 2679: www.fda.gov/opacom/morechoices/fdaforms/FDA-2679.pdf

A sample Warehouse Sanitation checklist is provided in Chapter 8 of this manual.

NOTE: Most US warehouses are subject to some element of 21 CFR Part 117. Review the regulations carefully and ensure the sections that apply to the facility are managed accordingly.

A topic listing of 21 CFR Part 117 is listed below:

PART 117—CURRENT GOOD MANUFACTURING PRACTICE, HAZARD ANALYSIS, AND RISK-BASED PREVENTIVE CONTROLS FOR HUMAN FOOD

Contents

Subpart D—Modified Requirements

Subpart E—Withdrawal of a Qualified Facility Exemption

Subpart F—Requirements Applying to Records That Must Be Established and Maintained

Subpart G—Supply-Chain Program

7 Warehouse Sanitation

7.3 Safety Data Sheets (SDS)

A Safety Data Sheet, (SDS), also called a Product Safety Data Sheet (PSDS), is a document containing relevant information about the make-up and properties of hazardous chemicals, including ingredients, physical and chemical characteristics, fire and explosion warnings, health hazard data, and precautions for safe handling and control.

Safety Data Sheets are intended to assist workers with the proper procedures for handling and using the labeled substance, and also include first aid, spill-control procedures, necessary Personal Protective Equipment (PPE) and proper storage procedures. The primary audience of the document are workers who are occupationally exposed to hazards at work; employers who need to know proper methods for storage and handling of hazardous chemicals, and emergency responders, such as firefighters, hazardous material crews, emergency technicians and emergency room personnel who find themselves treating persons exposed to hazardous chemicals. SDS's are not meant for consumers, but rather for those who work with hazardous materials in an occupational fashion.

In the US, employers are required by the Department of Labor (DOL) to maintain SDS information on any hazardous chemicals to which employees may be exposed. Similar requirements are found in many nations.

The information contained in an SDS is extensive, and different countries list the information slightly differently, however, the information generally falls into the following categories and sub-categories:

- **Substance Identification**
  - Technical name
  - Trade names or synonyms
  - General description
  - Chemical family
  - Molecular formula
  - Molecular weight
- **Components & Contaminants**
  - Components (including relative percent present in compound)
  - Exposure limits
- **Physical Data**
  - Description
  - Boiling point

- Melting point
- Specific gravity
- Vapor pressure & density
- pH
- Solubility

- **Fire & Explosion Data**
  - Fire & explosion hazard
  - Flash point
  - Upper & lower explosive limit
  - Auto ignition temperature
  - Firefighting media
  - Firefighting

- **Toxicity**
  - Irritation data
  - Toxicity data
  - Carcinogen status
  - Local effects
  - Acute toxicity level
  - Target effects

- **Health Effects & First Aid**
  - Inhalation (acute & chronic)
  - First aid
    - Skin contact (acute & chronic)
    - Eye contact (acute & chronic)
    - Ingestion (acute & chronic)
  - Antedote

- **Reactivity**
  - Incompatibilities
    - Oxidizers
  - Decomposition
  - Polermization

- **Storage & Disposal**
- **Conditions to Avoid**
- **Spill & Leak Procedures**
  - Soil spill
  - Water spill
  - Occupational spill
  - Reportable quantity

- **Exposure Controls**
- **First Aid**
    - Skin exposure
    - Eye exposure
    - Ingestion
- **Personal Protective Equipment**
    - Ventilation
    - Respirator
    - Clothing
    - Gloves
    - Eye protection

US required Safety Data Sheet information:

Hazard Communication Safety Data Sheets

Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients includes information on chemical ingredients; trade secret claims.

Section 4, First-aid measures includes important symptoms/effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.

Section 8, Exposure controls/personal protection lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties lists the chemical's characteristics.

Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.

Section 11, Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12, Ecological information*
Section 13, Disposal considerations*
Section 14, Transport information*
Section 15, Regulatory information*

Section 16, Other information, includes the date of preparation or last revision.

*Note: Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 through 15 (29 CFR 1910.1200(g)(2)).

Receiving Checklist

CRITICAL INFORMATION:		
Customer Name:		
Customer Contact:		
Customer Phone:		
Customer Fax:		
Load Information:	Purchase Order:	
	Number of Cases or Units:	
	Number of Different Items in Load:	
	Type of Loading (pallet, floor, slip sheets):	
	Temperature of Load (chilled or frozen):	
	Scheduled Arrival Time at Facility:	

ACTION ITEM:		RESPONSIBLE PARTY:	COMPLETED BY:	DATE & TIME:
Assign or record PO number		Office Staff		
Notify receiving dock of truck arrival		Office Staff		
Collect appropriate paperwork from driver		Office Staff		
Collect appropriate I.D. from driver, if appropriate		Office Staff		
Document truck arrival time		Office Staff		
Verify customer data from table above		Office Staff		
Resolve any discrepancies in paperwork, notify customer of any changes		Office Staff		
Assign receiving door to load		Office Staff		
Send appropriate paperwork to receiving dock supervisor or foreman		Office Staff		
Enter data into database (if appropriate)		Office Staff		
Create receiving manifest		Office Staff		
Send "non-negotiable warehouse receipt" to customer		Office Staff		
Check seal on trailer		Warehouse Staff		
Ensure proper trailer position at dock, verify that safety procedures have been followed		Warehouse Staff		
Ensure product integrity		Warehouse Staff		
Collect Appropriate Load Data:	Seal number	Warehouse Staff		
	Trailer number			
	Thermostat temperature			

ACTION ITEM:		RESPONSIBLE PARTY:	COMPLETED BY:	DATE & TIME:
	Thermostat setting			
	HACCP information, if appropriate			
Assign Lot Number		Warehouse Staff		
Print Lot Labels (if appropriate)		Warehouse Staff		
Collect Appropriate Load Data:	Trailer Temperatures (back, middle, front)	Warehouse Staff		
	Product Temperatures (back, middle, front)			
	Damage (trailer or cases)			
	Spoilage (product)			
	Date of unloading			
	Time of unloading			
	Box count of load			
	HACCP inspection sheet, if appropriate			
Cross reference load information with Bill of Lading (BOL), note any discrepancies		Warehouse Staff		
Provide driver with original BOL, including notations of product temperature, discrepancies, damage and piece count		Warehouse Staff		
Scan product, if applicable, or note on warehouse receiving form		Warehouse Staff		
Palletize product and prepare for put away		Warehouse Staff		
Verify that all information on this form is correct, signatures and date/time is entered.		Warehouse Supervisor		

Over, Short & Damage (OSD) Report

Job Number:		**Date:**	
Location:		**PO Number:**	
Client:		**Account Number:**	
Vendor:		**Received By:**	
Carrier:		**MRN Number:**	
Freight Bill Number:		**OSD Number:**	

Delivery Receipt:

Item	Quantity	Over, Short & Damaged (Customer and/or Vendor Discrepancy)

Item	Quantity	Over, Short & Damaged (Freight Related Claim)

Additional Comments:

Completed By:

Product Recall Checklist

CRITICAL RECALL INFORMATION:							
Facility Information:	Date:						
	Start Time:		End Time:				
	Recall Contact Person:						
	Phone Number:		E-mail Address:				
	Type of Recall:		Actual:		Mock:		
	USDA Class of Recall:		I		II		III
	Warehouse to Collect External Products?		Yes		No		
Recalled Product Information:	Customer:						
	Customer Contact Person:						
	Item Code(s):						
	Lot Number(s):						
	Production Date(s):						
	Pallet Identification(s):						
	Product Description(s):						
	Brand Name(s):						
	Weights:						
	Distribution:		Domestic		Export		
	Distinguishing Marks:						
	Original Delivery Date(s):						

STEP BY STEP RECALL MANAGEMENT:			
STEP	**ITEM**	**COMPLETED**	**TIME**
1	Received notification from Government or Customer		
	Placed temporary hold on outbound products		
2	Identified warehouse contact person		
3	Received written authorization to hold products		
	Collected critical information & data		
	Pulled internal documents from inbound load(s)		
4	Internal inventory records search performed		
	Internal physical product search performed		
	External inventory records search performed		
	Inventory summary sheet produced for customer		
5	Recalled product located within warehouse		
	Recalled product tagged as "Hold"		
	Recalled product relocated to secure area		
	Access to secure area restricted		
6	Product returned to customer		
	Product tested by third party		
	Product properly destroyed		
COMMENTS:			

Shipping Checklist

CRITICAL INFORMATION:		
Customer Name:		
Customer Contact:		
Customer Phone:		
Customer Fax:		
Load Information:	Purchase Order or Release Number:	
	Number of Cases or Units:	
	Number of Different Items in Load:	
	Type of Loading (pallet, floor, slip sheets):	
	Temperature of Load (chilled or frozen):	
	Estimated Arrival Time at Facility:	
	Participating Pallet Exchange Program?	
	Name of Carrier:	

ACTION ITEM:	RESPONSIBLE PARTY:	COMPLETED BY:	DATE & TIME:
Assign or record PO or Release Number	Office Staff		
Obtain loading diagram from customer	Office Staff		
Notify shipping dock of truck arrival	Office Staff		
Collect appropriate paperwork from driver	Office Staff		
Collect appropriate I.D. from driver (photo or copy of Driver's License)	Office Staff		
Document truck arrival time at plant	Office Staff		
Verify customer data from table above	Office Staff		
Resolve any discrepancies in paperwork, notify customer of any changes	Office Staff		
Assign shipping door for loading	Office Staff		
Send appropriate paperwork to shipping dock supervisor	Office Staff		
Enter data into database (if appropriate)	Office Staff		
Verify the condition (cleanliness and odor) of the trailer. If dirty, have driver take appropriate cleaning action(s) or contact the customer for additional direction	Warehouse Staff		
Ensure proper trailer position at dock, verify that safety procedures have been followed (wheel chocks, ICC bars, dock plate, etc.)	Warehouse Staff		
Document any trailer damage (insulation or door closures and seals)	Warehouse Staff		
Verify that floor drains are closed	Warehouse Staff		

ACTION ITEM:		RESPONSIBLE PARTY:	COMPLETED BY:	DATE & TIME:
Verify that trailer is pre-cooled (if specified)		Warehouse Staff		
Collect Appropriate Loading Data:	Load Pick Up or PO number	Warehouse Staff		
	Arrival time at dock			
	Start time of loading			
	End time of loading			
	Number of pallets in the truck at arrival (for pallet exchange programs)			
Obtain proper product for shipment from warehouse or staging area		Warehouse Staff		
Cross-Check Loading Process:	Verify case counts	Warehouse Staff		
	Cross-check item codes (SKU)			
	Cross-check lot numbers			
	Cross-check delivery and pick tickets			
	Collect "catch" or "take" weights, if required by the customer			
Cross reference load information with Purchase Order (PO), correct any discrepancies		Warehouse Staff		
Request that the driver count the products submitted for shipment (Optional, if the driver is allowed on the dock)		Warehouse Staff		
Have the driver sign the delivery ticket		Warehouse Staff		
Close the trailer doors upon completion of loading and verification. If the trailer is sealed, record the seal number		Warehouse Staff		
Verify that all information on this form is correct, signatures and date/time is entered.		Warehouse Supervisor		

Material Handling Safety Checklist

YES	NO	N/A		
☐	☐	☐	**1**	Is there a formal training program for material handling equipment operators with periodic updates?
☐	☐	☐	**2**	Is there a qualified material handling safety trainer on site?
☐	☐	☐	**3**	Is there a formal training process to qualify equipment operators?
☐	☐	☐	**4**	Is there a process to license operators?
☐	☐	☐	**5**	Are written records kept detailing the training and licensing of equipment operators?
☐	☐	☐	**6**	Is updated training offered for new equipment?
☐	☐	☐	**7**	Is individual training updated following an accident?
☐	☐	☐	**8**	Is a formal pre-operational check list used to ensure that all equipment is in acceptable working order.
☐	☐	☐	**9**	Are equipment maintenance records kept up-to-date?
☐	☐	☐	**10**	Are speed limits set within the operation?
☐	☐	☐	**11**	Are all operators aware of the weight and height limitations of the equipment?
☐	☐	☐	**12**	Is there a separate area set aside to refuel or change the fork lift batteries?
☐	☐	☐	**13**	Is there safe clearance for equipment to pass through aisles and doorways?
☐	☐	☐	**14**	Are aisle ways designated, permanently marked, and kept clear to allow unhindered passage?
☐	☐	☐	**15**	Are vehicle's shut off and brakes set prior to loading or unloading?
☐	☐	☐	**16**	Are containers of combustibles or flammables, when stacked while being moved, always separated by dunnage sufficient to provide stability?
☐	☐	☐	**17**	Are dock boards (bridge plates) used when loading or unloading operations take place between vehicles and docks?
☐	☐	☐	**18**	Are trucks and trailers secured from movement during loading and unloading operations?
☐	☐	☐	**19**	Are dock plates and loading ramps constructed and maintained with sufficient strength to support imposed loading?
☐	☐	☐	**20**	Are hand trucks maintained in safe operating conditions?
☐	☐	☐	**21**	Are chutes equipped with sideboards of sufficient height to prevent handled materials from falling off?

YES NO N/A

☐ ☐ ☐ **22** Are chutes and gravity roller sections firmly placed or secured to prevent displacement?

☐ ☐ ☐ **23** At the delivery end of the rollers or chutes, are provisions made to break the movement of the handled materials?

☐ ☐ ☐ **24** Are pallets visually inspected before being loaded or moved?

☐ ☐ ☐ **25** Are hooks with safety latches or other arrangements used when hoisting materials so that slings or load attachments will not accidentally slip off the hoist hooks?

☐ ☐ ☐ **26** Are securing chains, ropes, chokers, or slings adequate for the job to be performed?

☐ ☐ ☐ **27** When hoisting material or equipment, are provisions made to assure no one will pass under the suspended loads?

☐ ☐ ☐ **28** Are safety data sheets available to employees handling hazardous substance?

