



Guide to Effective Warehouse Operations





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Introduction

Dear Member:

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

We would like to recognize the following GCCA members who contributed their time and talents to this publication, especially Pat Floyd, Ken Johnson, and Nick Pedneault. We also thank Stephen Neel for his diligent leadership on this important publication.

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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,

J. William Hudson
President and CEO

GCCA Operations

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Chapter 1: Effective Receiving Practices

1.1 Receiving Practices, Including Receiving Checklist

Effective receiving practices are important aspects of successful warehousing. Receiving involves both the front office staff as well as 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 incoming 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 of the trailer (chilled or frozen)
- Arrival time at the facility

This information will help determine the length of time and equipment required to handle the shipment. A schedule of all appointments and deliveries should be maintained, and 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. Front office personnel should reconcile any paperwork discrepancies, notify the customer of any 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

be 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, 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 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. 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. 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 receiving 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 potentially fees from the carrier.

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 an active locator system, 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. Generally speaking put away practices should be prioritized with the following emphasis:

- Grouping lots together
- Grouping product codes together
- Grouping customers' products together
- Using any available space

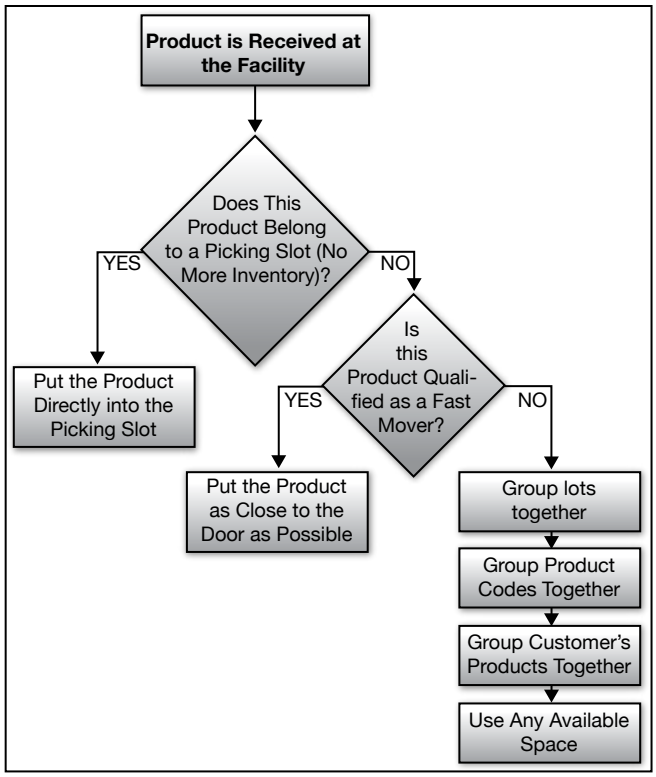
If the first criteria cannot be met, the warehouse operator should move on to the next. Not being able to group lots together could be symptomatic of honeycombing. Honeycombing can be defined as the waste of space that results from partial depletion of a lot and the inability to use the remaining space 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 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 mail one copy to the customer. It is recommended that warehouse receipts be mailed within twenty-four hours from the product receiving date.

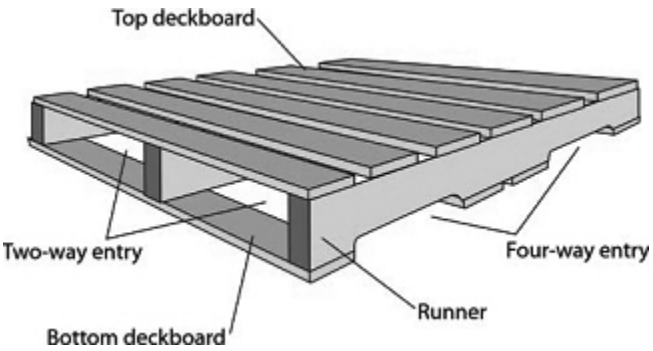
1.2 Palletizing Inbound Products

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.

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 unit load low to the floor whenever 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.

1.3 Managing Product Damage

Product damage can occur at many points during the distribution cycle, during loading at the source facility, during transit in trucks, during offloading at the warehouse, during put away for storage, during picking or during loading for shipment.

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" damage 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.

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

1. Verify 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.
2. Conduct a cursory 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.
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 consignee and/or carrier of this action.
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.
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.

