Cold Chain Management Principles

Temperature Sensitive Medical Products (TSMPs)

Good Distribution Practices (GDP)

Distribution Operations Center
United States Army Medical Materiel Agency

“Medically Ready Force...Ready Medical Force”
Overview

- Historical Events
- USAMMA DOC Functions
- Core Products Overview
- Why Are We Here
- Cold Chain Management (CCM) Process and Procedures
- Safe Guarding Temperature Sensitive Medical Products (TSMPs)
- CCM Equipment
- Cold Chain References/Guides

“Medically Ready Force...Ready Medical Force”
Historical Events

1997 – Secretary of Defense approved Department of Defense (DoD) Anthrax Vaccine Immunization Program (AVIP)
**Army designated Executive Agent (EA)**

1998 – Loss of 200,000 doses of Anthrax Vaccine (AVA).

1998 – USAMMA tasked to perform DoD distribution of AVA
**Created Distribution Operations Center (DOC) to manage DOD AVA Distribution**
**Cold Chain Management Principles/Procedures (CCM) were developed**

1999 – DHA Immunization Healthcare Branch (formerly known as Military Vaccine Agency – Vaccine Healthcare Centers Network (MILVAX-VHCN) replaced MEDCOM as AVIP policy developer/clinical guidance
The Distribution Operations Center (DOC) manages critical vaccines and pharmaceutical products which may or may not require Cold Chain Distribution, to include: the packaging, storage and special handling requirements of the medical material requiring refrigeration; the management of the shipment; and the oversight of the product from initial requesting agency to end user, in support of DOD personnel and operations.

DOC is also responsible for DOD Medical Materiel Quality Control (MMQC) messages and Army Medical Materiel Information (MMI) messages.
Core Products Overview

- Anthrax Vaccine
- Smallpox Vaccine (ACAM2000)
- Influenza Vaccine
- Adenovirus Vaccine (Type 4 & Type 7)
- Vaccinia Immune Globulin intravenous (VIGIV)
- Investigation New Drug (IND) products
- Foreign Military Sales (FMS)
- Other Temperature Sensitive Medical Products (TSMP’s)-(He-Bat, Rabies etc.)
- Other Non-Temperature Sensitive Critical products
Why are we here?

• The great loss of 1998 – Over 200,000 doses of Anthrax Vaccine was compromised due to freezing

• Sites contribute to thousands of dollars each year in vaccine losses due to the following Major Factors:

  ➢ Mechanical Failures - such as alarm system and power outages/supply malfunctions
  ➢ Human Process Failures - such as poor cold chain management techniques
  ➢ Failure to follow policies - procedures and local regulations
  ➢ Training
Vaccines are sensitive biological substances that can lose their potency and effectiveness if exposed to heat, extreme cold and/or light

- **Minimize waste/save thousands of tax payers dollars**
  - Prevent vaccine from being compromised
  - Assures vaccine maximum shelf life and suitability for use by minimizing the rate of deterioration
  - Some vaccines are in critically short supply

- The loss of vaccine potency **CANNOT** be reversed

- Assures leadership, service members and DoD beneficiaries that vaccine/products are safe to use and at full potency when administered
US Pharmacopeia (USP) Temperature Standards

- **Refrigerated Storage** - Thermostatically controlled from 2°C to 8°C; approximately 35°F to 46°F

- **Frozen Storage** - Thermostatically controlled from -25°C to -10°C; approximately -13°F to 14°F

- **Room Temperature** - Thermostatically controlled from 20°C to 25°C; approximately 68°F to 77°F
What is Cold Chain Management

Cold chain begins with the cold storage unit at the vaccine manufacturing plant

Extends through the transfer of vaccine to the distributor

The Chain is most Compromised at the point of ‘Provider to Patient’
TSMP Coordinator

Responsible for:

Developing a Routine Vaccine Storage and Handling plan, kept in a visible location near all vaccine storage units.

- Current contact information for the primary and back-up vaccine coordinators
- Pharmacy, logistics, local Immunization Healthcare Specialist (formerly known as Regional Analysts), USAMMA
- Vaccine manufacturers, the medical equipment repair office
- Storage unit alarm company
- Written emergency plan – natural disasters, power outages etc.
- Temporary placement of vaccine in a working refrigerator
Storage Unit Selection and Characteristics

- Medical grade stand-alone refrigerators and freezers (over-the-counter type) are the most highly recommended.