Trailer Inspection Checklist

CRITICAL INFORMATION:		
Facility Information:	Shipper:	
	Bill of Lading Number:	
	Unit Number:	
	Ship Date:	
	Ship To:	
	Inspector:	
	Today's Date:	
Vehicle Information:	Trucking Line:	
	Driver's Name (Optional):	
	Trailer License Number (Optional):	
	Trailer Number:	
	License Plate (State):	

TRAILER OR CONTAINER INSPECTION CHECK LIST:			
AREA	**ITEM**	**SATISFACTORY CONDITION**	
		YES	**NO**
Refrigeration Unit	Trailer has been Pre-Cooled (if specified)		
	Refrigeration Unit is Unobstructed		
Cleanliness	Overall Trailer Condition		
	Floors Free of Rubbish, Product Residue or Insects		
	Walls Free of Product Residue and Tape		
	Drains Open & Unobstructed (Free Flowing)		
	Absence of Odor(s)		
Condition	Ceiling Undamaged		
	Air Delivery Chute Intact & Functional		
	Door Seals Intact & in Good Repair		
	Door Undamaged		
	Walls & Wall Insulation Undamaged		
	Floors in Good Repair		
FINAL RESULT:	**SATISFACTORY FOR LOADING**		
COMMENTS:			

Docks and Elevated Surfaces Checklist

YES	NO	N/A		
☐	☐	☐	**1**	Are signs posted showing the elevated surface load capacity?
☐	☐	☐	**2**	Are surfaces elevated more than 30 inches above the floor or ground equipped with standard guardrails?
☐	☐	☐	**3**	Are surfaces elevated to a height where people or machinery could be exposed to falling objects provided with standard 4-inch toe boards?
☐	☐	☐	**4**	Is a permanent means of access and egress provided to elevated storage and work surfaces?
☐	☐	☐	**5**	Is material on elevated surfaces piled, stacked, or racked in such a manner to prevent tipping, falling, collapsing, rolling, or spreading?
☐	☐	☐	**6**	Are dock boards or bridge plates used when transferring materials between docks and trailers, trucks or rail cars?
☐	☐	☐	**7**	Is required head room provided, where necessary?
☐	☐	☐	**8**	Are employees driving forklifts slowly on docks and dock plates?
☐	☐	☐	**9**	Are the dock plates secured?
☐	☐	☐	**10**	Can the dock plate safely support the load?
☐	☐	☐	**11**	Are employees ensuring forklifts are not backed up to the dock's edge?
☐	☐	☐	**12**	Are employees providing visual warnings near dock edges?
☐	☐	☐	**13**	Are there policies in place to ensure employees are not "dock jumping"?
☐	☐	☐	**14**	Do dock ladders and stairs meet OSHA specifications?
☐	☐	☐	**15**	Are employees trained in dock safety and that the rules are enforced?
☐	☐	☐	**16**	Are locking devices used on every vehicle at the dock?
☐	☐	☐	**17**	Are floors marked with yellow tape or paint to identify walkways, doorways, parking aisles and overhead obstacles?
☐	☐	☐	**18**	When traveling through the facility, are people protected from sharp corners and from falling off dock edges?
☐	☐	☐	**19**	Is the dock area inspected daily to ensure that emergency equipment is not blocked or damaged?
☐	☐	☐	**20**	Is the dock edge painted with a reflective yellow to provide a better view of the dock?
☐	☐	☐	**21**	Do the ladders from the dock floor to the dock meet all of OSHA specifications?

YES NO N/A

- ☐ ☐ ☐ **22** Are exit routes in compliance with OSHA 29 CFR 1910.37(b)(1) illumination standard?
- ☐ ☐ ☐ **23** Are overhead hazards such as pipes, doors, and electrical wires marked?
- ☐ ☐ ☐ **24** Are the floors of trailers and trucks inspected before forklifts or pallet jacks are driven onto them?
- ☐ ☐ ☐ **25** Is the landing gear and stabilizing jacks inspected on trailers at the dock?
- ☐ ☐ ☐ **26** Are the dock levelers returned to the stored position after being used?
- ☐ ☐ ☐ **27** Are the dock seals or dock shelters in place to keep the rain and the snow off the loading docks?
- ☐ ☐ ☐ **28** Is an inspection program in place to identify defective pallets?
- ☐ ☐ ☐ **29** If the trailers are loaded by conveyor belts, is the conveyor height adjustable to reduce lower back stress?
- ☐ ☐ ☐ **30** Are guards installed over conveyor sprockets, gears, and rollers to protect people from pinch points?
- ☐ ☐ ☐ **31** Is plastic or metal banding used to secure products to pallets for transport?
- ☐ ☐ ☐ **32** Are loose products shrink-wrapped for transportation or storage?
- ☐ ☐ ☐ **33** Are the dock areas cleaned out periodically to remove accumulated debris?
- ☐ ☐ ☐ **34** Are OSHA-trained and authorized employees only allowed to operated hand trucks and forklifts?

Ergonomics Checklist

YES	NO	N/A		
☐	☐	☐	**1**	Can the work be done without twisting or excessively bending the lower back?
☐	☐	☐	**2**	Can employees get help with lifting more than 30 pounds (as per NIOSH recommendations)?
☐	☐	☐	**3**	Have employees been trained in proper lifting methods?
☐	☐	☐	**4**	Are job tasks that require repetitive movements varied or rotated?
☐	☐	☐	**5**	Are tools, instruments, and machinery shaped, positioned, and handled so that tasks can be performed comfortably?
☐	☐	☐	**6**	Can the job task be completed without prolonged raising of the arms?
☐	☐	☐	**7**	Is the task designed so that the neck and shoulders do not have to be stooped to view the task?
☐	☐	☐	**8**	Have pressure points on any part of the body (wrists, forearms, back of thighs) been eliminated?
☐	☐	☐	**9**	Can the work be done using the larger muscles of the body?
☐	☐	☐	**10**	Are there sufficient rest breaks, in addition to the regular rest breaks, to relieve stress from repetitive-motion tasks?
☐	☐	☐	**11**	Are all pieces of furniture adjusted, positioned, and arranged to minimize strain on all parts of the body?

Security Self Audit

Instructions: After answering the question, assign a value or rank to the importance of the question, using a 5-point scale, with 1 representing minor importance and 5 representing major importance.

Establish priorities for those security issues that have high value rankings.

CATEGORY	QUESTION	YES/NO	RANK
Facility Security	Is there a perimeter fence around the facility and is it in good repair?		
	Are there security guards and a security checkpoint (security shack)?		
	Is the communications area locked with access limited to authorized personnel only?		
	Is the computer area locked with access limited to authorized personnel only?		
	Is the phone area locked with access limited to authorized personnel only?		
	Is the office area secure with access limited to authorized personnel only?		
	Is the main electrical room or area locked with access limited to authorized personnel only?		
	Is the engine room secure area secure, with access limited to authorized personnel only?		
	Is there a security team in place with an emergency contact list?		
	Does the crime rate of the area compare with the national average?		
	Does the security at the facility compare to that of neighboring companies?		
	Have there been any security issues within the past 12 months, including employee theft, on-site violence, or threats?		
Employee Safety & Protection	If used, is badge information accurate and up to date?		
	Is there adequate lighting in employee parking lots and access areas?		
	Are drug screens and criminal background checks performed on potential employees?		
	Are temporary employees hired or contracted by a third-party?		

	Are employee entrances and visitor entrances clearly marked and used?		
	Are emergency exits clearly marked and locked from the outside?		
	Is there a cooperative relationship between employees and management?		
	Are permanent employees trained to understand facility and food security issues?		
Theft, Vandalism & Damage	Are logs and badges used for employees, visitors and contractors?		
	Is there a closed-circuit camera system in place and properly working?		
	Is there a functional alarm system?		
	Are inbound and outbound trailers/containers sealed with seals verified and recorded?		
	Are trailers parked on the lot with product on them locked and sealed?		
COMMENTS:			

Risk Assessment Template

Use the table below to list, classify and categorize potential risks within and around your facility, including personnel, machinery and environmental risk factors. The corresponding risk level is located in the upper right-hand corner of the table.

			Probability of Occurring				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
Severity	Catastrophic	I	1	2	6	8	12
	Critical	II	3	4	7	11	15
	Moderate	III	5	9	10	14	16
	Negligible	IV	13	17	18	19	20
			Risk Levels				

Forklift Safety Checklists

Forklift Pre-Operational Checklist
Record of Added Fluids

Date:	**Operator:**	
Truck#:	Fuel:	Hydraulic Oil:
Model#:	Engine Oil:	Radiator Coolant:
Serial#:	Battery Water:	Drive Hour Meter Reading:
Shift:	Department:	Hoist Hour Meter Reading:

Forklift Safety and Operational Checklist:
Prior to Initial Assignment

Have a qualified mechanic correct all problems

Motor Off Checks	OK	Maintenance Required
Leaks – Hydraulic Oil, Battery		
Tires – Condition and Pressure		
Forks, Top Clip Retaining Pin and Heel -- Condition		
Load Backrest Extension – Attached		
Hydraulic Hoses, Mast Chains, Cables & Stops – Check Visually		
Finger Guards – Attached		
Overhead Guard – Attached		
Safety Warnings – Attached (Refer to Parts Manual for Location)		
Battery – Water/Electrolyte Level and Charge		
Hydraulic Fluid Level – Dipstick		
Transmission Fluid Level – Dipstick		
Operator's Manual in Container		
Capacity Plate Attached – Information Matches Model & Serial Number		
Battery Restraint System – Adjust and Fasten		
Sit Down Truck - Seat Belt – Functioning Smoothly		
Man-up Truck – Fall protection/Restraining means - Functioning		
Brake Fluid – Check level		
Motor-On Checks (Unusual Noises Must Be Investigated Immediately)	**OK**	**Maintenance Required**
Accelerator Linkage – Functioning Smoothly		
Parking Brake – Functioning Smoothly		
Service Brake – Functioning Smoothly		
Steering Operation – Functioning Smoothly		
Drive Control – Forward/Reverse – Functioning Smoothly		
Tilt Control – Forward and Back – Functioning Smoothly		
Hoist and Lowering Control – Functioning Smoothly		
Attachment Control – Operation		

Horn – Functioning		
Lights & Alarms (where present) – Functioning		
Hour Meter – Functioning		
Battery Discharge Indicator – Functioning		
Instrument Monitors – Functioning		

Powered Industrial Truck (PIT) Checklist

YES	NO	N/A		
☐	☐	☐	**1**	Is the site utilizing a current Powered Industrial Truck (PIT) Safety Program?
☐	☐	☐	**2**	Are all operators provided with licenses showing expiration date, equipment/location/tasks for which the operator is certified?
☐	☐	☐	**3**	Has each operator completed required initial training covering all required topics and refresher training every three years?
☐	☐	☐	**4**	Is each PIT operator reviewed annually and is this review documented using an Operator's Review Form?
☐	☐	☐	**5**	Are documented pre-shift inspections being conducted and defects are being corrected?
☐	☐	☐	**6**	Has the site conducted retraining for each employee violating PIT procedures where termination was not the result of the violation?
☐	☐	☐	**7**	Are all PIT operators observed to be following safe operating procedures?
☐	☐	☐	**8**	Are only trained personnel allowed to operate industrial trucks?
☐	☐	☐	**9**	Is substantial overhead protective equipment provided on high-lift rider equipment?
☐	☐	☐	**10**	Are the required lift truck operating rules posted and enforced?
☐	☐	☐	**11**	Is directional lighting provided on each industrial truck that operates in areas with less than two-foot candles per square foot of general lighting?
☐	☐	☐	**12**	Does each industrial truck have a warning horn, whistle, gong, or other device that can be clearly heard above the normal noise in areas where operated?
☐	☐	☐	**13**	Are the brakes on each industrial truck capable of bringing the vehicle to a complete and safe stop when fully loaded?
☐	☐	☐	**14**	Will the industrial truck’s parking brake effectively prevent the vehicle from moving when unattended?
☐	☐	☐	**15**	Are industrial trucks operating in areas where flammable gases or vapors, combustible dust, or ignitable fibers may be present in the atmosphere approved for such locations?

YES	NO	N/A	
☐	☐	☐	**16** Are motorized hand and hand/rider trucks designed so that the brakes are applied and power to the drive motor shuts off when the operator releases their grip on the device that controls travel?
☐	☐	☐	**17** Are industrial trucks with combustible engines operated in buildings or enclosed areas carefully checked to ensure such operations do not cause harmful concentrations of dangerous gases or fumes?
☐	☐	☐	**18** Is the “NO PASSENGERS” rule enforced?
☐	☐	☐	**19** Are precautions taken during refueling or recharging?

Master Cleaning Schedule ~ Weekly

WEEK OF:	MONTH:		WAREHOUSE MANAGER:	
	DATES:			

		1ST WEEK						2ND WEEK						3RD WEEK						4TH WEEK						5TH WEEK					
	WEEKLY DUTIES	M	T	W	T	F	S	M	T	W	T	F	S	M	T	W	T	F	S	M	T	W	T	F	S	M	T	W	T	F	S
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Instructions: Initial the appropriate box when the duty is completed

Master Cleaning Schedule ~ Monthly

MONTH OF:			WAREHOUSE MANAGER:																											
		1ST WEEK						2ND WEEK						3RD WEEK						4TH WEEK						5TH WEEK					
WEEKLY DUTIES		M	T	W	T	F	S	M	T	W	T	F	S	M	T	W	T	F	S	M	T	W	T	F	S	M	T	W	T	F	S
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PERIODIC DUTIES																															
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4																															
5																															

Instructions: Initial the appropriate box when the duty is completed

Warehouse Sanitation Checklist

Critical Information:		
Facility Information:	Establishment Name:	
	Establishment Location:	
	Inspector:	
	Inspection Date:	