Chapter 2: Effective Handling and Storage

2.1 Managing Product Damage

Product damage in the warehouse is a casualty of normal business operations, but should be managed to minimize financial losses and maintain a solid company reputation and relationship with customers.

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" damage 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. 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 share these pictures with the customer.

Presumably, any product damage that occurred prior to arrival and unloading at the warehouse was detected at the receiving dock and noted. Therefore, it can be assumed that any additional damage noted or discovered is most likely the responsibility of the warehouse and was presumably caused by warehouse staff. However, once product damage is noticed within the warehouse by warehouse staff, the following procedures should be initiated:

- The product should be traced back to receiving and receiving records should be reviewed to determine if any product damage was noted at the time of receiving. Especially look for photo documentation of product damage at receiving.
- Surveillance photos and security video should be reviewed to determine, if possible, where and when the product damage occurred.
- Pallet history records should be reviewed to determine which employees handled the products most recently.

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

Slightly Damaged Products:

It is important to note that each customer may choose to handle slightly damaged products differently, depending on their corporate policies or procedures. 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 can 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 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. Lot number
    b. Weight
    c. Number of cases
    d. Condition
    e. Cause of damage

f. 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), and legally disposed of.
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."

2.2 Pallet Management

A pallet is, by definition, 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. 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 a freight car 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 services; although some maintain in-house repair departments. Many warehouses, customers and shipping companies, however, participate in some form of pallet exchange 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. 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 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 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 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 Pallets:

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.

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 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 using a radio frequency (RF) terminal. 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 or broken case schemes are used. 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.

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), description, unit or material, and quantity of material required for the order. 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.

2.4 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 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 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, 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 product, stored in inventory or in the process of being distributed, as well as external product that has 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 single point of contact, or contact person, to deal with the specific recall. This individual would be responsible for coordinating the recall process, as well as serving as the primary point 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 contact person 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.

2.5 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.

Traditional cross docking, as described above, exists but is not always the norm. More frequently, cross docking can also be defined as "short hold" storage. 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 a short hold form of cross-docking, 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 an effective cross docking system are:

1. **Time.** Since cross docking procedures, as defined, result in products being moved **through** a warehouse **without** entering into cold storage rooms, 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.

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

Chapter 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:

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 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 PO or release number from the customer, front office personnel should generate a release number that the customer is willing to use. The release number (or PO in some cases) 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 identification 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 their 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 or 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. 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.

Warehouse Shipping Dock:

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 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 prior to loading, specifically including the following areas of emphasis:

Refrigeration Unit:

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 that it is shut 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 unites turned back on.

4. The thermostat on the units should be set 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.

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, they can authorize payment to the warehouse for cleaning the trailer, or they 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. 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 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, 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 can be located in 2.2 of this manual.

Picking Product(s):

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. Obviously, the office will be contacted and they will enter the location where the product resides.

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 where 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 can be located 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 not held at a consistent enough temperature for refrigerated products or 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:

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 will use the data (weights) for billing purposes. 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 signature on the delivery ticket relieves 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. 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 they know is that a shortage was discovered when the product was counted on their dock. If they received the shipment with seals intact and the proper serial numbers, they 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 verify if the proper number of cases is on hand. If the count confirms that the 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 completed 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.

3.2 Managing Product Damage

Product damage during the picking and shipping process is not uncommon during normal business operations, but should be managed to minimize financial losses and maintain a solid company reputation and relationship with customers.

Presumably, any product damage that occurred prior to arrival and unloading at the warehouse was detected at the receiving dock and noted. Therefore, it can be assumed that any damage noted or discovered during picking and shipping is most likely the responsibility of the warehouse and caused by warehouse staff.

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" damage 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 also important to note that each customer may choose to handle slightly damaged products differently, depending on their corporate policies or procedures. 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 damage is detected in the warehouse a supervisor should be notified immediately. The supervisor should be responsible for determining if the damage is slight or severs, then the following procedures should be taken:

Slightly Damaged Products:

When product cases are slightly damaged, crushed or torn **but** the inner packs are not affected, the product can 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. These boxes are generally broken down and saved, and are commonly called "knock-downs", or KD's.
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 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. Lot number
    b. Weight
    c. Number of cases
    d. Condition
    e. Cause of damage
    f. 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), and legally disposed of.
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."