- Combination refrigerator and frost-free freezer for home use is acceptable but only the Refrigerated section is recommended due to the freezer going through defrosting cycle.

- **NOT AUTHORIZED** (SB 8 75 11) – Dormitory style refrigerators, due to National Institute of Standards and Technology (NIST) vaccine study, showed the units displayed severe temperature control and stability issues.
Medical Grade Refrigerators/Freezers

• Medical grade refrigerators/freezers ensure temperature consistency

• Provides ease of serviceability, integrate with wireless temperature monitoring systems

• Able to bring temperatures down much more quickly than non-medical grade units

• Greater efficiency of compressors in medical grade refrigerators
Features / Checklist

- Consider serviceability
- Storage volume
- Ability to maintain consistent temperature
- Front-mounted compressor will allow for easier service

Construction Material:
- Stainless steel refrigerators are highly durable
  - Non-medical grade refrigerators - plastic and other less sophisticated components
  - Cheap or flimsy hinges and seals will result in temperature leaks and an overburdened compressor
- Glass front doors, which allow you to visually inspect product without opening the door; fewer openings will positively impact the life of the unit.

When determining the cubic volume you require
- Consider your current as well as future storage needs
Accurate thermometer readings are essential to determine whether vaccines are maintained at the required temperature.

- Storage units **should** have a National Institute of Standards and Technology (NIST) certified and calibrated thermometer – in each compartment (refrigerator/freezer)

- Continuous graphic recorder thermometer, monitors ranges and durations is recommended

- Uncertified liquid (mercury or alcohol) thermometers and dial-type are not authorized

- Thermometers should be placed in the center of the compartment away from coils, walls, floor, and fan
Thermometers

Based on studies of thermometers conducted by NIST in 2012, the CDC recommends using a digital thermometer with a detachable probe that is kept in a glycol-filled bottle. NIST studies found that these probes in glycol-filled bottles can determine the actual temperature of the vaccine vial temperature when it is placed in the same area where the vaccine is stored.

- At least one reading/15 min
- Memory storage: *39 days recording
- Battery life: 6 months minimum
Monitoring & Recording Temperatures

• Manually confirm the temperature of ALL vaccine storage units a minimum of TWO times a day – once at the beginning of the workday and once at the end of the workday

• Applies regardless of whether or not there is a 24-hour/7-day temperature alarm system, chart recorder thermometer, or a digital data logger

  THERE IS NO SUBSTITUTE FOR MANUALLY CHECKING/ DOCUMENTING THE TEMPERATURE TWICE A DAY

• Document the date, time, and temperature on a vaccine log

• Pay special attention to any trend in deviation of temperature as this could indicate a possible future mechanical malfunction or power outage of the storage unit
# Temperature Monitoring

**Temperature Log for Refrigerator and Freezer — Celsius**

Completing this temperature log: Check the temperatures in both the freezer and the refrigerator compartments of your vaccine storage units at least twice each working day. Place an “X” in the box that corresponds with the temperature and record the ambient (room) temperature, the time of the temperature readings, and your initials. Once the month has ended, save each month’s completed form for 3 years, unless state or local jurisdictions require a longer time period.

If recorded temperature is in the shaded zone take immediate corrective action:

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**Refrigerator temperature**

- Aim for 5°

**Freezer temp**

- Aim for 0°

This represents an unacceptable temperature range. Follow these steps:
1. Move vaccine(s) to a working storage unit.
2. Label the vaccine(s) as “do not use”, do NOT destroy/discard the vaccine(s).
3. Activate your facilities vaccine Emergency Retrieval and Storage Plan.
4. Contact PUSAMMA/DOC and your Immunization Healthcare Specialist (IHS) and standby for further instructions on the disposition of the vaccine.
5. Document the action taken on the reverse side of this log.