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
Receiving Dock	Door seals in good condition without excessive daylight visible from inside					
	Doors remain closed when not in use					
	Dock bumpers provide a tight seal during unloading and/or loading					
	Lights are protected against breakage in open product areas					
	Ceiling areas properly maintained to be free of excessive dust, debris, peeling paint or rust					
	No evidence of excessive spillage					
	Overall cleanliness of area					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
	Evidence of non-compliance with company defined Good Manufacturing Practices (GMP), including food or drink consumption or tobacco use in the area					
	Adequate number of covered trash receptacles					
	Area is free of evidence of current insect, rodent or bird activity					
	Interior traps adequate in number and properly maintained (placement, frequency of inspection, integrity)					
	Proper room temperatures maintained					
Coolers	Evidence of condensation on overhead surfaces					
	Doors remain closed when not in use					
	No evidence of excessive spillage					
	Overall cleanliness of area					
	Evidence of non-compliance with company defined Good Manufacturing Practices (GMP), including food or drink consumption or tobacco use in the area					
	Area is free of evidence of current insect, rodent or bird activity					
	Interior traps, if present, properly maintained (placement, frequency of					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
	inspection, integrity)					
	Cooling units are equipped with catch pans, with no evidence of leaks					
	Products elevated off of the floors and away from walls					
	Evidence of mold on any structural areas					
	Floor drains properly working without pooling of water					
	Proper room temperatures maintained					
	Evidence of product damage, spills, or leaks					
	Areas for potential material accumulation, including damage to floors, walls or expansion joints					
Freezers	Evidence of excessive frost or ice build up on overhead surfaces					
	Doors remain closed when not in use					
	Door seals in good condition without excessive air infiltration					
	No evidence of excessive spillage					
	Overall cleanliness of area					
	Evidence of non-compliance with company defined Good Manufacturing Practices (GMP), including food or drink consumption or tobacco use in					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
	the area					
	Area is free of evidence of current insect, rodent or bird activity					
	Interior traps, if present, properly maintained (placement, frequency of inspection, integrity)					
	Proper room temperatures maintained					
	Evidence of product damage, spills, or leaks					
	Areas for potential material accumulation, including damage to floors, walls or expansion joints					
	Products elevated off of the floors and away from walls					
Dry Storage	Doors remain closed when not in use					
	Evidence of product damage, spills, or leaks					
	Lights are protected against breakage in open product areas					
	No evidence of excessive spillage					
	Overall cleanliness of area					
	Evidence of non-compliance with company defined Good Manufacturing Practices (GMP), including food or drink consumption or tobacco use in the area					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
	Area is free of evidence of current insect, rodent or bird activity					
	Interior traps adequate in number and properly maintained (placement, frequency of inspection, integrity)					
	Inspect pheromone-monitoring devices, if present, for activity					
	Products elevated off of the floors and away from walls					
	Floors, walls & ceiling conducive to cleaning					
	Rodenticides properly labeled & stored					
	Insecticides properly labeled & stored					
	Toxic chemicals & potential adulterants properly labeled & stored					
Recoup Areas	Lights are protected against breakage in open product areas					
	No evidence of excessive spillage					
	Overall cleanliness of area					
	Evidence of non-compliance with company defined Good Manufacturing Practices (GMP), including food or drink consumption or tobacco use in the area					
	Area is free of evidence of current insect, rodent or bird activity					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
Dry Dock	Door seals in good condition without excessive daylight visible from inside					
	Doors remain closed when not in use					
	Dock bumpers provide a tight seal during unloading and/or loading					
	Lights are protected against breakage in open product areas					
	Ceiling areas properly maintained to be free of excessive dust, debris, peeling paint or rust					
	No evidence of excessive spillage					
	Overall cleanliness of area					
	Evidence of non-compliance with company defined Good Manufacturing Practices (GMP), including food or drink consumption or tobacco use in the area					
	Adequate number of covered trash receptacles					
	Area is free of evidence of current insect, rodent or bird activity					
	Interior traps adequate in number and properly maintained (placement, frequency of inspection, integrity)					
Shipping Dock	Door seals in good condition without excessive daylight visible from inside					
	Doors remain closed when not in use					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
	Dock bumpers provide a tight seal during unloading and/or loading					
	Lights are protected against breakage in open product areas					
	Ceiling areas properly maintained to be free of excessive dust, debris, peeling paint or rust					
	No evidence of excessive spillage					
	Overall cleanliness of area					
	Evidence of non-compliance with company defined Good Manufacturing Practices (GMP), including food or drink consumption or tobacco use in the area					
	Adequate number of covered trash receptacles					
	Area is free of evidence of current insect, rodent or bird activity					
	Interior traps adequate in number and properly maintained (placement, frequency of inspection, integrity)					
	Proper room temperatures maintained					
	Delivery vehicles clean and in good repair					
Welfare Facilities	Restroom doors self-closing					
	Restroom doors not propped open					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
	"Wash Hands" signage properly placed in restroom					
	Restrooms functional and properly equipped with hot and cold running water, soap, towels and waste receptacles					
	Restrooms adequately ventilated					
	Lockers are well maintained, without food storage					
	Break room clean and well maintained					
	Area around vending machines able to be easily cleaned					
	No evidence of excessive spillage					
	Overall cleanliness of area					
	"Wash Hands" signage properly placed in break room					
External Grounds	18-Inch **"Vegetative Free"** perimeter around buildings present and properly maintained					
	Evidence of burrowing or rodent harborage areas					
	Bait stations properly secured to the ground and locked					
	Presence of trees close to facility that may allow rodents onto the roof of the facility					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To:	Date Completed:
		Yes	No			
	Dumpster areas closed to limit pest attractants					
	No evidence of excessive spillage around dumpsters					
	Grounds free from trash					
	Dock areas well maintained and free of windblown debris					
	Grounds properly graded to limit standing water near the building					
	Open windows screened					

9 Glossary of Terms

80/20 Rule: See *Pareto's law*.

ABC: See *Activity Based Costing*.

Absolute liability Common carrier accepts liability and is not protected by normal exemptions found in bill of lading or common law liability.

Accept/Reject Advice: A standardized notice sent to vendors advising that a shipment has been accepted or rejected and will be kept, rejected, or otherwise disposed. It contains pertinent information about the shipment and, if rejected, the nature of the rejection.

Acceptance: The termination of a common-carrier contract when a consignee acknowledges receipt of a shipment. Acceptance can also signify a promise to pay if specified in the contract.

Accessorial Charges: Charges for supplemental services and privileges that are not included in normal freight or warehousing rates. Accessorial charges are usually flat fees for packing, pickup, delivery, in-transit privileges, demurrage, switching, marking, weighing, preparing bills, loading, unloading, and similar extra services. Also called ancillary charges.

Accredited Customer List: A list of accounts authorized to draw directly from stock in the warehouse. The list is generally furnished by the owner of the goods or a designated agent.

Accuracy Level: The percentage of items located during an audit or sampling program that match the book inventory. The opposite measurement is the error rate. The accuracy rate can also be viewed as 100% minus the error rate.

ACF: See *Attainable Cubic Feet*.

Acknowledgment: A communication from a vendor to advise the purchaser that a purchase order has been received and the order has been accepted.

Acquiescence: When a bill of lading is accepted or signed by a shipper or his agent without protest, he or she is said to acquiesce to the terms, thereby giving silent consent.

Act of God: An unavoidable occurrence or accident produced by a physical cause such as floods, earthquakes, most fires, and other natural disasters.

Active Inventory: The inventory from which goods are being picked, as distinct from reserve inventory.

Active Locator: Computer directed choice of locations to put, move, and pick product.

Active Storage: Storage area where cartons required to replenish picking are held.

Activity Based Costing (ABC): An accounting method that enables a business to better understand how and where it makes a profit. In ABC, all major activities within a cost center are identified and the costs of performing each are calculated, including costs that cross functional boundaries. The resulting costs are then charged to the product, product line, customer, or supplier that caused the activity to be performed.

Activity Cost: The total cost required to perform a procedure or task, including overhead items.

Acute Toxicity: Ability of a chemical to produce adverse health effects as a result of a single exposure of short duration.

Ad Valorem Duty: A tax that is imposed on imported goods, calculated as a percentage of a product. Value of the merchandise. The literal Latin meaning is "according to value."

Added Value: A term implying that, at each production and distribution function, a product's value is increased in terms of time, place, and form utilities from various activities.

Address: 1) A combination of letters and numbers used to identify storage locations. 2) In data processing, a label name or number that designates a location in a computer's memory.

Adjustable Ramp: See *Dock Plate*.

Adoptive Notice: The point at which one carrier takes over legal obligations and operations for another carrier.

Advanced Charge: Freight charge collected by the consignee for a shipment that is advanced by the shipper or by one transportation company to another.

Advanced Shipment Notice (ASN): Detailed information of the contents and nature of the shipment, available to the consignee before a shipment's arrival, often in the form of a fax or DI transmission.

Advice of Shipment: A form provided by the shipper to a freight forwarder that contains shipping instructions.

AFFI: See *American Frozen Food Institute*.

Aggregated Shipment: A consolidation including smaller orders combined into a single shipment.

Air Contaminant: Any particulate matter, gas, or combination thereof other than water vapor or natural air.

Air Curtain: A device used to produce a movement of air across a doorway between two different temperature areas to minimize refrigeration loss.

Airborne Release: Release of any chemical into the air.

Aisle: A passageway used to gain access to a storage bay, pallet slot, pallet rack, or bin.

Aisle Space Percentage (ASP): The proportion of a warehouse devoted to aisles.

Allowance: Deduction from the weight or value of goods.

Alphanumeric: Using a character set that contains letters, numbers, and other groups of symbols.

Ambient Temperature: The environmental temperature without heating or cooling.

American Frozen Food Institute (AFFI): The American Frozen Food Institute (AFFI) is a national trade association representing all aspects of the frozen food industry supply chain, from manufacturers to distributors to suppliers to packagers; the Institute is industry's voice on issues crucial to future growth and progress.

American Meat Institute (AMI): AMI is the national trade association representing companies that process 70 percent of U.S. meat and poultry and their suppliers throughout America. Headquartered in metropolitan Washington, DC, AMI keeps its fingers on the pulse of legislation, regulation and media activity that impacts the meat and poultry industry and provides rapid updates and analyses to its members to help them stay informed. In addition, AMI conducts scientific research through its Foundation designed to help meat and poultry companies improve their plants and their products.

American National Standards Institute (ANSI): A nongovernmental organization that manages the formation of voluntary national standards such as those for Electronic Data Interchange (EDI.)

American Production and Inventory Control Society (APICS): A professional organization dedicated to improving efficiency in inventory management and production through research and application of scientific methods.

American Standard Code for Information Interchange (ASCII): The standard seven-bit character code used to transfer simple text files. ASCII allows information to be shared among computers with different operating systems.

AMI: See *American Meat Institute*.

Amortization: The depreciation expense assigned to an asset.

Ancillary Charges: See *Accessorial charges*.

Angle Stacking: Placing stock in a storage area at a 45 degree angle to the aisle.

Anniversary Billing: A method of public warehouse billing for storage in which the customer is billed a one-month storage charge for all products as they are received. The same unit, if still in storage, is billed an additional monthly charge on each monthly anniversary date thereafter. This method does not involve any pro-rating of time in storage and so requires that anniversary dates for each item in storage be separately identified.

Annual Inventory: See *Physical Inventory*.

ANSI: See *American National Standards Institute*.

APICS: See *American Production and Inventory Control Society*.

Apparent Good Order: When freight or inventory appears to be free of damage and in proper condition.

Apron: The area directly outside the dock door upon which delivery vehicles can be parked or positioned for loading and unloading. This area is of the correct depth to allow trailer floors to line up with the warehouse floor.

Arrival Notice: A document sent to a consignee by a carrier informing the consignee that a shipment has arrived.

AS/RS: See *Automated Storage Retrieval System*.

ASCII: See *American Standard Code for Information Interchange*.

ASN: See *Advanced shipment notice*.

ASP: See *Aisle space percentage*.

Assembly Area: A warehouse location where materials, components, or finished products are collected and combined.

Assorting: Mixing items into the combinations or assortments required by customers.

Attainable Cubic Feet (ACF): The cubic space that is allowable by safety guidelines, regulations, and restrictions with the available equipment.

Audit Trail: The records and management controls that document business activities. Receipt, handling, and movement of materials throughout a warehouse are part of an audit trail.

Automated Sorting: The directing of products on a conveyor based on encoded tags on the product.

Automated Storage Retrieval System (AS/RS): A computer controlled system, including racks, bins, and stacker cranes. Using an Automatic Guided Vehicle System, the AS/RS can receive and deliver materials without the aid of humans. These systems, while initially expensive, offer increased inventory accuracy, reduced labor costs, and savings on warehouse space requirements.

Automated Warehouse: A warehouse facility in which mechanical devices are the primary means of receiving, moving, storing, and retrieving merchandise.

Available Stock: The amount of inventory on hand that can be sold or used.

Average Clear Stacking Height: The average height available for storing material while maintaining the required vertical clearance from the sprinkler heads.

Average Warehouse Cost: The total cost of the operation of the warehouse. This calculation requires adding the depreciation cost, warehouse utility cost, warehouse taxes, interest on investment, labor costs, obsolescence costs, stockout costs, and all other warehousing costs.

B/L or BOL: See *Bill of Lading*.

Back Order: Items that have been ordered but cannot be shipped due to stockout. Merchandise on back order is scheduled for shipment when it becomes available.

Backhaul: The transport of materials from suppliers back to the operator's facilities. The providing of transportation services to a third party by using vehicles that otherwise would return empty to the origination point.

Backlog: Customer orders received but not yet shipped.

Baffle: A metal barrier used in conjunction with a sprinkler system. It is installed between storage racks or between rack levels to concentrate heat on sprinkler heads. Baffles minimize the time between the outbreak of a fire and the activation of the sprinkler system.

Banding: Material used to wrap around a shipment to hold it in place.

Bar Code: A combination of parallel lines of bars and spaces that communicates data about the product or shipping container to which it is affixed. The data elements can be read by an electronic scanner. The Universal Product Code A standard, widely used by retailers in the US and Canada, and the newer Code 128 (see UCC/EAN-128) are key enablers of efficient consumer response, allowing the grocery industry to track, manage, and control physical product flow.

Bar Code Character: The bars and spaces that represents individual digits, letters, or symbols.

Bar Code Reader: A device used to identify and decode bar code symbols.

Base Stock: The amount of inventory required to serve an average amount of demand.

Baseline Measures: Initial measurements or metrics that establish current or starting levels of performance for benchmarking progress.

Basket Sides: Spacer-like wooden sides to hold bulk hams on a pallet for blast freezing.

Batch Picking: The selection of the total quantity of each item for a group of orders. In a break-out area, batches are re-sorted into the individual quantities for each order.

Bay: A designated area within a section of a storage area outlined by markings on columns, posts, or floor.

Beams: The horizontal bars in storage racks.

Belt Conveyor: A moving belt designed to carry merchandise. Belt conveyors are used to move materials between facilities or between floors of a facility.

Benchmark: A set of measurements used to establish goals, operating targets, and productivity programs.

Best Practices: A management idea which asserts that there is a method, process, technique, incentive reward or award that is more effective at delivering a particular outcome than any other method.

Best-in-Class Achievements: See *Benchmark*.

Bi-Directional Read: A system that has the ability to read bar coded data in either direction, from left to right or right to left.

Bill of Lading (B/L or BOL): A contract between the shipper and carrier that provides proof that the merchandise was transferred from the shipper to the consignee and that the carrier has assumed responsibility for the cargo until it is delivered. All carriers and freights forwarders issue B/Ls, but brokers do not issue them.

Bill of Sale: A written contract that transfers ownership from one party to another.

Bin Pallet: A pallet that has a bin affixed to it so that it becomes an open-topped box.

Blanket Purchase Order: A long-term commitment to a supplier.

Blanket Release: A blanket agreement or contract giving authorization to ship.

Blast Freezing: A freezing method in which product is arranged with maximum surface exposure to low temperature circulating airflow for fast freezing.

Blind Check: A method of checking merchandise without verifying against a copy of the invoice or packing list.

Blind Corner: Intersection of aisles where vision is blocked.

Block: Solid squares of wood or other material found between the top deckboards and bottom deckboards of a pallet. Blocks create the space needed to insert forks into the pallet.

Block Pattern: A method of storing merchandise on a pallet in a pattern to allow a stable pallet load.

Bogie: A set of special wheels used as rear wheels under a trailer or container.

Bonded Blocking: A method of stacking boxes or containers that reduces the possibility of the stack toppling over. Containers are overlapped like bricks in a wall.

Bonded Goods: Goods in the charge of customs officers and on which bonds instead of cash have been given for export duties.

