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OPTIMIZATION OF PREPOSITIONED WAR RESERVES: A SAVINGS THROUGH VALUE ENHANCEMENT PROJECT

by
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PREFACE

This is a report on the study of the mix of different Army rations such as the Meal, Ready-to-Eat (MRE), the Food Packet Long Range Patrol (LRP), and Ration Cold Weather (RCW) to optimize the types and mix of rations purchased for War Reserve stockage and to minimize the cost. The restraints studied included the number of rations needed to be prepositioned for future military scenarios, the need to maintain the MRE industrial base and the maximum amount of alternative rations to the MRE that could be fed. It was concluded that LRP, made up of inherently stable freeze dried and dehydrated components, be used as an alternative ration for a portion of MRE War Reserve stockage. Adjustments to the length of the rotation cycle were recommended in order to assure the availability of the highest quality rations at all times while minimizing total costs. The recommended rotational cycle would be to replace 26% of the MREs with the equivalent LRPs over a 3.18 year period. The RCWs would not be a replacement, as it is not cost effective to procure them in great quantities.

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Future Scenario of Operational Rations

The operational scenario outlined in planning documents for Joint Vision 21, Army After Next, Marine Corps and Navy Vision for the Future and the Logistical Vision for Force 21 each envision preeminent land power forces capable of land dominance across the full spectrum of conflict. This strategy requires a significant level of individual mounted and dismounted warfighters that must be sustained in field environs. As ration systems evolve into tailored rations to meet the sustainment/performance requirement of the advanced land warrior system, the need to stockpile extensive quantities of Meals, Ready-to-Eat (MREs) is diminished. Future battlefield doctrine projects that hostilities will last no more than 5 days and stabilization action will be predominate and group type ration systems will be in place to provide the hot meal sustainment.

Background

The Defense Logistics Agency (DLA) maintains a War Reserve (WR) stockage of MREs, B Rations, unique B Rations, and Heat and Serve Rations which are located both in Continental United States (CONUS) and in Europe. Additionally, the Military Services (MS) submit requirements through the Other War Reserve (OWR) program to support wartime planning beyond the Prepositioned War Reserve (PWR) period. While WR stockage assures the availability of critical rations during the initial deployment of troops, the costs associated with warehousing are substantial and the diversion of rations into storage for long periods negatively impacts the quality of rations. Furthermore, current improvements to the MRE that significantly enhance the quality of life for the warfighter are not immediately available in the field (e.g., while MRE 1999 Date of Pack (DOP) are being assembled, MRE 1996 DOP and 1997 DOP are being issued).

Objective

Optimization of WR, a Savings Through Value Enhancement (SAVE) Program, focuses on evaluating and optimizing the types and mix of rations. The SAVE program proposes that alternative rations to the MRE, comprised of inherently stable freeze dried components (i.e., Food Packet Long Range Patrol (LRP) and Ration Cold Weather (RCW)), be prepositioned and adjustments made to the length of the rotation cycle in order to assure the availability of the highest quality rations at all times while minimizing total costs.

Definitions

The War Material Requirement (WMR) is that quantity of food required to support the specified force for the duration of the two major regions of conflict (i.e., two Major Theaters of War (MTW)). The prepositioned war reserve is that portion of the WMR that is the individual MS requirements. The PWR program is that quantity of food required to support the specified

force from Day 1 of deployment to a specific date that CONUS sustainment would be available. The PWR protectable level is the funded quantity of inventory that is owned and managed by DLA for the MS. It is stocked aboard prepositioned ships, DLA depots, and commercial cold storage facilities to fill MS requirements in the initial stages of a contingency. The OWR is that quantity of food required to support the specified force from the end of the PWR period to the end of the War. Those stocks maintained for OWR are stored in CONUS depots and commercial cold storage.

Shortfalls exist in both the PWR and OWR between requirements and quantities stocked. Shortfalls in PWR will be met through Host Nation Support (HNS) if available, DLA peacetime stocks, and lastly drawing off OWR assets. The OWR shortfalls would be met similarly with HNS and peacetime stocks. Also counted is the military operational ration industry's ability to surge production to meet wartime demand. One additional limitation is the transportation to the MTW. Surface movement (sealift) is slow and may require up to another month's consumption of PWR while in transit to the theater.

