



DPSC HANDBOOK 4155.2

SUBSISTENCE

INSPECTION OF MEAL, READY-TO-EAT (MRE)

RATIONS

**EVALUATION OF TEMPERATURE
STRESSED MRE'S**

CHANGE 1 APPENDIX A

JULY 1997

**DEFENSE PERSONNEL SUPPORT CENTER
2800 South 20th Street, Philadelphia, PA
19145-5099**



DEFENSE LOGISTICS AGENCY
DEFENSE PERSONNEL SUPPORT CENTER
2800 SOUTH 20TH STREET
PHILADELPHIA, PENNSYLVANIA 19145-5099

Change 1
Appendix A
DPSCH 4155.2

HSQ

Change 1
Appendix A
DPSCH 4155.2

July 15, 1997

EVALUATION OF TEMPERTURE STRESSED
MEAL, READY-TO-EAT (MRE) RATIONS

A. REFERENCES:

1. Richardson, Thomas and Finley, John W. Et.al. Chemical Changes During Food Processing. Van Nostrand Reinhold Company. New York, NY. 1985.
2. Ross, Edward W. and Shaw, Carol P. Color Measurement As Predictor of Consumer Ratings of Military Ration Items. Natick Research, Development and Engineering Center. Publishment pending. 1995.
3. Porter, William; Wright, Bruce; and Shaw, Carol. Occurrence and Effects of High Temperature Stress in Rations Stored in Container Vans: A Comparison With Storage Studies in the 1950's. Technical Report, NATICK/TR-93/027. 1993.
4. DPSCM 4155.2, Appendix A. Inspection of Meal, Ready-To-Eat (MRE) Rations. 1991.

B. PURPOSE: To provide guidance on evaluating MREs which have been stored at high temperatures for long periods of time. It is hoped that this document will serve to standardize ration evaluation within both the US Army Veterinary service and the consumers of these rations.

C. APPLICABILITY AND SCOPE: DPSC Manual 4155.2, Appendix A, offers guidance on the inspection of MREs. The emphasis of this guidance is on defects which would be present on initial receipt from the ration assemblers. Because MREs are an important part of our strategic war reserve stockpile, it is necessary to store rations for long periods of time prior to consumption. This is because MREs are a unique food item, not produced for a large commercial market. There is not an industrial base for producing a large quantity in a short time period, as would be necessary to meet a surge situation. Therefore, a stockpile is maintained which must be rotated and consumed regularly to preclude loss to the government. Most of the MRE stockpile is stored in cold storage which greatly lengthens shelf-life. However some of it must be kept on

**Change 1
Appendix A
DPSCM 4155.2**

ships, in forward areas, or in unit basic loads. It is for these rations that this document was developed, since guidelines in DPSCM 4155.2, Appendix A, are subjective and can result in differences between inspectors when assessment of quality is required. Research at US Army Soldier Systems Command (Natick), indicates that the appearance and quality of applesauce and cheese spread vary consistently over time with the application of heat. Photos showing color change along with descriptions of other sensory changes are provided. Included are evaluations of the different levels of heat stress by taste/sensory panels. Therefore, this document not only provides a means for determining the relative severity of the heat stress, it also furnishes benchmarks for the acceptability of heat stressed rations.

This inspector's guide is not meant as way of determining the wholesomeness of MREs. MREs which show an advanced degree of darkening may be fit to eat. There may be times when heat-stressed MREs is all that is available for consumption. In that case, the inspection activity must make judgments as to wholesomeness. The purpose of this document is to establish a minimum acceptable quality level, that MRE consumers can normally expect.

D. Definitions:

Emulsion - System consisting of two non-miscible liquids, one being globules in the other. A small amount of a third substance may render the dispersion stable. The liquid broken up into globules is the dispersed (discontinuous phase); the surrounding liquid is the external (continuous) phase.