Bonded Warehouse: 1) A place used for the storage and custody of import merchandise that is subject to duty until duties are paid or the goods are reshipped without entry into the host country. 2) A public warehouse covered by a state surety bond. 3) A warehouse approved by the US Treasury Department and under bond or guarantee for compliance with revenue laws. Import duties and excise taxes are not paid until the merchandise is withdrawn from the warehouse.

Book Inventory: A record of items on hand by type and number based on the recording of receipts and shipments during a given period.

Book Value: Property valued at original cost less any applicable depreciation.

Bracing: A material that secures the contents of a container, trailer, or railcar to prevent shifting in transit.

Break Bulk: The splitting up of one consolidated shipment into smaller ones for ultimate delivery to consignees.

Break-Out Area: An area within a warehouse designated for unpacking containers so that merchandise can be distributed to its proper storage locations.

Brick Pattern: A method of storing merchandise on a pallet in a pattern to accommodate items of unequal width or length. Also called a "Pinwheel pattern".

Broken Lot: A less-than-standard unit of inventory such as a half pallet or a half case of goods.

Broker: An agent who arranges business transactions for a commission. Brokers are common in all facets of logistics, such as arranging domestic and international movement of goods or leasing of equipment.

Buffer Stock: A certain level of inventory maintained to meet sales demand and lead-time variations so as not to incur an out-of-stock situation. Also called float stock, fluctuation inventory, inventory buffer or safety stock.

Bulk Carrier: A barge, truck, railcar, or other vessel that carries commodities such as petroleum, grain, or ore. The cargo is usually not packaged.

Bulk Freight: Product, usually a commodity, that is shipped without packaging.

Bulk Packing: Packing a number of small containers into a single larger container, or master carton, to facilitate movement of merchandise. This method reduces losses from damage and theft in transit.

Bulk Storage: Stacking product one pallet on another without pallet racking.

Bulk Warehouses: Warehouses providing tank storage of liquids and open or sheltered bin storage of dry bulk products.

Bulkhead: A wall for restraining and stabilizing cargo in a trailer, flatcar, railcar, container, etc.

Bumpers: Pieces of rubber located at the floor level of a dock opening to cushion the building from truck trailer impacts.

Bunching: Unauthorized consolidation of inbound railcars at a consignee's warehouse.

CA: See *Controlled Atmosphere*.

Caged Storage: Storage space within a warehouse that is separated from other storage areas by screening or fencing. Items kept in caged storage are usually of high value.

California Billing: See *Split-month billing*.

Canadian Food Inspection Agency (CFIA): An agency of the Canadian governement that is dedicated to safeguarding food, animals and plants, thereby enhancing the health and well-being of Canadians. Similar to the United States Department of Agriculture (USDA)

Cancellation Charge: A fee charged by the seller as a penalty or to cover costs when an order is canceled.

Cancellation Notice: The form used to advise a supplier that a purchase order has been canceled and delivery is no longer desired.

Canopy: A covering over the area outside a dock door, used to prevent rain, ice, or snow from interfering with truck loadings.

Captive Pallet: A pallet that is restricted in use to a single facility or system.

Car Load (CL): In freight classification, CL is the minimum weight necessary to fully load a 40-ft (12.2-m) railcar.

Carousels: Moving racks that rotate products to a central picking location. The rotation is controlled by a computer which responds to keypad entries of a worker. The design is like a carnival carousel.

Carriage: On a forklift, the assembly that moves up and down with the load and to which the forks or other attachments are mounted.

Carrier Liability: The obligation to deliver merchandise to its proper destination with reasonable speed and in the same condition in which it was received from the shipper.

Carrying Costs: The cost of holding inventory in storage, including taxes, depreciation, handling, cost of invested capital, and insurance. Expressed as a percentage of total inventory, carrying cost is used in calculating economic order quantities.

Cartage: 1) Moving goods, usually over short distances such as within a city. 2) The charge for the transportation of goods.

Carton Clamp: Lift truck attachment that allows pickup of cargo by squeezing it from the sides instead of lifting it on pallets or slipsheets.

CAS Number: See *Chemical Abstract Service number*.

Case Mark: Information, such as destination and contents, that is shown on the outside of a shipping carton.

Case-Lot Picking: Selection of full cases of a product when the order is less than a full pallet load.

Cash on Delivery (COD): The bill for the goods received and any applicable transportation charges are collected upon delivery. The carrier may act as agent for the consignor by collecting the payment for the purchase price of the merchandise. In this case, the carrier is liable to the consignor for the amount due. The carrier may also act on its own behalf to collect freight charges.

Casual Labor: Temporary workers used to meet peak workloads.

Catch Weight: See *Take Weight*.

Category Management (CM): The management of product categories as strategic business units. The practice can empower a category manager with full responsibility for assortment decisions, inventory levels, shelf-space allocation, promotions, and buying. With this authority and responsibility, the category manager may be able to judge more accurately the consumer buying patterns, product sales, and market trends of that category. By emphasizing profits and sales for entire product groups rather than individual items or brands, category management can encourage a longer-term, joint retailer-supplier focus in marketing and merchandising.

Centralized Dispatching: Organizing of the dispatching function for a warehouse, business unit, or company into one central location.

Centralized Inventory Control: Organizing all inventory decisions for a warehouse, business unit, or company in one office or department.

CERCLA: See *Comprehensive Emergency Response Compensation and Liability Act*.

Certified Inventory Report: An inventory report signed by a corporate officer to attest to its correctness.

CFR: Cost and freight (an Incoterm used in international trade).

CFR: See *Code of Federal Regulations (US)*.

Chamfer: An inclined surface along the edges of pallet deckboards and stringers to allow easier insertion of forks or pallet jacks.

Change-of Location Card: Document containing lot number, quantity, product code, and other descriptive language used by a warehouseman to record where a product was moved from and to.

Channel of Distribution: The levels at which a manufacturer distributes products from the plant to the ultimate user, including public warehouses, brokers, wholesalers, and retailers.

Chargeback: Form used for recording transactions involving vendor returns.

Chemical Abstract Service Number (CAS Number): An identification number assigned by the Chemical Abstract Service (www.cas.org) used in various databases for identifying and retrieving information on chemicals.

Chocks: Triangular blocks of rubber, wood, or metal placed in front of, between, or behind truck wheels to prevent accidental trailer movement.

CIF: Cost, insurance, and freight (an Incoterm used in international trade).

CIP: Carriage and insurance paid (an Incoterm used in international trade).

CL: See *Car Load*.

Class Rating: A single freight rate applicable to a group of commodities.

Clean Bill of Lading: A bill of lading without any shortages, damages, or other exceptions.

Clear Stacking Height: The maximum allowable storage height for machinery, storage bins, or stacked material in a facility. The required clearance distance from the top of the highest article and the lowest sprinkler head is usually 18 in. (46 cm), but will vary based on local fire codes.

Cleat: A strip of wood or metal used to afford additional strength in packaging, to prevent warping, or to hold materials in position.

CLM: See *Council of Logistics Management*.

CM: See *Category Management*.

CO_2 Railcar: Railcars that utilize a controlled release of pressurized carbon dioxide to maintain temperature, instead of mechanical refrigeration units. Also called a cryogenic railcar.

COD: See *Cash on delivery*.

Code of Federal Regulations (US) (CFR): The collection of rules and regulations originally published in the Federal Register by various US governmental departments and agencies. OSHA regulations are found in 29 CFR; EPA regulations are found in 40 CFR; and Department of Transportation regulations are in 49 CFR.

COFC: See *Container on Flat Car*.

Collapsed Height: The height measured from the floor to the top of the forklift truck mast, load backrest, or operator cage when the forks are completely lowered. This measure is critical in low clearance situations, such as when loading trailers.

Collect Bill of Lading: A bill of lading that calls for charges to be paid by the consignee.

Co-Load: A combination of two shipments from different terminals for shipment as one load.

Combo Bin: See *Tote*.

Committed Order: Customer order with specific lots allocated. An order in the process of being picked.

Commodity: A collection of materials or items with similar characteristics.

Commodity Rates: Fees applicable to a described commodity without regard for other freight classifications. Carriers typically charge commodity rates for large movements made on a routine basis.

Commodity Warehouse: Specialized warehouse for agricultural commodities, such as cotton, wool, tobacco, or grain. Typically, a commodity warehouse stores only one type of commodity and offers other services particular to that commodity.

Common Carrier: A carrier that transports goods at any time to any location for any shipper.

Comprehensive Emergency Response Compensation and Liability Act (CERCLA): The 1980 US federal statute that set the first criteria for notification of emergencies involving hazardous substances. Administered by the US Environmental Protection Agency (EPS).

Confirmed Order: A picked order awaiting shipment.

Confirmed Pick: See *Confirmed Order*.

Confirming Order: A purchase order that verifies the items ordered and terms of an order placed orally.

Consigned Stock: Finished goods inventories in the hands of agents or dealers but still the property of the supplier.

Consignee: The party to whom goods are delivered.

Consignment: A transaction in which the title to goods remains with the shipper (the consignor) until the buyer (the consignee) sells the goods.

Consignor: The party who originates a shipment of goods. This term is used interchangeably with "shipper."

Consolidating: Combining small shipments to obtain reduced freight rates for higher volume.

Consolidation Point: The point at which small shipments are combined and loaded for reshipment.

Consolidator: A company that specializes in providing consolidation services to shippers.

Constructive Placement: The placing of a railcar at a yard or hold point when actual placement cannot be made due to consignee's lack of sufficient rail dock space.

Container: 1) Anything in which articles are packed. 2) A standardized box used to transport merchandise particularly in international commerce. Marine containers are typically 8 ft. x 8 ft. (2.44 m x 2.44 m) with length of 10, 20, 30, or 40 ft. (3, 6, 9, or 12 m). These containers may be transloaded from rail cars or ships onto a truck frame and delivered to their final destination.

Container on Flat Car (COFC): A trailer without chassis or an intermodal container shipped on a railroad flat car.

Container, Refrigerated: An insulated container that provides a temperature-controlled environment to protect perishable materials.

Containerization: The process of transporting merchandise in containers.

Continuous Replenishment (CRP): The practice of partnering between distribution channel members that changes the traditional replenishment process from distributor-generated purchase orders, based on economic order quantities, to the replenishment of products based on actual and forecasted product demand.

Contract Carrier: A carrier that does not serve the general public, but conducts its business on a selective basis, charging customized rates for its services. It generally serves a limited number of shippers under specific contractual arrangements.

Contract Warehouse: Third-party warehouse operating under a formal agreement with a customer for a fixed amount of space.

Controlled Atmosphere (CA): A storage environment which allows certain fresh fruits and vegetables to be stored for extended periods in above-freezing temperatures. Sealed rooms maintain a specific mix of oxygen, nitrogen, and carbon dioxide at a precise temperature range.

Cooler: A refrigerated space that holds material above freezing but usually below 50 F (10 C).

Corner Guard: Angle plate of wood or metal used to protect merchandise from being hit by equipment.

Corner Post: Upright angle post used to strengthen corners in a package.

Corrugated Paper Pallet: A pallet constructed of components made from corrugated paper.

Cost per Square Foot (CSF): A monetary cost per unit of area to measure the basic cost of operating a warehouse. It represents the costs of the physical space of a facility and the activities that occur within it.

Council of Logistics Management (CLM): Professional organization for logistics managers.

CPT: Carriage paid to (an Incoterm used in international trade).

Cross Docking: A distribution system in which merchandise received at the warehouse or distribution center is not put away, but instead is readied for shipment. Cross docking requires close synchronization of all inbound and outbound shipments. By eliminating the putaway, storage, and selection operations, it can significantly reduce distribution costs. In pallet-level cross docking, entire pallets are received by rail or truck and moved directly to the outbound trucks without further handling. In case level cross docking, cases are transferred into an appropriate order assembly system which routes them to the outbound staging area for delivery.

CRP: See *Continuous Replenishment*.

Cryogenic Railcar See *CO_2 Railcar*.

CSF: See *Cost per Square Foot*.

Cube Rate: Rate based on trailer space instead of weight. Used for light, bulky loads.

Cube Utilization: The percentage of space occupied compared to the space available.

Customs Broker: A specialist in customs procedures who provides customs clearance assistance for a fee.

CWT: Hundred pounds or hundredweight.

Cycle count: A physical inventory verification procedure performed at regular intervals throughout specific aisles or sections in a store. The duration of the cycle may vary, but the activity in all individual sections is generally completed before the next begins.

Cycle time: The period of time required to order and deliver the required stock. Cycle time is composed of two factors: order cycle and replenishment cycle.

DAF: Delivered at Frontier (an Incoterm used in international trade).

Damage claim: Request by a shipper or consignee for reimbursement from a carrier for damage to a shipment.

Date code: A label showing the date of production. In the food industry, it becomes an integral part of the lot number.

DC: See *Distribution center*.

DDP: Delivered Duty Paid (an Incoterm used in international trade).

DDU: Delivered Duty Unpaid (an Incoterm used in international trade).

Dead storage: A product that does not move from its storage location for a long time.

Deadhead: Moving an empty truck or container.

Deck: The upper or lower surface of a pallet. It can be of one-piece construction, such as plywood, or made up of planks.

Deck opening: The space between the deckboards of a pallet.

Deckboards The planks of a pallet deck. Deckboards are perpendicular to the stringer or stringer board.

Declared value: The value of a shipment unless the shipper declares higher value.

De-consolidation center: A warehouse where most of the freight enters in truckloads and leaves in smaller quantities.

Dedicated capacity: A designated amount of transportation a carrier commits to provide for an individual shipper with equipment that is part of a common or contract fleet serving numerous customers. The equipment and driver are not for the exclusive use of one shipper, but capacity is reserved.

Dedicated contract carriage: An arrangement in which a carrier has a contract with each shipper to move all specified freight. The shipper obtains personnel, equipment, and sometimes facilities for the exclusive use of the shipper. Terms of service and rates are specified in the contract.

Dedicated location system: A system of storing materials in a warehouse in which a specific place is reserved for each item.

Dedicated storage space: That portion of occupyable storage space that is reserved to store merchandise, expressed in square feet or square meters.

Deep-lane storage: Storage of merchandise greater than one unit deep on one or both sides of an aisle.

Deflection: The sag, bend, or deformation of a rack beam platform or container side due to the weight of a load.

Delivery receipt: A carrier-prepared form that is signed by the consignee at the time of delivery.

Delivery window: A period during which a delivery (or deliveries) must be made.

Demurrage: The charge levied against the shipper or consignee for detaining a railcar, ship, truck, or container beyond the specified time allotted for loading or unloading. Its purpose is to offset the loss caused by the delay to the carrier. In trucking, the charge is commonly called "detention."

Depot warehouse: 1) A storehouse for the consolidation and distribution of rail freight. 2) Any warehouse located near a transportation terminal.