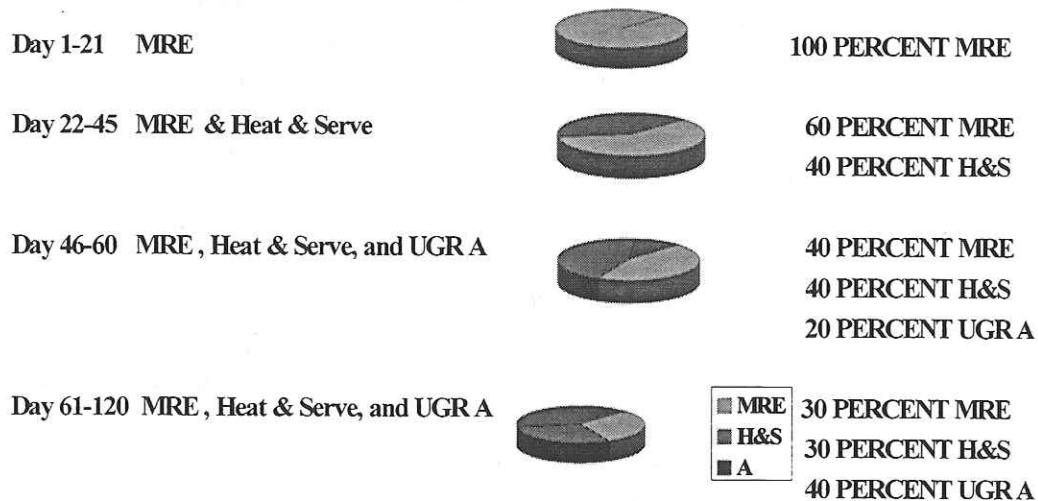
Wartime Feeding Plan

The current wartime feeding plan for future operational scenarios was provided by the Office of The Deputy Chief of Staff for Logistics (ODCSLOG) and is at Figure 1. It is used to determine WR levels and industrial surge requirements and is based upon combat activity and the anticipated arrival of troops and equipment. It provides the latest insight into necessary WR support required for one MTW and two near simultaneous MTW deployments in different geographic locations. The plan outlines the ration deployment mix of MREs and Unitized Group Rations and source (PWR and OWR) levels for four periods during deployment (Day Zero to Day 120). It is anticipated by ODCSLOG that 100 percent MRE PWRs from the prepositioned ships will be used to feed forward deployed troops during the first 21 days (Day 1 to Day 21) of hostilities. The goal of Industrial production planning is to work with the operational ration manufacturers to provide industrial surge capabilities that will meet the requirements once the PWR and OWR stocks have been exhausted. As peacetime consumption (source rotation of WR stocks) drops the WR stockage must be comparatively reduced to maintain the quality of the rations. This places greater reliance on Industry while reducing the annual buy of their products.



WARTIME FEEDING PLAN

- ✓ Wartime feeding plan is used to determine War Reserve levels and industrial surge requirements
- ✓ Plan is based on combat activity and arrival of troops and equipment



ODCSLOG LTC Karrhaff/DALO-TST/225-1202/Aug 96

SUPPORTING SOLDIERS

Figure 1. Wartime Feeding Plan

Ration Characteristics

The MRE is used by the MS to sustain individuals during operations that preclude organized food service facilities, but where resupply is established or planned. Each meal contains an entree/starch, crackers, a spread (cheese, peanut butter, or jelly), a dessert/snack, beverages, an accessory packet, a plastic spoon and a flameless ration heater. The flexibly packaged foods are heat processed in retortable pouches. The components are lightweight, compact and easily opened. Through MRE XV (1995), there are 12 meals per shipping container, one of each menu.

The number of menus was expanded to 16 for MRE XVI (1996), 20 for MRE XVII (1997) and 24 for MRE XVIII (1998). MREs must also meet nutritional requirements more stringent than those required for commercial products, and must be nutritionally acceptable for consumption up to 21 days as a sole diet. Military recommended dietary allowances are greater than allowances specified by the National Academy of Sciences for the population-at-large because the typical Individual Service Member (ISM) using MREs is more physically active than his or her civilian counterpart. Each meal provides an average of 1300 calories (13% protein, 36% fat, and 51% carbohydrate) and weighs less than 1.5 pounds. Other than adding water to the beverages (i.e., beverage base, coffee, instant tea) the MRE is ready to heat and eat. Approximately 23 ounces of water is required to rehydrate all beverages. Finally, MREs must be assembled and packed to survive rough handling and air delivery --- with and without parachutes.