Chapter 4: Information Technology (IT) Basics

4.1 Management Software

Warehouse Management Systems (WMS):

Warehouse management systems (WMS) 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 (TMS) 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 (LMS) 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 redeploy 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:

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.

4.2 Radio Frequency Systems

Automatic Identification and Data Capture (AIDC):

Automatic Identification and Data Capture (AIDC), or 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:

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 our 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):

Radio-frequency identification (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:

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 demagnetization 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:

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.

4.3 Business to Business Communications

Electronic Data Interchange (EDI):

Electronic data interchange (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):

Enterprise application interface (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:

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 accounts 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 is provide 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.

Chapter 5: Warehouse Security and Risk Management

5.1 Managing Internal and 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, Vandalism & Damage:

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 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 ex-

posure 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.*

5.2 Operational Risk Management

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 or environmental and 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
Security	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
Security	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.

5.3 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.

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.

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 times 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 GCCA Crisis Management Manual for additional information and support. As part of an effective crisis man-agement strategy, it is recommended that the crisis manage-ment team organize meetings with regulatory authorities, in-cluding 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 and training institutes provide a warehouse operator with access to the latest information and professional expertise.

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	Extinquished 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-conducive metals
D	Combustible metals, such as sodium and potassium	Extinguished with metal-specific fire extinguisher

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 stages of suppression, with each stage requiring additional fuel and oxygen. 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. 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. 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.

Chapter 6: Safety Management

6.1 Process Safety Management

Process Safety Management (PSM) is designed to protect workers from hazardous waste generated or stored in working environments, including refrigerated warehouses. Since not all wastes are hazardous it is important to distinguish which compounds fall into the category of hazardous waste. Generally speaking, if the material in question can catch fire, corrode, or explode it can be hazardous to humans. Hazardous waste can normally be classified into one or more of the following categories:

- Contains toxic chemicals
- Is a fire hazard
- Is corrosive or caustic
- May explode
- Reacts violently with water or air
- Generates toxic gases
- Is biologically viral
- Is radioactive

The following table helps further define the categories of hazardous materials:

Characteristic	Description
Ignitability	A waste capable of causing flames during routine transportation or of burning so vigorously that it creates a hazard. Flash point below 140 degrees F.
Corrosivity	An aqueous waste that has a pH of less than 2 or more than 12.5, or that corrodes steel at a rate of more than 0.25 inches per year.
Reactivity	A waste that, because of its extreme instability and tendency to react violently or explode, poses a problem at all stages of the waste management process.
Extraction Procedure Toxicity	A waste that, when subjected to a specific leaching procedure, contains certain parameters in the leachate fraction in a concentration 100 times greater than specified in the national interim primary drinking water standard.
Source: The Warehouse Management Handbook; Tompkins & Smith; Second Edition, 1998, Tompkins Press, pg. 374	

It is important to note that some compounds are hazardous but NOT toxic. Ammonia is both hazardous and toxic. Since ammonia represents one of the most common hazardous chemicals within the refrigerated warehouse, is therefore the primary focal point of most PSM plans.

The Clean Air Act (CAA) of 1990 empowered the Occupational Safety and Health Administration (OSHA) to enforce PSM rules, which took effect in May of 1992. Under this mandate, the OSHA was responsible for creating a chemical safety program or programs relating to specific chemicals, and to identify other chemicals that may create chemical hazards to employees working within commercial facilities. Owners and/or employers at commercial facilities are required 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.

A key element of any PSM plan 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. 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 Material Safety Data Sheets (MSDS) 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. 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).

Process chemistry was originally aimed more for a petrochemical 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.

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 operability 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 im-

mediately 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 employee with experience and knowledge specific to ammonia refrigeration (this individual represents the operations aspect of systems), one individual or employee with experience in refrigeration system design/construction, and one 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 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" (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 have 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. 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 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.

6.2 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 a RMP to the EPA does not constitute an active plan. For a 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 refrigerated warehouses will qualify for this RMP classification, due to the nature of the chemicals used in the refrigeration process.

Eligibility for RMP programs 2 and 3 is more complex, and is based on Standard Industrial Classification (SIC) codes, recently 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 49312. SIC code 4222 does not fall under the SIC code 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.

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 EPA does not allow facilities with a SIC code of 4222 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 programs.