Depreciation: 1) An accounting term that signifies the process of allocating the costs of plant and equipment to the accounting periods in which they are used. 2) The diminishing value of a product while in storage due to obsolescence, spoilage, or deterioration.

Detention: See *Demurrage*.

Deterioration: Any reduction in the quality, value, or usefulness of merchandise. The quality of some commodities held in storage may diminish through spoilage. Deterioration may be magnified if proper storage conditions (temperature and humidity) are not maintained.

DEX/UCS: See *Direct exchange UCS*.

Direct exchange UCS (DEX/UCS): A store-level data interchange system that extends UCS (Uniform Communication Standard) to support direct store delivery, allowing direct data transfer between the supplier's delivery personnel and the store's receiving agent. The vendor's salesman or driver is equipped with a hand-held terminal in which details of the order are maintained. The data is transmitted to the retailer's accounting department for reconciliation and payment.

Direct labor: Labor that is specifically applied to a product or service.

Direct material: A specific, measurable amount of material that is incorporated into an end product.

Direct product cost (DPC): Along with direct product profit, a yardstick for measuring the profitability of any given product. Originated in the late 1960s in

the grocery industry, DPC is a tool developed to assign all costs—for shipping, storing, stocking, etc.—directly to individual products in an effort to determine their direct product profitability (DPP).

Direct product profit (DPP): An accounting method to examine each product's contribution to a retailer's overall profit by refining gross margins into net contributions to costs and profit by individual SKUs. To determine the DPP of an item, a special formula is developed to deduct all direct and indirect costs of handling that item. DPP/DPC does not address overhead allocation problems—only the costs related directly to a product (e.g., ordering and stocking). ABC does address these overhead and indirect costs. Also, unlike DPP/DPC, ABC is tied to the business's general ledger, allowing easier and more accurate determinations of profitability by department, category, or SKU.

Direct store delivery (DSD): A distribution method in which suppliers deliver product directly to the retail store and bypass the distribution center.

Directed putaway: System in which a computer chooses the best and most logical locations to store product.

Discrete order picking: The completion of a single order at a time. This method requires a complete tour through the order picking area for each order to be picked.

Distribution: The activities and planning required to move product from the end of a production line to the final user. Distribution is the post-production channel.

Distribution center (DC): A warehouse for finished goods. The facility from which wholesale and retail orders are filled. The term is used to describe a high velocity operation as opposed to a dead storage warehouse.

Distribution modeling: The use of computerized tools to determine and compare the total costs of various logistics designs for a company.

Distribution system: The system and processes of transporting goods within and among plants, warehouses, and other facilities.

Distributor: A business that is in the middle of a supply channel. Distributors buy and sell finished goods. They may alter, assemble, combine, or otherwise add value to the goods.

Diversion: Changing the consignee, destination, or route of a shipment while in transit.

Dock: The sorting or staging platform where shipments are loaded or unloaded.

Dock board: See *Dock plate*.

Dock face: The outside wall of the dock door area.

Dock fire door: Generally used with enclosed apron areas, this is a safety feature to protect the interior dock area from fires that may occur on the apron or in the trailer itself.

Dock leveler: See *Dock plate*.

Dock light: A flood light positioned so it illuminates the interior of a trailer while not obstructing loading and unloading activities.

Dock plate: A manually or hydraulically operated ramp, located at the dock entrance, that can be raised or lowered approximately 1 ft. (30 cm) to accommodate varying trailer floor heights. Also called an adjustable ramp.

Dock receipt: A receipt issued for a shipment at a pier or dock.

Dolly: 1) A trailer dolly, having a fifth wheel, used to convert a semi-trailer to a full trailer. 2) A small platform on wheels used for handling freight in a warehouse.

Double reach forklift: A forklift designed to reach back two pallet positions.

Double-deep storage: Rack storage of merchandise two loads deep on one or both sides of an aisle.

Double-reach forklift: A reach truck that is equipped with pantograph extensions capable of moving a load several feet (a few meters) beyond the front of the mast.

DPC: See *Direct product cost*.

DPP: See *Direct product profit*.

Drayage: The local cartage of freight. The term is also used to describe longer distance hauls, but usually in an intermodal context. For instance, the term would apply to a container that is hauled from a rail head or ship to its final destination and vice versa.

Drive-in rack: Storage rack which provides side rails to allow high stacking in deep rows. Unlike drive-through racks, it provides access only from the aisle.

Drive-through rack: Storage rack which provides side rails to allow high stacking of products in deep rows and access to the product from either end of the row.

Driveway installation: A ramp located on the outdoor apron of the dock, used to raise or lower a truck trailer so that its floor becomes level with the dock floor.

Drum: A shipping container with cylindrical shape and flat ends, made of metal or fiber-board.

Drum forks: The forks used to lift drums, barrels, or other cylindrical loads by grasping the lid.

DSD: See *Direct store delivery*.

Dunnage: Lumber or other material used in bracing shipments.

Duty: A tax assessed by a government for importing and exporting goods.

EAN: See *European Article Numbering System*.

ECR: See *Efficient consumer response*.

EDI: See *Electronic data interchange*.

Efficient consumer response (ECR): A strategy in which the grocery retailer, distributor, and supplier trading partners effect methods to work closely together to create efficiencies in the grocery supply chain and better serve the consumer.

Enterprise Application Interface (EAI): Software that provides the ability to map and relate any system to any other system. These tools provide standard interface libraries, like a set of EDI records, and allow the user to create an unlimited number of subsets, each for a specific trading partner or other system.

Electronic data interchange (EDI): The computer-to-computer transmission of business information between trading partners. Information is organized in accordance with guidelines administered by the Uniform Code Council (UCC) for the grocery industry or the Voluntary Inter-Industry Communications Standards Group (VICS) for the general merchandise industry. Standards have been developed for all regular business-to-business communication, including purchase orders, invoices, shipping notices, and funds transfer.

Elevated height: The height to which a forklift can raise a load, measured from the floor to the bottom of the forks at a fully raised position.

Empty pallet stacker: A device that stores and disburses empty pallets.

Ending inventory: A statement of on-hand inventory levels at the end of a period.

Enforced storage: A term used by shippers to denote merchandise that must be stored in their facilities because of an inability to complete delivery.

Ergonomics: The arrangement of tools, lighting, furniture, and other workplace devices aimed at reducing fatigue, discomfort, and injury by accommodating human capabilities.

Error rate: A percentage of total items picked or shipped in a distribution facility that are not as ordered. The error rate can also be viewed as 100% minus the accuracy level. A company with an accuracy rate of 95% will have a error rate of 5%.

Estimated time of arrival (ETA): A measure of when a vehicle or cargo is expected to arrive at a certain place. of a particular journey.

European Article Numbering System (EAN): A standardized format for a 13-digit bar code and number identification of products and shipping containers used primarily outside the US and Canada. EAN bar codes are compatible with the UPCs of the US and Canada, although there are differences in format.

Exchange pallet: A pallet identified for use within a specific group of shippers and receivers. The ownership of the pallet is transferred when the ownership of unit load is transferred.

Expendable pallet: A pallet intended for single use only.

Extended height: The maximum elevation reached by the forklift mast assembly, fork carriage, load backrest, or operator cage when the mast is in a fully raised position. This height determines the minimum building clearance for safe operation.

Extension forks: Attachments placed on the forks of a lift truck to lengthen them.

External costs: Those costs that originate outside the warehouse facility, but would not occur if the facility were not there. These include: transportation charges to and from the warehouse, inventory taxes on goods stored at the warehouse, insurance on the inventory, and the user's costs of controlling the warehouse.

F/B: See *Freight bill*.

FA: See *Free astray*.

Facility: The physical plant and storage equipment. Permanent storage bins in a warehouse may be considered part of the facility, whereas material handling equipment may not.

Facing: 1) A storage location that can be reached without traversing another storage slot. 2) The reachable presentation of an SKU.

FAS: See *Free along side*.

FCA: Free carrier (an Incoterm used in international trade).

FIFO: See *First in, first out*.

Fill rate: A measurement of how well a warehouse is meeting service objectives. It is calculated by dividing the number of orders filled by the total number of orders within a given period. Also called order ratio.

Fire, class A: A fire involving combustible materials such as wood, packing materials, paper, or cloth.

Fire, class B: A fire involving petroleum products or paint.

Fire, class C: A fire involving wiring, fuse boxes, or other energized electrical equipment.

Fire, class D: A fire involving metals.

Firewall: 1) A wall made of fire-resistant material to prevent a fire from spreading. 2) In computer applications, a security measure to prevent unauthorized users from gaining access to a computer network.

First in, first out (FIFO): A method of inventory rotation in which the oldest items are shipped first. It is also a method of inventory valuation in which cost is based on the oldest purchased materials.

Fishyback: Transportation of truck trailers or containers on ships or barges.

Five-sided wrapping: Using stretch wrapping to secure a pallet from the top, as well as from all four sides.

Fixed beam scanner: A barcode scanner that is stationary and reads codes as items move past it.

Fixed interval system: An inventory reordering rule in which goods are supplied at specified fixed intervals. The size of the lot varies according to replenishment needs.

Fixed location system: An inventory storage system in which the location of a product in the warehouse never varies.

Fixed position scanner: See *Fixed beam scanner*.

Fixed reorder point system: An inventory rule that calls for reordering when stock level declines to a specific point.

Fixed slot: A storage slot reserved for a specific SKU.

Float: See *Buffer stock*.

Floating slot system: See *Random location system*.

Floor load: A system of loading in which goods are stacked just one pallet high to allow for quicker turnaround of transfer vehicles.

Flow rack: Metal shelves fitted with rollers or wheels which allow a product to flow from the back of the rack to the front. Used in small-quantity order picking, flow racks can expedite the process.

Fluctuation inventory: See *Buffer stock*.

FOB: Free-on-board. Abbreviation precedes the name of the point at which the shipper is responsible for transportation charges. An Incoterm used in international trade.

FOB destination: Free on board to the consignee's address. The consignor retains liability for merchandise until it reaches the destination. Title to merchandise does not pass to the consignee until the goods arrive at the destination. Typically the shipper is responsible for selecting a carrier and for all charges up to the point of transferal.

FOB origin: Free on board up to delivery to the carrier. The consignor retains liability for merchandise until it is picked up by the carrier. The consignee is considered to have title to the goods beginning at the time the carrier accepts the shipment. Typically the consignee is responsible for selecting the carrier and for all charges relating to transportation.

FOB shipping point: Title to merchandise passes to the consignee at the point when the goods are delivered to the transportation provider.

FOB vessel, car, or truck: Similar to FOB origin but the shipper accepts responsibility for loading the shipment onto the carrier vehicle.

Force majeure: A contract relief clause that covers an irresistible force that prevents compliance with the provisions of the contract.

Forced air cooling: A method of drawing cool air through product (usually fresh fruits and vegetables) to remove unwanted heat.

Foreign trade zone (FTZ): In the United States, areas where goods are treated as outside the US stream of commerce by the US Customs Service. Goods can be stored, processed, and remanufactured within an FTZ without incurring import duties or meeting import quotas.

Fork spreader: A device that permits the forks of a truck to be moved laterally so that loads of varying width can be accommodated.

Forklift: A motorized load carrying device that can raise, lower, and move freight. The operator may sit or stand. The forklift has many slang names, including bug, hi-lo, lift truck, fork truck, and lift.

Forks: The flat metal appendages mounted on forklifts to facilitate the movement of merchandise on pallets. They are generally 4-6 inches wide and 42-48 inches long (10-15 cm wide and 1-1.2 m long).

Forwarding agent: Firm specializing in international shipping.

Four-way container: A container that is configured for storage and retrieval from all four sides.

Free along side (FAS): A shipping term applying when the consignee assumes liability for delivering shipment to a point adjacent to or alongside the vehicle of the carrier. An Incoterm used in international trade.

Free astray (FA): The movement of a shipment without additional charges if it has been misrouted (i.e., gone "astray") or has been damaged. Often applied to a partial shipment which was held because it would not fit in a fully loaded truck or boxcar.

Free path equipment: Equipment, such as a forklift, that is not constrained by power supply or support devices and has the ability to move freely throughout the warehouse.

Free standing rack: A storage rack supported only by the floor. Free standing racks are not attached to the ceiling, walls, or any other part of the warehouse.

Free time: The time allotment for shippers or receivers to load or unload cargo without additional charges.

Freelift: The vertical distance the forks of a forklift can be raised from a lowered position before the mast assembly begins to extend from its collapsed height. Freelift typically ranges from only a few inches to 60 inches (several cm to 1.5 m).

Freezer separato: See *Spacer*.

Freight bill (F/B): The invoice used by carriers to notify the responsible party of charges due for transportation of shipments.

Freight broker: A person or company responsible for arranging the transportation of goods between points in interstate commerce by motor carrier. As compensation for arranging transport, the broker receives a commission.

Freight consolidation: The merging of shipments from several manufacturers for transport to the same destination under a single bill of lading. This method of shipping provides freight savings for all parties involved.

Freight forwarder: A shipping specialist who consolidates the shipments of many firms into one shipment. Typically, a freight forwarder consolidates less-than-truckload (LTL) shipments of individual shippers into carload (CL) and truckload (TL) quantities. A freight forwarder profits by charging shippers discounted LCL or LTL rates, but paying rates based on a full load. A freight forwarder typically takes responsibility for arranging transportation and ensuring that merchandise reaches its destination.

Fresh product: Product that has not yet been frozen for preservation of quality.

FTL: See *Full truck load*.

FTZ: See *Foreign trade zone*.

Full truck load (FTL): A truck loaded to legal capacity limits. Eligible for full truckload rate.

Gateway: The point at which freight is interchanged or interlined between carriers.

Gaylord: See *Tote*.

General merchandise warehouse: The most common type of warehouse. These warehouses store almost every kind of merchandise and are used by manufacturers, distributors, and their customers. They can be public warehouses or private warehouses.

GCCA: See *Global Cold Chain Alliance*

GHP: See *Good housekeeping practices*.

Global Cold Chain Alliance (GCCA): The Global Cold Chain Alliance (GCCA) is an alliance of four (4) international business associations comprised of companies within the perishable foods supply chain and logistics industry. The following associations are considered "Core Partners" of the Alliance:

- World Food Logistics Organization (WFLO)
- International Association of Refrigerated Warehouses (IARW)
- International Refrigerated Transportation Association (IRTA)
- Controlled Environment Building Association (CEBA)

GMA: See *Grocery Manufacturers of America*.

Good manufacturing practices (GMP): A term that is recognized worldwide for the control and management of manufacturing and quality control testing of food products.

Grocery Manufacturers of America (GMA): A trade association whose members are manufacturers and processors of food and other products sold in retail grocery outlets.

Gross ton (GT): The equivalent of 2,240 pounds, 20 long hundredweights, or 1000 kilos. A standard ton is only 2,000 pounds.

Gross weight The weight of both a container and its contents. Also called a long ton.