*USAMMA/DOC Emergency Contact: Phone: (301) 619-3017/4318, DSN (343), After hours: (301) 676-0808/1184, email: usarmy.detrack.medcom-usamma.mbx.doc@mail.mil*

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**FV VACC VNC (15 Sep 14) (677) GET-VACC www.vaccine.gov**

“Medically Ready Force…Ready Medical Force”
Protecting the Power Supply

- Avoid using power outlets with built-in circuit switches, power switches, or outlets that can be activated by a wall switch
- Use a safety-lock plug or an outlet cover to reduce the chance of a storage unit becoming inadvertently unplugged
- Post a warning sign at the plug and on the refrigerator and freezer unit as well as label fuses and circuit breakers to alert people not to turn off the power to the storage unit

Labels/SOPs should include who to call and the steps to take if the power is interrupted and checked periodically by the TSMP coordinator
Safeguarding Alarming Devices

• Alarms should be monitored electronically and physically 24 hours a day, seven days a week – **NO EXCEPTIONS**

• At the time of a power failure the system should
  
  ➢ **IMMEDIATELY** notify an accountable person
  
  ➢ The system should be able to provide continuous temperature monitoring in order to verify that the integrity of the vaccine stayed within the proper temperature during storage.

• **Monthly** testing of the entire system insures POCs and phone numbers are accurate
  
  ➢ records should be kept for three years

• Backup generators should be capable to run for 72 hours
TSMP Inventory Management

• Identify and be accurate when ordering a supply of vaccines

• Disposal of expired vaccine leads to costly waste of taxpayers' money

• Vaccines are expensive and the cost is continuously rising

• **DO NOT OVERSTOCK** vaccine, if a compromise occurs there is a risk of losing a large amount of vaccine

• Monitor vaccine usage and rotate stock
Receiving TSMP Shipments

- Upon delivery – open the package as soon as possible
  - Verify that the amount received matches the packing slip
  - Check the expiration dates on the vaccines (using the shortest-dated vaccine first)
  - Refrigerate vaccines in their original box – removing exposes the vaccine to room temperature and light
  - Immediately place vaccine in the proper storage container within the refrigerator/freezer

**Anthrax Vaccine/Smallpox Vaccine/Adenovirus Vaccine**

Once the box is delivered, call USAMMA DOC immediately, a case manager will instruct you to read the TempTale, place it in the appropriate return envelope, pending the digital reading from the TempTale will determine if the vaccine is ‘verbally released’ or suspended
Safe Guarding TSMPs

• Store vaccines on the middle shelves **NEVER** store vaccines on the doors or vegetable bins

• Proper air circulation is imperative – leave adequate space between packages to maintain proper air flow

• Proper storage of vials within the storage unit
  - eliminates the wrong type of vaccine being administered
  - monthly inventory more accurate
  - expiration and tracking of the vaccine easier

• Store each vaccine in its own labeled section

• Bins and/or baskets with slotted sides should also be labeled

• Verify the type of vaccine and expiration date before administering
TSMP Transport Procedures

Protecting Vaccines at Off-Site Immunizations Sessions

• Pack only the expected amount that will be used during the immunization session

• Minimize the number of times the container is opened

• Transport vaccine in an approved/validated insulated container **ONLY**.
  - No brown paper bags
  - No uncertified Styrofoam coolers

• Vaccines taken to an off-site clinic
  - fill out an issue receipt/number/type of vials taken
  - vaccine must be maintained at proper temperature

• Returning vaccine
  - document the number/type of vials returned
  - verify the vaccine was maintained at proper temperature
Equipment Used to Support Cold Chain Distribution

“Medically Ready Force... Ready Medical Force”
The TempTale multiple use temperature monitor system provides complete time and temperature history on all of our temperature sensitive product shipments. Data collected is used to validate that the products have preserved their integrity during distribution from the manufacturer to the end user. The TempTale temperature monitor is manufactured by Sensitech, Inc. This device can be set to read every ten (10) minutes for approximately two (2) weeks and record 2,000 data points.
CCM Equipment Insulated Shipping Container

• The Insulated shipping container (endurotherm box) is used to ensure the cold chain distribution process is not broken during transporting TSMP's.

• There are four different sizes: small, medium, large and extra large. The boxes have gone through various testing protocols and they can maintain the required temperature guarantee for 3 days and depending upon environment up to 7 days.

“Medically Ready Force...Ready Medical Force”
VaxiPac (PX1L) Shipping Container

PERFORMANCE OF ACUTEMP PXC (+7°C)

• AcuTemp PXC (+7°C) is a safe replacement for ice to keep vaccines and other temperature sensitive goods cold in the AcuTemp PX1L without accidental freezing.
• Used according to the instructions, the AcuTemp PX1L system will maintain vaccines/products between 2-8°C (35 – 46°F) for more than 20 hours at an ambient temperature of 24°C (75°F).