RMP Program 3:

Facilities participating in Program 3 must submit a RMP 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 RMP. 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 RMP.

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 local emergency response organizations.

Emergency response requirements under the EPA'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.

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)

Chapter 7: Warehouse Sanitation

7.1 Master Cleaning Schedule

A master cleaning schedule (MCS) is 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. 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. In smaller warehouses, or those with only a few cleaning tasks, a more simple 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.

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, 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 should be promptly removed from equipment surfaces.
- 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 weekly, monthly or periodic need. Examples of typical duties include, but are not limited to:

Weekly:

- Sweeping of docks, including receiving, shipping and dry docks
- Cleaning salvage areas
- Removing waste food
- Removing damaged stock from storage
- Cleaning waste barrels and trash receptacles
- Cleaning restrooms
- 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

7.2 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 health, 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:

www.fda.gov/opacom/morechoices/fdaforms/FDA-2679.pdf

A sample Warehouse Sanitation checklist is provided in Chapter 8 of this manual.

7.3 Material Safety Data Sheets (MSDS)

A Material Safety Data Sheet, (MSDS) 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.

Material Safety Data Sheets are intended to assist workers with the proper procedures for handling and using the labeled substance, and also include first air, spill-control procedures, necessary protective equipment and proper storage procedures. The primary target audience for MSDS information are workers who are occupationally exposed to hazards at work; employers who need to know proper methods for storage of hazardous chemicals, and emergency responders, such as firefighters, hazardous material crews, emergency technicians and emergency room personnel who might find themselves treating persons exposed to hazardous chemicals. MSDS's are not meant for consumers, but rather for those who work with harardous materials in an occupational fashion.

In the U.S., 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.

Information contained in an MSDS is extensive, and 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
- **Protective Equipment**
  - Ventilation
  - Respirator
  - Clothing
  - Gloves
  - Eye protection

8.1 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			
	Thermostat setting			
	HACCP information, if appropriate			
Assign lot number		Warehouse Staff		
Print lot labels (if appropriate)				

Action Item		Responsible Party	Completed By	Date & Time
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		

8.2 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):			
	Weight:			
	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 and 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:			

8.3 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 CONTAINOR INSPECTION CHECKLIST			
Area	**Item**	**Satisfactory Condition**	
		Yes	**No**
Refrigeration Unit	Refrigerator thermostat properly set		
	Refrigerator unit temperature setting		Degrees
	Refrigerator unit operational		
	Vents closed		
Cleanliness	Overall trailer condition		
	Floors free of rubbish, product residue, or insects		
	Walls free of prouct residue and tape		
	Drains open and unobstructed		
	Absense of odor(s)		
Condition	Ceiling undamaged		
	Air delivery chute intact and functional		
	Door seals intact and in good repair		
	Door undamaged		
	Walls and wall insulation undamaged		
	Floors in good repair		
Final Result	Satisfactory for loading?		
Comments			

8.4 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 number 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 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		
Ensure proper trailer position at dock verify that safety procedures have been followed	Warehouse Staff		
Verify that floor drains are closed	Warehouse Staff		
Verify that trailer refrigeration unit is running and that the trailer is pre-cooled	Warehouse Staff		

Action Item		Responsible Party	Completed By	Date & Time
Collect Appropriate Loading Data	Load pick up or PO number	Warehouse Staff		
	Arrival time at dock			
	Start time of loading			
	End time of loading			
	Thermostat setting			
	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 the 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 driver sign the delivery ticket		Warehouse Staff		
Close 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		

8.5 Security Self Audit

Instructions: After answering this 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 security checkpoints (security shack)?		
	Is the communications are 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 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 last 12 months, including employee theft, on-site violence, or threats?		
Employee Safety, and 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, and 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			

8.6 Risk Assessent Template

Use the table below to list, classify and categorize potential risks within and around our 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 Occuring				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
Security	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				

8.7 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
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
10																														
Monthly Duties																														
1																														
2																														
3																														
4																														
5																														
Periodic Duties																														
1																														
2																														
3																														
4																														
5																														
Instruction: Initial the Appropriate Box When the Duty is Completed																														

8.8 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
1																															
2																															
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20																															