Hand truck: A device used for manually transporting goods. A metal plate is slid under the load, then truck and load are tilted toward the operator and moved. There are two varieties: the western type has its wheels located within the side rails, while the eastern type places the wheels outside the side rails.

Handling: The movement of materials or merchandise within a warehouse.

Hidden Damage: Damage to cases or product that is not visible upon initial inspection of a pallet. If cases or products are damaged inside the pallet, they may be hidden from detection until the pallet is picked prior to shipping or when the pallet is received at the customer's location.

Hold-down rings: Components of the safety equipment for dock operations. They are used to chain the front of a truck trailer to the ground and minimize the possibility of a near-empty trailer tipping as forklifts enter the back.

Honeycombing: A waste of space that results from partial depletion of a lot and the inability to use the remaining space in the area.

Hotwater defrost: A method of thawing meat for the purpose of government inspection for import to the US.

Hub: A central location where several customers' logistics needs are managed.

Hybrid truck: A vehicle that combines high bay storage and retrieval capabilities with the flexibility of a forklift.

IARW: See International Association of Refrigerated Warehouses

Import/export license: A government authorization allowing for the shipping of goods across national boundaries.

In apparent good order: A shipment not showing any visible loss or damage.

In-and-out costs: The total labor costs associated with receiving, moving to storage, retrieving, preparing for shipping, and loading merchandise.

Incoterms: A uniform set of international rules for the interpretation of the costs commonly incurred in foreign trade, devised by the International Chamber of Commerce in Paris, France. The 13 Incoterms in use currently are: EXW, FCA, FAS, FOB, CFR, CIF, CPT, CIP, DAF, DES, DEQ, DDU, and DDP. Definitions for several of these terms are included in this glossary.

Indirect costs: Costs that can not be directly associated with specific goods or services such as utilities, marketing, and staff functions. These are typically allocated to a final product through an overhead account.

Integrated EDI: A term applied to the direct entry of information received electronically into the recipient's computer system (e.g., the entry of a transmitted invoice directly into the accounts payable ledger). It requires the sender to adhere strictly to standard, pre-agreed formats. Some programs that depend on integrated EDI are computer assisted ordering, continuous replenishment, and direct store delivery.

Interchange: Exchanging freight or equipment, such as railcars or trailers, from one carrier to another.

Interline freight: Merchandise that is transported by two or more carriers.

Intermediately positioned warehouse: A distribution center that is located between the manufacturing plant and major customers.

Intermodal transport: Shipping of freight in which more than one transportation mode is used.

Internal costs: Those costs generated within the facility and directly under the control of warehouse management. These include storage, handling, clerical services, and administration.

International Association of Refrigerated Warehouses (IARW): The International Association of Refrigerated Warehouses (IARW) came into existence in 1891 when a number of conventional warehousemen took on the demands of storing perishable food and soon realized the increased challenge and complexity of operating temperature controlled storage facilities. IARW's goals and activities have broadened considerably over the years. Today, in

addition to collecting information and encouraging the exchange of ideas, the association aggressively promotes more efficient distribution services, aids members in adopting new technology, advises members of legislation and regulations affecting the food industry, assists members in complying with U.S. and international regulations, and participates in alliances with industry and international organizations having a common interest in the safe and efficient flow of food products around the world. All active members of IARW are also members and beneficiaries of the work of The World Food Logistics Organization.

Inventory: The merchandise on hand at a warehouse or production plant.

Inventory buffer: See *Buffer stock*.

Inventory control: The activities and techniques associated with maintaining the optimal level and location of raw materials, work-in-progress, and finished goods in a supply chain.

Inventory reconciliation: The process of reconciling the physical count of merchandise with the book records and updating records to reflect the true nature of the inventory.

Inventory tax: A tax imposed by some state and local governments on the value of inventory on hand.

Inventory zoning: A technique for taking physical inventory by establishing zones for the purpose of a physical inventory count.

Issue: The transfer of items from a stock location to an internal or external customer.

Item size: Cubic dimensions of a particular stock keeping unit (SKU).

JIT: See *Just in time*.

Joint rate: A single rate applied to transportation services when two or more carriers share responsibility for transporting a shipment.

Just in time (JIT): The practice of timing inbound material flows so that they arrive just before they are required, resulting in smaller inventories. A JIT system requires close links among forecasting, production scheduling, and purchasing groups as well as suppliers and carriers.

Kan ban: A term meaning "signboard" in Japanese, it refers to the instruction placards placed on warehouse carts containing materials scheduled for production. In warehousing, Kan ban is essentially the same as just-in-time.

Knock Downs (KD's): Damaged boxes or cases that have been saved on behalf of the customer. If cases are damaged but the products inside are usable, the product is normally transferred to a new case, and the original (damaged) case is broken down and saved for the customer as proof of re-packaging.

Latent defects: Faults which are not readily apparent through normal diligence. The carrier is not responsible for latent defects.

Lateral collapse: The failure of pallet joints due to extreme forces. The force occurs in a direction perpendicular to the stringer board.

Lay time: Downtime during loading or unloading for which there is no demurrage charge.

Layer: One complete row of boxes on a pallet or unitized stack.

Layer Picking: A popular method of order picking, whereby a full layer of a pallet is retrieved at a time.

LC: See *Letter of credit*.

LCL: See *Less than carload*.

Lead logistics: A company that can provide or assume full responsibility for all functions of a customer's logistics pipeline.

Lead time: The period of time that elapses between the time an order is placed and the time it is received in storage. Also called replenishment time.

Legal weight: The weight of the goods and the interior packing but not the container.

Length block: A pallet pattern in which package lengths are loaded parallel to the pallet length.

Less than carload (LCL): The term used for a railroad shipment that weighs less than the minimum necessary for the application of the carload rate.

Less than truckload (LTL): The term used for a shipment that weighs less than the minimum necessary for the application of the truckload rate.

Letter of credit (LC): A letter issued by a bank to assume that payment will be made in accordance with specific terms which must be met. This letter protects both buyer and seller in international trade.

License plate number (LPN): A bar code attached to an item for tracking purposes.

Line items: Specific stock-keeping units (SKUs) within a product line. Line item reporting is typically the base level of record keeping for products. Generally, two comparable items from different vendors are recorded under separate SKUs.

Live rack: A storage rack constructed to allow items to move unaided toward the picking point. The rack is slanted so that the picking point is lower than the rear loading point, allowing gravity to draw items to the front. A roller conveyor or other low-friction surface supports the merchandise.

Load: 1) An existing stationary force that is constant in magnitude and direction. 2) Materials and merchandise being moved in small or large amounts, such as on a pallet or in a container.

Load Bar: A securing mechanism designed to prevent cargo from moving within the trailer. The bar contracts and expands with the wall of the trailer to keep the cargo safely in place during transit. The load bar should be placed between the wall of the truck and the palletized products, directly behind the last pallets loaded onto the trailer.

Load center: Half the length of a load measured from the center to the end of a fork on a lift truck.

Load height: The dimension of a load measured from the bottom of a pallet, or other load platform, to the top of the load.

Load length: The dimension of a unitized load measured perpendicular to the aisle in which it is stored.

Load width: The dimension of a unitized load measured parallel to the aisle in which it is stored.

Load-bearing pallet surface: The bottom surface of a pallet.

Load-carrying pallet surface: The top surface of a pallet.

Loading system: A systematic method of building unitized loads.

Location audit: A systematic verification of the location records of an item or group of items by checking the actual locations in a warehouse or storage area.

Location card: Document containing lot number, quantity, product code, and other descriptive language used by a warehouseman to record where product is placed.

Location change card: See *Change-of location card*.

Locator address system: A storage address designation system. A grid system assigns each warehouse bay or row a number that indicates its relative north-south or east-west position within the warehouse.

Locator file: A system that records where a product is stored. This system is necessary when stock is stored in random locations.

Logistics: The management of inbound and outbound materials, parts, supplies, and finished goods. Originally confined to traffic and warehousing, logistics has evolved to include production scheduling, forecasting, customer service, order entry, inventory control, and product allocation among customers.

Long ton: See *Gross ton*.

Longshoreman: A person who loads and unloads marine vessels.

Lot: Each unit of goods for which a separate accounting is kept by the warehouse operator.

Lot number: Identifying number used to keep a separate accounting for a specific lot of merchandise.

Low lift: See *Pallet jack*.

LPN: See *License plate number*.

LTL: See *Less than truckload*.

Lumper: A self-employed casual laborer who loads/unloads trailers.

Magnetic strip: A type of identification tag that uses a strip of magnetic material attached to a container or to the merchandise itself. The strip is encoded with information that can be read by a magnetic scanner.

Maintenance, repair, and operating items and supplies (MRO): All items used maintaining, repairing, and operating a facility. Includes, tools, janitorial supplies, replacement parts, fuel, office supplies, etc.

Man up forklift: A forklift truck in which the operator is raised and lowered with the load.

Manifest: A statement describing the load on a vehicle.

Mast: The upright assembly and hydraulic cylinders that enable a forklift to lift and support loads.

Mast, four stage: Mast providing the greatest vertical lift on a forklift truck, consisting of four telescoping channel sections.

Mast, single stage: A forklift mast consisting of two upright channels in which the carriage rides up and down. This type of mast has the least number of moving parts and provides the highest stability for moving loads.

Master carton: A single large carton that is used as a uniform shipping carton for smaller packages. It is used primarily for protective purposes, but also simplifies materials handling by reducing the number of pieces handled.

Master Cleaning Schedule (MCS): A tool designed to effectively allow supervision of cleaning functions and provides management with information pertaining to which jobs have been completed and what work remain to be done.

Material Safety Data Sheet (MSDS): A document containing information about hazardous chemicals, including ingredients, physical and chemical characteristics, fire and explosion warnings, health hazard data, and precautions for safe handling and control. In the US, employers are required by the Department of Labor to maintain MSDS information on any hazardous chemicals to which employees may be exposed. Similar requirements are found in many nations.

Min-max system: An order-point replenishment system. The minimum point is the order point and the maximum is the "order-up-to" level.

Mode: A method of transporting materials such as truck, rail, air, ocean barge, or intermodal.

MRO: See *Maintenance, repair, and operating items and supplies*.

MSDS: See *Material Safety Data Sheet*.

Multi-tine fork: Attachment to a forklift truck that allows the movement of two pallets side-by-side, rather than one pallet at a time.

Negotiable warehouse receipt: A legal certification that listed goods are held in a public warehouse. The certificate can be purchased or sold, thus transferring title to the goods.

Node: A station in a distribution system, such as a warehouse, breakbulk facility, or office.

Non-dedicated contract carrier: A carrier that serves one or more shippers and charges established rates contained in a contract.

Non-negotiable warehouse receipt: A legal certification that listed goods are held in a public warehouse. The certificate cannot be bought or sold.

Non-vessel-operating common carrier (NVOCC): A cargo consolidator for small ocean-bound shipments. Containerization is performed at the port and business is generally solicited locally.

Notch: The indentation in the lower side of a pallet stringer that allows space for insertion of forks.

NVOCC: See *Non-vessel-operating common carrier*.

OBC: See *On-board computer*.

OCR: See *Optical character recognition*.

OD: See *Outside dimension*.

On-board computer (OBC): A computer on a truck that is used to calculate fuel usage, driver efficiency, and other data related to motor carriage.

One-way pallet: 1) A pallet that can only be accessed by a forklift from its front or back. 2) An expendable pallet.

On-order stock: The total of outstanding replenishment orders.

OO: See *Owner operator*.

Open order: Customer order received, specific lots not yet allocated. An order not yet in the picking process.

Optical character recognition (OCR): Computer controlled reading and recognition of letters and numbers. The characters being read are not encoded and can also be recognized and read by a human being.

Optical scanners: Reading devices used in material handling to record and count.

Order bill of lading: A form used by the shipper when payment is desired before goods are delivered to the consignee. This bill allows the shipment to be turned over only to the person named specifically thereon.

Order clerk: The person responsible for reading and ensuring the accuracy of orders.

Order cycle: The time and processes involved from placement of the order to receipt of the shipment by the consignee. It includes communicating the order, order processing, transporting the shipment, and delivering the order.

Order entry: The process of entering information such as customer orders into a computer.

Order fill, measure of: A warehouse productivity ratio that measures the total number of orders that were picked complete (without stockouts, damage, or backorders) in a given time period.

Order picker: 1) Lift truck which allows the warehouse worker to ride with the pallet and to pick from various levels. 2) A warehouse worker whose prime job is selection of orders.

Order picking: The selection of items in an order.

Order point system: An inventory control mechanism that causes a reorder when the stock level drops to a certain quantity of goods on hand.

Order ratio See *Fill rate*.

Order-notify (bill of lading): A term which calls for surrender of the bill of lading to a bank before the freight is delivered to the consignee.

Originating carrier: The first carrier to receive a shipment of merchandise from the shipper.

OS: See *Out of stock*.

OS&D: See *Over, short, and damage report*.

OSHA: S*ee U.S. Occupational Safety and Health Administration*.

Out of stock (OS): When the warehouse lacks inventory of a particular order code or lot number.

Outage: A quantity of some item lost in transportation or storage.

Outbound logistics: The portion of logistics that primarily involves the movement of materials and products from a company's production plant or storage warehouses.

Outrigger: A stabilizing structure that extends beyond the main body of a lift truck.

Outside dimension (OD): The exterior dimension of a container or package. In drums it is the diameter measured over the rolling hoops.

Outsourcing: Using a third-party manufacturer, carrier, or warehouse to perform functions formerly assigned to employees.

Over, short, and damage report (OS&D): A report prepared by the warehouse receiver which provides the information required to make a claim against the shipper or the common carrier.

Overage: Freight that exceeds the quantity shown on the shipping document.

Overhang: The part of a product stacked on a pallet which projects beyond the edges of the pallet.

Overhead cost: Those costs that are not directly related to warehousing and storage, but which are still part of the total costs of a facility. These include janitorial services, heat, light, power, maintenance, depreciation, taxes, and insurance.

Overhead guard: A metal cage that covers the operator of a forklift truck to prevent falling objects from striking the driver. In the US, these are required by the Occupational Safety and Health Administration on all forklifts that elevate enough to raise a load over the driver.

Overseas pack: A container designed to withstand the normal handling inherent in transportation, storage, and distribution overseas.

Overshipment: A shipment containing more than originally ordered.

Owner operator (OO): A truck driver who also owns the truck.

Owner's risk: A consignee's assumption of responsibility for goods during shipping, thereby relieving the carrier of part of the risk.

Packing list: A document that shows the merchandise packed and the particulars of that merchandise. A copy is usually sent to the consignee to assist in verifying the shipment received.

Pallet: A device used for moving and storing freight. It is used as a base for assembling, storing, stacking, handling, and transporting goods as a unit load. Commonly it is about 48 x 40 inches and is so constructed to facilitate the placement of a forklift's forks between the levels of a platform so it may be moved onto a freight car or into a warehouse.