Maillard Reaction - A group of organic reactions, especially between amino acids and reducing sugars, producing brown color and flavor changes in many food materials. Also known as non-enzymatic browning.

MRE - Meals, Ready-to-Eat; the basic military operational ration. Each case contains 12 menu bags. Each menu bag contains several pouches, whose contents together comprise one meal.

E. PROCEDURE: Natick stored MRE components (applesauce and cheese spread) at temperatures of 40, 80, 100, 120, & 140°F. Photographs, which are enclosed, were taken at intervals of

3, 6, 12, 24, and 36 months. These photos show darkening of the product color progressing consistently with temperature and time. In both of these products, the darkening is probably due to non-enzymatic Maillard browning. Browning is only one of the degradative changes occurring in MREs. Many components lose texture, and develop off-flavors. However, there is considerable variation among the other MRE components as to what degree of deterioration is exhibited at different temperatures. This is why this document uses applesauce and cheese spread as the key. Other manifestations (besides darkening), of heat stress in ration components includes, but is not limited to, "webbing" in the coffee. (This is the leaching out of the caffeine in coffee causing the appearance of white web strands or specks.) Another example of heat stress is melting of the charm pops.

1. TASTE PANEL RESULTS: Researchers at US Army Soldier Systems Command (Natick) conducted sensory panels using trained food technologists and untrained subjects (consumers). Consumer panelists rated the product on a continuous scale ranging from "extremely like" to "extremely dislike" with "neither like nor dislike" as the midpoint. We will use the "neither like nor dislike" value as the minimum quality normally acceptable for MREs. For both applesauce and cheese spread, the minimum acceptable quality in applesauce would be represented by the photo of 6 months at 100°F*, or three months at 120°F. Using Inspection Table J in DPSC Handbook 4155.2, Appendix A, the applesauce photos of 1 year at 100°F or 6 months at 120°F would be considered a Major A (404) defect. For shades of lightness/darkness that fall between the acceptable and the Major A (404) defect threshold, a Major B (508) defect is assessed. The assessment of a Major B (508) defect due to comparison with the color photos may be changed to a Major A (404) or Minor (611) if the judgment of the inspector indicates that the odor, texture or flavor warrant a different defect assessment. For cheese spread, the photo of 120°F for 3 months represents an acceptable color*. Cheese spread photos depicting 120°F for 6 months would constitute a Major A (404) defect. For shades of lightness/darkness that fall between the acceptable and the Major A (404) defect threshold, a Major B (508) defect is assessed. The assessment of a Major B (508) defect due to comparison with the color photos may be changed to a Major A (404) or Minor (611) if the judgment of the inspector indicates that the odor, texture or flavor warrant a different defect assessment. A summary of defect criteria is shown below:

DEFECT TABLE

Applesauce

*6 months at 100°F/3 months at 120°F - Acceptable
12 months at 100°F - Major A Defect (404)

Cheese Spread

*3 months at 120°F - Acceptable
6 months at 120°F - Major A Defect (404)

** Although acceptable, DPSC or other accountable agency must be informed if the rations approximate these photos. This is because the rations probably have little remaining shelf life.*

2. This document has application to rations produced up to the present time. For MRE XVI (DOP 1995 and later) there has been a formulation change to the cheese spread. Because of this, there will have to be some adjusting of the cheese spread benchmark for MREs with a DOP of 1995 or later. U.S. Army Soldier Systems Command, Sustainability Directorate, has initiated keeping quality tests for the new cheese spread formulation. Keeping quality evaluation of the new cheese spread formulation is on-going. For updates on this study, please contact DPSC-HSQ or Sustainability Directorate, Natick Research and Development Center, U.S. Army Soldier Systems Command.

3. **TEMPERATURE RECORDS:** In the inspection of rations kept in storage over long periods of time, it is recommended that temperature records be reviewed prior to, and in conjunction with inspection. For product that is no longer "under warranty", inspection lots may be grand-lotted according to storage history (time in storage and temperature during that time). Rations of the same contractors' lots which have different storage history, or for which similarity in storage history cannot be determined (i.e. missing or incomplete temperature records) should not be grand-lotted.