Instruction: Initial the Appropriate Box When the Duty is Completed

8.9 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					
	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					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To	Date Completed
		Yes	No			
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 inspection, integrity)					
	Cooling units are equipped with catch pans, with no evidence of leaks					
	Products elevated off 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 front or ice build up on overhead surfaces					
	Doors remain closed when not in use					
	Door seals in good condition without excessive air infiltration					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To	Date Completed
		Yes	No			
Freezers	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 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 floors and away from walls					
Dry Storage	Doors remain closed when not in use					
	Evidence of product damage, spills or leaks					
	Lights 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					
	Interior traps, if present, properly maintained (placement, frequency of inspection, integrity)					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To	Date Completed
		Yes	No			
Dry Storage	Inspect pheromone-monitoring devices, if present, for activity					
	Products elevated off floors and away from walls					
	Floors, walls, and ceiling conducive to cleaning					
	Rodenticides properly labeled and stored					
	Insecticides properly labeled and stored					
	Proper room temperatures maintained					
	Evidence of product damage, spills or leaks					
	Toxic chemicals and potential adulterants properly labeled and stored					
Recoup Areas	Lights 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					
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 protected against breakage in open product areas					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To	Date Completed
		Yes	No			
Dry Dock	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, if present, 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					
	Dock bumpers provide a tight seal during unloading and/or loading					
	Lights 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	Item	Satisfactory Condition		Corrective Action	Assigned To	Date Completed
		Yes	No			
Shipping Dock	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					
	Delivery vehicles clean and in good repair					
Welfare Facilities	Restroom doors self-closing					
	Restroom doors not propped open					
	"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					
	Evidence of non-compliance with company defined Good Manufacturing Practices (GMP), including food or drink consumption or tobacco use in the area					
	"Wash Hands" signage properly placed in break room					

Area	Item	Satisfactory Condition		Corrective Action	Assigned To	Date Completed
		Yes	No			
External Grounds	18-Inch "Vegetable 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					
	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					

Chapter 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 resorted 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.*

GCCA: *See Global Cold Chain Alliance.*

GCCF: *See Global Cold Chain Foundation.*

General merchandise warehouse: The most common type of warehouse. These warehouses store almost every kind of merchandise and are used by manufacturers, distribu-tors, and their customers. They can be public warehouses or private warehouses.

GHP: See *Good housekeeping practices.*

Global Cold Chain Alliance (GCCA): The Global Cold Chain Alliance (GCCA)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. GCCA'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 technol-ogy, 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 com-mon interest in the safe and efficient flow of food products around the world. All active members of GCCA are also members and beneficiaries of the work of The Global Cold Chain Foundation

Global Cold Chain Foundation (GCCF): 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 Foun-dation (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 Global Cold Chain Foundation (GCCF) formerly known

as WFLO. The GCCF 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 GCCF headquarters in Alexandria, Virginia, is supported by a Scientific Advisory Council comprised of leading food scientists.

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 de-tection 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 pur-pose 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.

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 in-terpretation 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 team 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 ad-ministration.

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 up-dating records to reflect the true nature of the inventory.

Inventory tax: A tax imposed by some state and local gov-ernments on the value of inventory on han

Inventory zoning: A technique for taking physical inven-tory by establishing zones for the purpose of a physical in-ventory 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 transport-ing a shipment.

Just in time (JIT): The practice of timing inbound material flows so that they arrive just before they are required, result-ing 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 contain-ing 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 ex-treme 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, where-by 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 applica-tion 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 ma-terials, parts, supplies, and finished goods. Originally con-fined to traffic and warehousing, logistics has evolved to in-clude 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 con-

taining 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.

Op**tical 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: See *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 con-

signee 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 offloaded 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 in-

ventory 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 pro-vides information concerning the current levels and condition of inventory within a warehouse. It can also be used to pro-vide 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 respon-sibility for the care of goods placed in a warehouse for stor-age. 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 educa-tion 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 Coun-cil.*

Wet pack: Fresh product that has been washed and re-sidual water allowed to remain (used with asparagus).

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.*

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 hin-ders unauthorized entry by making it more difficult to pry a dock door from the wall.

Zone picking: Process of picking goods in which work-ers 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.

3/4 Inch Binder Spine

Customer Instructions

Please keep all text and graphics in the area between side panels

(Crop Marks)

When printing to Mimeo only select your completed spine slide.

GUIDE TO EFFECTIVE WAREHOUSE OPERATIONS

Production Instructions:

Print on Card Stock;
Trim to 0.75 inch