• As the ambient temperature increases, the hold time will decrease:
  a. 15 hours @ 30°C (86°F)
  b. 12 hours @ 37°C (99°F)
  c. 9 hours @ 48°C (118°F)

PXC (+7°C) must be chilled at 3°C (±1°C) for 24 hours.

A maximum of 24 vials can be placed in the VaxiPac (a full layer consists of 12 vials).

When placing PXC in the PX1L, be sure to keep the pull-tab “UP” so that the pack can be removed easily.
AcuTemp PX6L Courier

- Handheld container for small-scale transportation of TSMPs
- Holds approximately 88 vials
- Used according to the instructions, the AcuTemp PX6L will maintain vaccines/products between 2-8°C (35 – 46°F) for up to 48 hours at an ambient temperature of 24°C (75°F).

**Comes with a carrying strap and handle for ease of transportation**
The AcuTemp AX27L mobile refrigerator/freezer addresses the need for a small, non-chlorofluorocarbon refrigeration unit that offers energy efficiency, precision temperature control and easy portability. With a 27 liter payload capacity and two temperature set-points (+4°C or -22°C) to accommodate payloads requiring refrigeration or freezing, this mobile thermal management unit is designed to safely transport and store temperature-sensitive vaccines, drugs, specimens and other bio-medical materials.

Power Sources
- Grid power (standard): 115 VAC or 230 VAC, 50-60 Hz
- Battery (standard): Two 21 amp. hr. gel cell batteries
- Car lighter outlet (available): 12 VDC

This versatile cold chain solution is capable of operating for up to five days on battery power only, making it perfect for global distribution of small, temperature-sensitive loads.
Responding to TSMP Storage and Handling Problems

Potentially Compromised Vaccine Procedures

• Ensure that the vaccines are placed in a working refrigerator and/or freezer
• Label the vaccines with the words “DO NOT USE”
• **DO NOT** destroy the vaccines
• Complete a Potentially Compromised Vaccine Response Worksheet
• Contact USAMMA DOC as well as your Immunization Healthcare Specialist (formerly known as MILVAX Regional Analyst (RA) and stand-by for further instructions
• Prepare an Executive Summary (EXSUM) if Command requires
• A refrigerator and/or freezer should have a stabilized temperature and power supply for at least 24hrs before vaccines are placed back in the unit
Emergency TSMP Retrieval and Storage Plan Worksheet

- Vaccine Coordinators – Telephone (Home and Cell)

- Emergency Staff Contact List – Telephone (Home and Cell)

- Refrigerator repair technician, Dry Ice Vendor, Electric Power Company, Temperature Alarm/Generator Repair Company(s)

- Alternate Vaccine Storage Facility(s)
  - Location, Contact Person, Address, Telephone Number

- Emergency Resources Contact List
  - USAMMA/DOC – 24 hour Emergency Line (301)676-0808/1184
  - Defense Logistics Agency – (215)737-6658 - (215) 284-6586
  - Immunization Healthcare Specialist
    (formally known as MILVAX Regional Analyst (RA)
**Steps to take for Potentially Compromised Vaccine Event**

- **Vaccine compromise identified:** outside temp range 2-8°C refrigerator or above -15°C freezer
- **Is refrigerator/freezer unplugged, door ajar or power out?**
  - Yes (Green arrow)
  - No (Red arrow)
- **Temp within range?**
- **Keep vaccines in storage unit**
- **Label vaccine as "DO NOT USE"**
- **Notify leadership and Medical Equipment Repair Office**
- **Contact Immunization Healthcare Specialist (IHS) for assistance in completing the Potentially Compromised Vaccine/TSMP worksheet**
- **Prepare Potentially Compromised Vaccine/TSMP Worksheets:** include vaccine inventory, temp log data and circumstances surrounding loss
- **Submit completed worksheet and supporting documentation to USAMMA and IHS**
- **Stand-by and await disposition from USAMMA; do not use or discard vaccine.**
- **Vaccine released for use; place back in inventory**
- **Report loss to leadership per command/local policy (i.e. EXSUM, etc.).**