Pallet dimensions: A pallet's length is measured between the pallet ends (including overhang) parallel to stringer or stringer board. A pallet's width is measured between pallet sides (including overhang) perpendicular to pallet length. A pallet's height is measured from outer edge of bottom deckboards to outer edge of top deckboards.

Pallet exchange program: An agreement between two or more shippers and receivers to make each responsible for the total stock of pallets. Pallets are exchanged on a one-for-one basis, and records are maintained on each pallet movement. Pallet exchange eliminates the need to off-load products from shipper to receiver, thus saving significant warehouse labor.

Pallet flow racks: A rack storage system in which pallets are put away on one side of a rack and flow on wheels to the opposite side, allowing for additional storage in depth at each storage level.

Pallet jack: A walk-behind forklift that raises pallet loads 4-6 ft. (1.2-1.8 m) above the floor for movement within a warehouse. Also called a pallet mover or low lift.

Pallet mover: See *Pallet jack*.

Pallet pattern: The pattern or arrangement of cases placed on each layer of a loaded pallet.

Pallet Picking: The most basic form of order picking, whereby the products are retrieved in full pallet quantities. Also called unit load picking.

Pallet position: The floor or rack space designated for a pallet location plus the overhead space above that area.

Pallet, all-way: See *Pallet, four-way*.

Pallet, four-way: A pallet that is constructed in such a way as to allow entry of fork tines from both sides and ends.

Pallet, safety work platform: A 48" x 40" pallet with 3 feet safety rails on all four sides. It is used with a lift truck to safely raise personnel for maintenance or inventory checks.

Pallet, type I: Single-faced, non-reversible pallet.

Pallet, type II: Double-faced, flush-stringer or block, non-reversible pallet.

Pallet, type III: Double-faced, flush-stringer or block, reversible pallet.

Pallet, type IV: Double-faced, single-wing, non-reversible pallet.

Pallet, type V: Single-faced, single-wing, non-reversible pallet.

Pallet, type VI: Double-faced, double-wing, reversible pallet.

Palletize: To place material on a pallet in a prescribed arrangement.

Palletizer: A type of materials-handling device using conveyors or robotics to position cubes or bags on a pallet.

Pareto's law: A rule stating that a relatively small number of products, sales, or activities comprise a large percentage of the total. First described by Italian sociologist Vilfredo Pareto.

Partial inventory: A count performed on a specific number of items in stock at regular intervals.

Physical distribution: The logistics activities that occur between the end of the production line and the final user. It includes traffic, packaging, materials handling, warehousing, order entry, customer service, inventory control, and forecasting.

Physical inventory: A physical count of every item located within the warehouse. Also called annual inventory.

Pick rack: 1) A storage rack located in the warehouse pick line where a small supply of each item is stored. This arrangement is used to make order selection more efficient. 2) A storage rack used for order picking.

Pick time: The amount of time it takes a worker to select and document an item.

Picker: See *Order picker*.

Picking: Selecting product by piece or unit for shipping.

Picking document: A form used to authorize and record the selection of merchandise in a warehouse.

Picking error: Removing the wrong product or quantity from the warehouse inventory.

Piece of pallet: A partial pallet load of product.

Piggyback: See *Trailer on a flat car*.

Pinwheel pattern: A method of storing merchandise on a pallet in a pattern to arrange items of unequal width or length. See Brick pattern. Also alled a brick pattern.

Pipeline stock: Inventory within the pipeline, including in-transit inventory as well as inventory positioned in distribution centers.

Point of origin: The terminal at which a shipment is received from a shipper by a transportation line.

Point-of-use storage: The practice of storing inventory close to the place where it will be used.

Portable plate: A loading ramp that can be moved to any loading position on the dock.

Pre-expediting: The process of tracking open orders to insure timely and proper delivery.

Prepaid bill of lading: The bill of lading that is used when the shipper pays the transportation charges.

Private carrier: A company that provides its own transportation, either through leased or owned equipment. Private carriers are allowed to transport goods for subsidiaries and to backhaul products from non-affiliated companies.

Private warehouse: A warehouse operated by the owner of the goods stored there. A private warehouse can be an owned or a leased facility.

Pro number: A progressive (serial) number used for identification of freight bills and bills of lading.

Product mixing: The use of a warehouse to combine the items in an entire line for shipments to customers. Sometimes used by manufacturers who have product-oriented plants in separate locations.

Proof of delivery: The receipt copy of the waybill signed by a consignee at the time of delivery.

Public refrigerated warehouse (PRW): A public warehouse that handles refrigerated and/or frozen products.

Public warehouse: A warehouse operated by a firm engaged in the business of storing goods for hire. The word public refers to the fact that the warehouse serves third parties, but does not necessarily indicate public ownership.

Pull distribution: System in which retail demand stimulates inventory and transportation flows.

Pulling: See *Picking*.

Pul-pa™: Trade name for a push/pull attachment for a lift truck, used to handle cargo on slip sheets.

Pup: A short trailer, usually 35 ft (10.7 m) or shorter in length.

Push distribution: A system in which distribution centers and retail points are stocked in anticipation of demand.

Push/pull device: A forklift attachment designed to handle unitized products on slip sheets.

Push-back racks: A pallet rack system which permits units to be stored by being pushed up a gently graded ramp, allowing for deep storage at each level. Wheels in the system allow pallets to flow down the ramp to the aisle.

Put document: A form used to indicate and/or record the locations where inbound product is to be put or has been put.

Putaway: The movement of material from the point of receipt to a storage area.

QC: See *Quality control*.

QR: See *Quick response*.

Quality assurance (QA): covers all activities from design, development, production, installation, servicing and documentation. This introduced the rules: "fit for purpose" and "do it right the first time". It includes the regulation of the quality of raw materials, assemblies, products and components; services related to production; and management, production, and inspection processes.

Quality control (QC): A system to ensure that products and/or services are designed and produced to meet or exceed customer requirements. These systems are often developed in conjunction with other business and engineering disciplines using a cross-functional approach.

Quarantine: The isolation of goods or materials until they can be checked for quality or conformance with all required standards.

Quay: A parallel docking area that allows for the loading and unloading of a ship or barge from one side.

Quick response (QR): A retail system similar to just-in-time (JIT) in which vendors use an accelerated supply system to swiftly replenish store stocks, with the goal of reducing the amount inventory needed at the retail level.

Quota: A limit on imports by class of goods or country of origin.

Rack: A structured storage system (single-level or multi-level) that is used to support high stacking of single items or palletized loads.

Rack-supported building: A warehouse in which the storage rack functions as the structural support for the roof.

Radio Frequency Identification (RFID): a modern form of data capture that utilizes RFID tags or transponders to store and/or remotely retrieve data. Most RFID tags contain an integrated circuit for storing and processing information through a modulating and demodulating radio frequency (RF) signal as well as an antenna for receiving and transmitting the signal. These components allow the product with the RFID tag or transponder to be tracked at all times, using localized detection equipment or satellite technology.

Radio-frequency terminals (RF terminals): Radio communication devices used as a link between computers in place of hard-wired connections. RF terminals can be used to communicate data between computers or between a hand-held data entry device and a computer.

Railcar mover: A mechanical device capable of moving one or a few railcars at a time. It is used to move and position rail cars at a warehouse dock.

Random location system: An inventory storage system in which items are stored in any available position. This system can be efficient in terms of utilizing space, but must be carefully monitored to avoid the misplacement of stock

Rate: An established charge for storage or transport of goods.

Rate files: A collection of published transportation prices or tariffs.

Reach forklift: A forklift with wheel-equipped arms that are about one-half of the load length and which sit below the forks. The reach truck is equipped with a pantograph device that allows the fork assembly and carriage to be extended from the truck so that a load may be placed in storage without moving the truck itself. The reach of the pantograph is capable of placing a pallet at the end of the arms. A reach truck is counterbalanced by the weight of the vehicle and rider.

Read area: The area covered by a scanner.

Real time: In data processing, the term refers to a system that is updated with each transaction—not on a batch basis—so that results will be available for immediate decision making.

Reasonable care: The extent to which a warehouse operator is liable for goods. As defined in section 7-204-1 of the Uniform Commercial Code: A warehouseman is liable for damages or injury to the goods caused by his failure to exercise such care in regard to them as a reasonably careful person would exercise under like circumstances, but unless otherwise agreed he is not liable for damages that could not have been avoided by the exercise of such care.

Receiving record: A complete listing of all incoming shipments during a specific period.

Receiving report: A record of the condition in which merchandise arrived.

Receiving tally: The warehouse receiver's independent listing of goods unloaded from an inbound vehicle, sometimes prepared on a blind basis to ensure accuracy.

Reconciling inventory: The process of comparing physical inventory results with the book values and making any necessary corrections.

Record of shipment: A record of details concerning an outgoing shipment. The record of shipment includes time of departure, destination, carriers and forwarders, and a description of the merchandise.

Reefer: A mechanical refrigeration unit on a vehicle, usually a truck.

Refrigerated warehouse: A warehouse that provides refrigeration and temperature control for perishable products.

Regional warehouse: A facility that serves a region rather than just one location. A regional warehouse can service other branch warehouses, service customers directly, or service both.

Relay: The process of hauling a load from one point to another, changing drivers along the way. This process is reminiscent of the relay in a track meet.

Release: The authorization to ship material.

Renewal storage: The rebilling fee (usually monthly) for products stored in a public warehouse.

Rental pallet: A proprietary pallet owned by a third party and rented or leased to the user. They are usually well marked with the logo and colors of the rental company.

Replenishment cycle: The process of resupplying inventory levels either from a central warehouse or from a vendor.

Replenishment time: See *Lead time*.

Request for proposal (RFP): A document sent to potential vendors describing system or product requirements.

Return on investment (ROI): A financial measure of the relative return on an investment. The ratio is the income from an investment or project divided by the cost of assets devoted to the project.

Return receipt: A form sent to the shipper after a consignee has received a shipment that indicates delivery has been made.

Rewarehousing: 1) Combining partial lots of the same product within a warehouse to free storage slots. 2) The process of moving product to other locations in a warehouse in order to change the storage configuration.

RFID: See Radio Frequency Identification

RF terminals: See *Radio-frequency terminals*.

RFP: See *Request for proposal*.

RO/RO: See *Roll-on/roll-off*.

ROI: See *Return on investment*.

Rolling stock: Assets used to transport freight, such as freight cars, trucks, and trailers.

Roll-on/roll-off (RO/RO): A ship designed to permit trucks to drive on or off at port.

Rotating forks: Forklift attachments that allow the fork carriage to rotate, thereby inverting a unit load.

Rotating head: A clamp attachment or fork on the lifting carriage of a fork truck that permits the rotation of the load.

Routing: The process of designating a route to be followed by a driver for pickups and deliveries. The route is designed to allow performance of duties with minimal consumption of time.

Safety stock: See *Buffer stock*.

Salvage value: 1) The value that can be retrieved from used or damaged goods. 2) For tax and accounting purposes, salvage value is an estimate of an asset's net market value near the end of its life.

SCBA: See *Self-contained breathing apparatus*.

SCC: See *Shipping container code*.

Scissor tongs: A forklift attachment that grips a load through scissor action when the fork is lifted.

Seal: A lockable numbered metal or plastic strip applied to the door of a railcar, truck, or container. A broken seal indicates that the door has been opened.

Seasonal inventory: Inventory held to meet seasonal demand.

Self-contained breathing apparatus (SCBA): A device worn by rescue workers, firefighters, and others to provide breathable air in a hostile environment. When not used underwater, they are sometimes called industrial breathing sets. The term "self-contained" differentiates SCBA from other apparatus connected to a remote supply by a long hose. An SCBA typically has three main components: a high-pressure tank (e.g., 2200 psi to 4500 psi), a pressure regulator, and an inhalation connection (mouthpiece, mouth mask or face mask), connected together and mounted to a carrying frame.

Semi: Slang for semi-trailer or tractor-trailer combination.

Semi-live skid: A small platform with two wheels on one end and two legs at the other, moved with a lift jack.

Serpentine pick: A picking route that passes by every warehouse slot in a serpentine pattern.

Service industries: Those businesses other than agriculture, mining, or manufacturing. Warehousing is a service industry.

Sharp freezing: Freezing product on trays prior to packaging.

Shelter: A cover that protects the space between the door of a railcar or truck and a warehouse from inclement weather.

Ship notice/manifest: An EDI transaction in which the shipper advises the customer of a pending shipment. Generically this is known as advanced ship notice (or ASN). The ASN enables the customer to identify short shipments before receipt and plan warehouse receiving more efficiently.

Ship-age limit: The final date a perishable product can be shipped to a customer.

Shipper: The party who tenders goods for transportation. The term can refer to a consignor, consignee who arranges for transportation services, or a third party that arranges for the transportation.

Shipper's advanced notice: A record that gives the shipper a listing of goods shipped, usually before the inbound vehicle gets to the warehouse.

Shippers Export Declaration: A US Treasury form that is required on export shipments from the US.

Shipping container code (SCC): A shipping code that is created by adding a two-digit package indicator to the front of a standard UPC code.

Shipping copy: A duplicate invoice that is sent to the shipping department authorizing preparation of merchandise for transportation.

Short shipment: A shipment containing less than the amount ordered.

Shrinkage: Reduction in inventory resulting from pilferage, scrap, or deterioration.

Shroud: A protective sheet that covers the top and sides of a load, but permits air to circulate from the bottom.

Side shifter: A device that permits the forks of a truck to be moved sideways to facilitate alignment of the load.

Single warehouse channels: The use of a single warehouse that services the retail requirements within an area. The single warehouse channel is often referred to as the shotgun channel because it takes a direct shot of goods from the plant to the wholesaler, who then services the needs of retailers.

Single-deep storage: Rack storage of merchandise one deep on an aisle.

Size: See *Item size*.

Skid: 1) A pallet having no bottom deck. 2) A platform with wheels, used to move articles.

SKU: See *Stock keeping unit*.

Slatting: See *Spacer*.

Slave pallet: A pallet used as a base for unitized loads in rack storage of AS/RS (Automatic Storage and Retrieval System). A slave pallet is used permanently within a single storage system.

Slip sheet: A sheet of cardboard, fiberboard, or plastic used to handle unitized loads with a push/pull attachment.

Slot: A position within a storage area reserved for a particular SKU. Usually one pallet wide and one or more pallets deep.

SOP: See *Standard operating procedure*.

Sortation: The process of separating packages according to their destination.

Spacer: A device, usually made of plastic or a similar hard, durable material, which is laid between layers of product on a pallet to separate the layers allowing free air flow for more rapid and even freezing.

Split shipment: A partial shipment that occurs when a warehouse is unable to fill an entire order. The remainder of the order is backordered.