4. **STORAGE TEMPERATURE VARIATION:** Within containers, rations on the top layers suffer more heat-stress than rations on the bottom or interior of the pallet. If containers are stacked, rations in the top container will probably be exposed to more heat. Shading containers or pallets from direct sunlight will significantly reduce the heat to which rations are subjected. Inspectors should be alert to these and other factors which affect heat stress.

5. THERMAL TIME INDICATORS (TTIs): US Army Soldier Systems Command has developed paper indicators which are applied to the exterior of ration cases. Information on these TTIs can be found in enclosure a. TTIs should be on all new cases of MREs beginning in 1997. Point of Contact for TTIs is Mr. Bruce Wright, US Army Soldier Systems Command, DSN: 256-4240.

6. CHEMICAL CHANGES: The color change in the applesauce and cheese spread is largely attributed to Maillard (or non-enzymatic) Browning. Maillard reactions are usually initiated by a reaction between carbonyl groups in sugars (usually glucose, fructose or lactose) and the ϵ -amino groups of the side-chains of lysines in proteins. Once the reaction is initiated, it results in a series of competing and cascading reactions. This progressing varies with the different foods, because each food represents a complex system. In applesauce, high temperature storage results in elevated levels of Hydroxy-methyl-furfural and glucose will initially drop, then increase as other sugars become involved in the reaction. Vitamin C (ascorbic acid) will drop during periods of heat stress. Research is currently underway to attempt to correlate Vitamin C levels in applesauce with time and temperature in storage. The fermented odor attributed to heat-stressed applesauce results from chemical changes, and not from yeast-induced fermentation. It is questionable whether any alcohol is actually formed during these reactions. The mottled appearance of heat-stressed cheese spread is due to a breakdown of the emulsion.

7. ENCLOSURES:

- a. Typical Stages in the Life of a Time Temperature Indicator (TTI)
- b. Photograph, applesauce, 3 months.
- c. Photograph, applesauce, 6 months.
- d. Photograph, applesauce, 12 months.
- e. Photograph, applesauce, 24 months.
- f. Photograph, applesauce, 36 months.

**Change 1
Appendix A
DPSCM 4155.2**

- g. Photograph, cheese spread, 3 months.
- h. Photograph, cheese spread, 6 months.
- i. Photograph, cheese spread, 12 months.
- j. Photograph, cheese spread, 24 months.
- k. Photograph, cheese spread, 36 months.

F. RESPONSIBILITY:

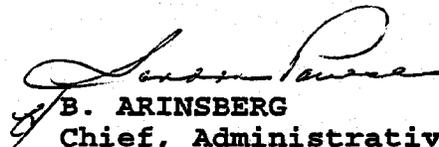
1. U.S. Army Soldier Systems Command, Sustainability Directorate, is responsible for Time-Temperature Storage tests and other research to determine servicable shelf-life of MREs.

2. Readiness CBU and Product Services, Directorate of Subsistence, DPSC, are charged with developing inspection procedures based on applicable research and quality assurance expertise, for the inspection of DPSC owned MREs. In addition, Readiness CBU is ultimately responsible for requesting inspection of DPSC owned MREs and determining disposition of MREs based on inspection results.

3. U.S. Army Veterinary Command is responsible for performing MRE inspections and providing reports of inspection.

G. EFFECTIVE DATE AND IMPLEMENTATION: This document is effective, but due to the cost of reproducing the photographic illustrations, distribution of this document will be limited. That is why it was not incorporated into the revised Appendix A. Military inspection units that must inspect heat stressed MREs should contact U.S. Army Veterinary Command or DPSC-HSQ.

BY ORDER OF THE COMMANDER



B. ARINSBERG
Chief, Administrative Support &
Base Supply Division
Office of Base Support Services

11 Enclosures