**Potentially Compromised TSMP Worksheet**

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<tr>
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<td>Required temperature and storage unit information:</td>
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  1a. Temperature recorded in F or C? |
  1b. Air temperature of room where vaccine(s)/other TSMP are located |
  2a. Were vaccine(s)/other TSMP left out of refrigerator or freezer? |
  2b. If YES, for how long? |
  3a. Were vaccine(s)/other TSMP stored in appropriate storage unit (refrigerator vs. freezer)? |
  3b. Located in transport container? |
  4. If vaccine(s)/other TSMP were located in refrigerator and/or freezer during this event, complete 4a. - 4d. below: |
    a. Refrigerator temp. current: |
    b. Freezer temp. current: |
      a. When was the last manual temp check taken? (within normal range documented prior to event) |
      b. Time: |
      c. Estimated time vaccine(s)/other TSMP were outside normal temp range: |
      d. Were water bottles in the refrigerator? |
        a. Yes |
        b. No |
        c. Were ice packs in the freezer? |
          a. Yes |
          b. No |
  5. Prior to this event, were the vaccine(s)/other TSMP exposed to temps outside the recommended range? |
  6. Explain |

**Please select all event types that apply:**
- Non-preventable loss: |
- Personnel Error: |
- Process Failure: |

**USAMMA Use Only:**

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• DoD activities are responsible for disposal of compromised or expired vaccines

• Destruction memorandums pertaining to Anthrax, Smallpox, Adenovirus, VIGIV and Army Influenza vaccines should be routed up the chain of command for review and endorsement before scanning and emailing to usarmy.detrick.medcom-usamma.mbx.doc@mail.mil or faxing to (301) 619-4468.

Methods of Destruction:

• Vaccine vials can be destroyed using the local hospital/clinics disposal procedures for all biohazard/hazard materials
• Can be disposed using return programs when applicable
• Disposition instructions available:
TSMP Issues, Responses and Prevention Strategies
Three categories of issues may lead to compromised vaccines:

- **Non-Preventable Loss**
  - Equipment/Alarm system failure
  - Power outage during a natural disaster/storm

- **Negligence**
  - Refrigerated vaccines placed in freezer; frozen vaccines placed in refrigerator
  - Storage unit unplugged
  - Vaccines not returned to a storage unit
  - Alarm batteries not charged

- **Non-Compliance**
  - No validated packing/transport equipment available
  - No temperature log was posted on storage unit
  - Staff did not record temperatures on temperature log
  - Emergency plan was not current or not properly followed
**Example A**

Facts presented from an actual reported TSMP compromise with no identifying information of the facility or location.

<table>
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<tr>
<th>Issue</th>
<th>Response</th>
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<td>✔ Prevention strategy</td>
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Total dollar value vaccines

**“Medically Ready Force…Ready Medical Force”**
Example #1

Site A was redistributing refrigerated vaccine (2-8°C) set to expire within the next two months to a site that could utilize the vaccine within the timeframe. Vaccine was packed with a TempTale monitor in an Endurothem box with gel packs. Upon receipt of vaccine, monitor was alarmed and the reading showed the temperatures were out of range for the duration of the shipment.

Total value: $3,650

Non-Compliance

Temperature was above range from time it was packed until the time it was opened.

- Ensure gel packs are preconditioned for at least 24 hours (preferable 48 hours) before shipment.
- Pack box in compliance with protocol instructions according to temperature requirements or TSMP and ambient temperature at receiving site.

Remember!

USAMMA DOC can provide assistance and guidance for sites seeking to redistribute TSMP.
0700 – 1630 EST: 301-619-3017/3954/4318
After hours: 301-676-0808/1184
### Example # 2

Site received notification at 0636 via text message that refrigerator alarm was going off. At 0910, POC checked unit and noticed that the temperature had been out of range for about 3 hours. Upon further inquiry, site POC learned that the loss of power to the unit was the result of a scheduled outage and the storage unit location housing the vaccines was not connected to emergency back-up power. Refrigerator was resorted at 1245 and reached appropriate temperature range by 1310. Vaccines remained in the unit for the entire time that the power was off and temperature out of range, no attempt to relocate vaccines was made.