Split-month billing: A method of public warehouse billing for storage in which the customer is billed for all inventory in the warehouse at the beginning of the month, as well as for each unit received during the month. Merchandise received during the first half of the month is billed at a full-month storage rate, while merchandise received after the 15th day of the month is billed at a half-month storage rate. Also called "California Billing."

Spoilage: 1) One form of product deterioration. 2) The reduction in an inventory's value resulting from inadequate preservation or excess age.

Spot check: A method of inspecting a shipment in which only a sampling of the total number of containers or items received are inspected.

Spot inventory: An inventory counting method in which only a particular group of items are counted.

Spur: A railroad track, separated from the main line, that is used to load and unload or store railcars. A spur may serve one warehouse or several facilities in an industrial complex.

Squeeze: Slang term for the carton clamp attachment on a forklift.

Stacked loads: Unit loads on pallets that are placed on top of each other to create a column of unitized loads.

Stacker: An individual who loads the freight onto a truck or unloads it.

Stacking: The process of placing merchandise on top of other merchandise.

Stacking height: The distance as measured from the floor to a point 24 inches or more below the lowest overhead obstruction. Stacking height is usually controlled to maintain clearances required by fire regulations.

Stacks: Refers to product stacked in the warehouse.

Staging area: Temporary storage in a warehouse or terminal where goods are accumulated adjacent to the dock for final loading.

Standard operating procedure (SOP): A set of instructions having the force of a directive, covering those features of operations that lend themselves to a definite or standardized procedure without loss of effectiveness. Every good quality system is based on its standard operating procedures (SOPs). The

presence of these quality documents is essential when inspections take place since the most frequent reported deficiencies during inspections are the lack of written SOPs and/or the failure to adhere to them.

Stevedore: A worker or agent who loads and unloads cargo from ships.

Stock: 1) Inventory on hand. 2) The activity of replenishing merchandise in storage.

Stock keeping unit (SKU): An individual color, size, flavor, or pack of a product that requires a separate code number to distinguish it from other items.

Stock locator system: A system that allows all storage spots within a warehouse to be identified with an alpha-numeric code and tracks the items and quantity in each location.

Stock report: A record of items on hand by type and number based on the paper recording of receipts and shipments during a given period.

Stockout: 1) The act of running out of items required for production or sale. 2) A deficiency of stock in storage.

Storage characteristics: Those features of a product or unit load that dictate how it is stored.

Storage costs: The sum total of all costs associated with storage, including inventory costs, warehouse costs, administrative costs, deterioration costs, insurance, and taxes.

Storage rate: See *Warehouse rate*.

Straddle carrier: A container lifting device that picks up boxes within the carrier's own framework.

Straddle forklift: A forklift that depends on two arms parallel to the forks for support. The load is carried between the boundaries of the arms. Straddle trucks are made in both standup rider and walkie-truck configurations.

Straight bill of lading: A non-negotiable transportation receipt that directs the carrier to deliver the shipment to any authorized person at the destination point.

Strap loading: The process of loading merchandise onto a pallet and securing it with metal or plastic straps.

Stretch wrapping: A process and means of applying a sheet of flexible plastic to packages in such a way that they are secured together in a unitized load.

Stringer: A continuous, solid board component that extends the length of a block pallet and supports the deck components. Stringers usually run at ninety degree angles to the deckboards and are identified by location as either edge or center stringers.

Stripping: Slang for unloading a container. Case by case unloading of a pallet or container.

Stuffing: Slang for loading a shipping container. Case by case loading of a pallet or container.

Surface forwarder: A freight forwarder that uses rail, motor, or domestic water carriers to transport merchandise.

Swing mast forklift: A forklift equipped with a mast assembly that rotates as a unit. Loads can be rotated only to the right or left.

Tail-gate delivery: Driver responsible for delivery onto the receiving dock.

Take weight: A product that is received in random weights, such as turkeys. Also called catch weight.

Tally: A sheet made up when goods are received to count and record their condition on arrival.

Tare: The weight of packaging or containers. Tare weight plus net weight equals gross weight.

Tariff: 1) A published set of prices for transportation services. 2) A duty imposed by a government on imported goods.

Temperature abuse: Exposure of frozen or refrigerated product to temperatures excessively higher (or lower in the case of certain foods) than optimal. The degree of temperature increase and time of exposure determine the extent of thermal abuse. Repeated exposure causes cumulative deterioration. Also called thermal abuse.

Tender: An offer by a shipper or transportation provider to enter into a contract.

Terminal: The term for a warehouse in early transportation systems. These storage facilities were at the terminal points for land and sea transport.

Thermal abuse: See *Temperature abuse*.

Third Party Logistics (3PL): A firm that provides outsourced or "third party" logistics services to companies for part, or sometimes all of their supply chain management function. Third party logistics providers typically specialize in integrated warehousing and transportation services that can be scaled and customized to customer's needs based on market conditions and the demands and delivery service requirements for their products and materials.

Third-party warehouse: A warehouse facility that provides storage and other logistics services.

Through bill of lading: A bill of lading that covers products from their point of origin through the final destination, even if multiple carriers are used.

Throughput: 1) The total number of units arriving at and departing from a warehouse divided by two. Used in public warehouse rate making to calculate average movement of product. 2) A measure of the amount of work done by a computer. Throughput is dependent on both hardware and software.

Tie: One complete layer of material on a pallet or unit load. Number of units making up one complete layer.

Tie/high pallet: Width and height of freight on pallets and warehouse storage racks.

Tie-down: A system of securing a unit load to a pallet.

Tier: 1) A single layer of boxes or bags forming one layer of a unitized load. 2) A set of storage locations that are at the same height.

Tie-sheets: Pallet-size pieces of rough cardboard or fiberboard used between tiers to stabilize unitized loads.

Tilt table: A mechanically powered device that can quickly change pallets or remove spacers by handling the entire load on a pallet rather than individual cases.

TL: See *Truck load*.

TOFC: See *Trailer on a flat car*.

Ton mile: A measurement that is used to describe the efficiency of a carrier. A ton mile is equivalent to one ton of cargo moved one mile.

Total landed cost: Total cost incurred from source/origin to destination/user in a distribution system.

Total warehouse costs: The total of storage, handling, and clerical costs.

Tote: A bulk handling container with sides and a bottom, open at the top, usually 4 ft. x 4 ft. x 4 ft. (1.22 m x 1.22 m x 1.22 m). Totes are often used to handle vegetables. Also called a combo bins or gaylord.

Traceability: The ability to track a shipment or item. Any item with a lot number or serial number should be traceable back to the manufacturer, date, and location of assembly.

Traffic management: The selection of transport modes and of specific carriers within the modes.

Trailer on a flat car (TOFC): A rail-truck service in which a loaded trailer is taken by truck to a rail terminal, placed on a railroad flatcar, and moved by rail. The trailer is then off-loaded and delivered to its final destination by truck. Also called a "piggyback."

Transfer car: A tracked four-wheeled cart that is part of an automated storage or storage retrieval system.

Transit time: The standard allotment of time used to plan the movement of products.

Trans-ship: Transfer or re-handling of goods from one means of transportation to another.

Truck door: The part of the warehouse which accommodates loading and unloading of trucks. It includes an overhead door and may include a dock leveler, a dock shelter, and a concrete pad for the trailer.

Truck load (TL): The term used for a shipment which weighs at least the minimum necessary for the application of the truckload rate.

Turnover: The number of times, on average, that inventory is replaced during a particular period. The total flow of inventory handled in a given period divided by the average amount on hand. This is a measure of inventory management efficiency.

Turnover rate: The number of times, on average, that inventory is completely replaced during a particular period. It is a key financial measure of the use of inventory and a measure of inventory velocity, generally stated as the number of turns per year or per month.

Turret forklift: A forklift that raises loads to their storage locations and then swivels the fork carriage so the loads can be placed in the storage space. The forks are mounted on a turret assembly. A turret truck can operate in aisles just slightly wider than the truck itself. Unlike the swing mast, the turret rotates both to the right and to the left.

Two-book inventory system: A system under which both the warehouse user and warehouse operator maintain inventory records to ensure accuracy. When the two books are not in balance, they can be compared to search incorrect entries.

UCC: See *Uniform Commercial Code*.

UCC/EAN-128: A bar code symbology and data format used for primary and secondary product identification. Primary identification consists of two formats: the Serial Shipping Container Code and the UPC Shipping Container Code. The first is an 18-digit code for the unique identification of a single mixed-merchandise shipping container, typically used in conjunction with an EDI advance ship notice transaction. The UPC Shipping Container Code uses 14 digits to identify a standard pack or case.

UCS: See *Uniform Communication Standard*.

UCS: See *Uniform Container Symbol*.

Ullage: The empty space that is left over when a container, truck, or vessel is loaded.

Ultra-low temperatures: Generally regarded as temperatures less than -10 F (-23 C).

Unconcealed damage: Damage to merchandise that is evident when a shipment is received.

Underhang: The space on a pallet between the outer edge of the packages and the pallet edges. Underhang indicates less than full pallet area use.

Uniform Commercial Code (UCC): One of a number of uniform acts that have been promulgated in conjunction with efforts to harmonize the law of sales and other commercial transactions in 49 states (all except Louisiana) within the United States of America. This objective is deemed important because of the prevalence today of commercial transactions that extend beyond one state (for example, where the goods are manufactured in state A, warehoused in state B, sold from state C and delivered in state D). The UCC deals primarily with transactions involving personal or property rather than immovable property.

Uniform Communication Standard (UCS): A set of standard transaction sets for the grocery industry that allows computer-to-computer, paperless exchange of documents between trading partners. The standards are maintained by the Uniform Code Council, which also administers two UCS substandards: DEX and NEX.

Uniform freight classification: A system of classifying similar products into specific rate categories. The rate categories are based on handling attributes of the products, such as bulk, special handling needs, value, etc.

Unit load: A combination of packages bound together so that the unit can be moved as a single item.

Unit load picking: The process by which pallet loads are pulled from stock. Also called full pallet picking.

United States Department of Agriculture (USDA): A branch of the U.S. federal government responsible for developing and executing policy on farming, agriculture and food. The USDA is the food inspeciton arm of the government, and has responsibility for ensuring a safe and wholesome food supply.

United States Enivornmental Protection Agency (EPA): A branch of the U.S. federal government charged with protecting human health and with safeguarding the natural environment: air, water, and land.

United States Food and Drug Administration (FDA): A branch of the U.S. federal government responsible for the safety regulation of most types of foods, dietary supplements, drugs, vaccines, biological medical products, blood products, medical devices, radiation-emitting devices, veterinary products, and cosmetics.

United States Occupational Safety and Health Administration (OSHA): An agency of the U.S. Department of Labor with the mission to prevent work-

related injuries, illnesses, and deaths by issuing and enforcing rules (called standards) for workplace safety and health.

Unitization: 1) The consolidation of a number of individual items onto one shipping unit for easier handling. 2) The securing or loading of one or more large items of cargo into a single structure or carton.

Universal product code (UPC): A unique 12-digit bar code that identifies items produced for use in a retail environment.

Uprights: Vertical support members used in storage racks.

Value added: The contribution made by a step in the distribution process to the functionality, usefulness, or value of a product.

Value added network (VAN): A company that acts as a clearinghouse for electronic transactions between trading partners.

Vendor: 1) A term used interchangeably with supplier. 2) The company that provides materials for production or resale.

Vertical clearance: The distance between the top of a stack and the bottom of obstacles on the ceiling of a facility, such as beams, trusses, and sprinklers.

Voucher: A document authorizing the disbursement of payment that also signals recognition of a service performed or product purchased.

W/B: See *Waybill*.

Walkie truck: A manually-operated or powered apparatus that is capable of lifting pallets off the floor for transport. The operator walks behind the truck rather than riding on it.

Wall bumpers: Concrete-filled pipes 12-18 in. (30-45 cm) tall located to the side of the dock opening to protect adjacent walls from the impact of a misaligned truck trailer.

Warehouse activity report: A report that details all activities occurring within the warehouse facility, including merchandise arrivals, loading and unloading times, and movements.

Warehouse delivery order: A document that authorizes the release of merchandise from the warehouse.

Warehouse entry: The document or form that identifies goods imported when placed in a bonded warehouse. The duty is not imposed on the products while in the warehouse, but will be collected when they are withdrawn for consumption.

Warehouse Information Network Standard (WINS): A message and communication standard used in the warehouse industry and compatible with the Uniform Communication Standard (UCS). UCS/WINS consists of numerous

transaction sets that allow members of the grocery supply chain to communicate with each other.

Warehouse inventory status report: A report that provides information concerning the current levels and condition of inventory within a warehouse. It can also be used to provide information on inventory available for shipment.

Warehouse rate: The charge for the storage of goods by a public warehouse. Also called storage rate.

Warehouse receipt: A legal acknowledgment of responsibility for the care of goods placed in a warehouse for storage. The receipt is usually non-negotiable.

Warehouse shipping advice: A document that provides information concerning the status of shipments departing the warehouse.

Warehouse warrant: A receipt issued by a public or bonded warehouse.

Warehousing Education and Research Council (WERC): A professional organization that promotes education and idea exchange in the field of warehousing.

Waybill (W/B): A document that accompanies merchandise while it is being transported.

Wedge: A bar code scanning device connected directly to a computer terminal.

WERC: See *Warehousing Education and Research Council*.

Wet pack: Fresh product that has been washed and residual water allowed to remain (used with asparagus).

WFLO: See *World Food Logistics Organization*.

Wharfage: A charge assessed against a shipping line for using a wharf or against freight handlers moving over the pier or dock.

WINS: See *Warehouse Information Network Standard*.

World Food Logistics Organization (WFLO): A non-profit organization dedicated to the proper handling and storage of perishable products and the development of systems and best practices for the safe, efficient, and reliable movement of food to the people of the world. Founded in 1943 as The Refrigeration Research Foundation (TRRF), the foundation took its initial support from contributions from refrigerated warehouse professionals. The name was changed in 1995 to The Refrigeration Research and Education Foundation (TRREF), to better reflect the increasingly important education functions of the foundation. In 1999 the name was changed again to more clearly depict the broad scope of the organization's work. The foundation then became known as the World Food Logistics Organization. The WFLO Board of Governors is comprised of refrigerated warehouse, distribution, and logistics professionals and academic, civic, and business leaders interested in promoting the distribution of

perishable commodities to consumers, particularly the citizens of less developed nations. The WFLO headquarters in Alexandria, Virginia, is supported by a Scientific Advisory Council comprised of leading food scientists.

Zee section track guard: A device used to protect a dock door's tracks from impact by forklifts, pallets, and other machinery. It also can be a theft prevention device that hinders unauthorized entry by making it more difficult to pry a dock door from the wall.

Zone picking: Process of picking goods in which workers are assigned to specific picking areas, or zones. Orders picked by workers in the various zones are accumulated (staged) near the outbound docks for shipment.

Zone storage: A storage system in which merchandise is stored in specific areas and locations.