<table>
<thead>
<tr>
<th>Negligence</th>
<th>Delayed response time after alarm.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ Please attend to your vaccines as quickly as possible after notification that it may have gone out of range.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Negligence</th>
<th>No backup power during a scheduled power outage.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ Ensure the unit has a back-up power source and test monthly.</td>
</tr>
<tr>
<td></td>
<td>✓ Plan for a scheduled outage and move vaccines to a designated temporary storage facility.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Negligence</th>
<th>Remember to always move vaccine to condition storage unit.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ Please attend to your vaccines as quickly as possible and ensure cold chain is maintained during transport.</td>
</tr>
</tbody>
</table>

Total value: $25,699.58
### Example # 3

Off sites coordinator entered Pharmacy to pick up vaccine for Logistics and found frozen vaccines stored in the refrigerator. Upon inspecting further, coordinator found refrigerated vaccine stored in the freezer. Vaccines had been delivered that morning and had been out of range for approximately 3 hours. POC immediately moved vaccines to proper storage and contacted TSMP coordinator and local IHS.

**Total value: $3,769.15**

<table>
<thead>
<tr>
<th>Negligence</th>
<th>Vaccines placed in incorrect storage unit.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ Ensure personnel pay close attention to details concerning temperature storage requirements for vaccines.</td>
</tr>
<tr>
<td></td>
<td>✓ POC who discovered the compromised responded appropriately by immediately moving vaccine to the proper storage unit and following Potentially Compromised Vaccine steps.</td>
</tr>
<tr>
<td></td>
<td>✓ Emergency Storage &amp; Handling plan had clear instructions on who to contact and steps to take.</td>
</tr>
</tbody>
</table>

**Remember!** Communication between all personnel handling vaccines is key (i.e. warehouse, clinic, off-sites clinic personnel)

"**Medically Ready Force…Ready Medical Force**"
**Example # 4**

Warehouse received vaccine shipment and filled out inventory sheet. Refrigerated vaccine was placed inside of appropriate unit, but frozen vaccines were left on the counter.

<table>
<thead>
<tr>
<th>Negligence</th>
<th>Vaccines not stored in any storage unit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Ensure that all vaccine is placed into appropriate storage unit immediately upon receipt.</td>
<td></td>
</tr>
<tr>
<td>✓ Inspect package for damage, verify quantity and lot numbers, then store all TSMPs in corresponding unit.</td>
<td></td>
</tr>
</tbody>
</table>

Total value: $6,311.09
### Example # 5

Refrigerator alarmed at 1700 and alarm facility paged two on-duty personnel. One pager was on mute and the other was not acknowledged. After an hour of no acknowledgment, alarm facility monitor called the clinic to notify about the temperature being out of range. Technicians found the thermometers fluid bath had leaked resulting in the compressor to malfunction and freeze.

<table>
<thead>
<tr>
<th>Non-Preventable Loss</th>
<th>Compressor malfunction.</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Establish routine maintenance procedures for storage units.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Compliance</th>
<th>Appropriate POCs could not be reached by alarm facility.</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Alarm alerts should be set up to notify POCs through multiple devices (i.e work phone, after duty phone, email, mobile phone).</td>
<td></td>
</tr>
</tbody>
</table>

Total value: $157,170.98

“Medically Ready Force…Ready Medical Force”
USAMMA Website/Cold Chain Links

USAMMA:
www.usamma.amedd.army.mil

DOC Homepage:
http://www.usamma.amedd.army.mil/net/Pages/docHome.aspx

DOC Cold Chain Management:
http://www.usamma.amedd.army.mil/net/Pages/doc/coldChainManagement.aspx

DOC Potentially Compromised Vaccine:
http://www.usamma.amedd.army.mil/net/Pages/doc/potentiallyCompromisedVaccine.aspx
Cold Chain References/Guides


Centers for Disease Control and Prevention (CDC). Notice to Readers: Guidelines for Maintaining and Managing the Vaccine Cold Chain. Recommendations of the Advisory Committee on Immunization Practices. MMWR 2003; 52(42); 1023-1025.

Centers for Disease Control and Prevention, Vaccine Storage and Handling Toolkit. Available at http://www.cdc.gov/vaccines/recs/storage/toolkit/default.htm


Questions and Comments

“Medically Ready Force…Ready Medical Force”