The LRP is designed to be a lightweight, low volume, extended life operational ration used to sustain personnel during initial assault, special operations and long range reconnaissance missions. The LRP meets the Nutritional Standards for a restricted ration (Army Regulation 40-25) and is approved for use by the ISM at an issue of one packet per day for up to ten days. It is nutritionally compatible with the MRE allowing menu mixes under scenarios where additional calories are required. The eight menus, currently packaged two per shipping container, each contain a dehydrated entree, cereal bar, cookie and candy components, instant beverages, accessory packet and a plastic spoon. Each menu provides an average 1560 calories (15% protein, 35% fat, and 50% carbohydrate). The shelf life is expected to be 10 years at 80°F.

An LRP improvement program was completed in FY96 that resulted in the approval of a redesigned packaging system. The new packaging system includes brick entree packaging which allows the LRP to be assembled on the same lines as the MRE, utilizing the same size shipping container.

The RCW is designed to sustain an individual during operations occurring under frigid conditions. It was developed to satisfy a Marine Corps requirement, but is also used by Army units operating in cold climates. The six menus per shipping container each contain dehydrated, fully cooked entrees and other low moisture foods. It is lightweight and many of the components can be eaten either dry or rehydrated. Several drink mixes and soup are included in each menu to encourage water consumption. There are two meal bags per ration providing food for 24 hours. Each menu provides approximately 4500 calories (8% protein, 32% fat, and 60% carbohydrate)--sufficient calories to meet energy expenditure during heavy exertion in extreme cold. Limiting the sodium (5 grams per ration) and protein content reduces the risk of dehydration in arctic environments. The Joint Services Operational Rations Forum and the Office of The Surgeon General (OTSG) recently approved redesigning the RCW into the Meal, Cold Weather (MCW) which provides three meals per day, packaged individually, in lieu of the current RCW which

provides one days worth of food packaged and issued in two meal bags.

As a result of an MS request, the MCW and the LRP are being combined. The new design of the MCW/LRP, recently approved by OTSG, will be procured for the Army as well as the Marines since it is more cost effective and fits into the Army Field Feeding concept that provides two hot meals and one cold meal per day. The U.S. Army Soldier Systems Center designed twelve proposed new menus combining the MCW and LRP. Each menu weighs about one pound and will be packed in the current MRE shipping container (12 per case) for a total weight of approximately 17 pounds. The new ration provides optimal nutrition (nutrient profile approved is similar to the current LRP) with minimal weight for use by the Marines and Army in cold/temperate climates as an operational ration (three meal bags per ISM per day) and by Special Operational Forces as a restricted ration (one meal bag per ISM per day for up to ten days). By combining the two rations and utilizing the current MRE shipping container, the costs associated with production, packaging and procurement of the ration will decline substantially. The increase in the procurement quantities not only drives down costs but will eliminate contract actions as well. Once the newly designed MCW/LRP is procured it would replace the current LRP and RCW rations, thus would also become a viable ration alternative to the MRE for prepositioning on the Army War Reserve ships.

Shelf Life Impact on Costs

Military rations must be capable of prepositioning, storage, and use under all environmental conditions around the world. Thus, it is important to ensure only high quality food is provided to our warfighters. The quality of military rations is a function of both the length of time and temperature of storage; the higher the storage temperature and/or longer the storage time the shorter time the food product remains serviceable. The cost associated with WR stockage is directly related to ration shelf life. The shorter the shelf life, the more often the stock has to be rotated, and the higher the cost to maintain WR material stock. The greater amount of WR material stock maintained and rotated within shelf life the closer the MS come to meeting the Class I WR shortfall. Projected reductions in field training in future years will impact on the MS ability to rotate current WR material stock through peacetime training.

DLA Manual 4145.12, Joint Service Manual for Storage and Materials Handling, dated April 1994, (Table 5-4(a)), was referenced for the estimated optimum storage life at various sustained storage temperatures for the MRE and the LRP. The estimated optimum storage life for the RCW was calculated from more recently obtained Natick Research, Development and Engineering Center (NRDEC) three year storage data.

MREs have an estimated shelf life of 66 months at 70°F (or 30 months at 90°F). At these same storage temperatures, LRP's have an estimated shelf life of 120 months and 36 months, respectively. It is estimated the RCW has a shelf life of 60 months and 24 months at these storage temperatures.

Prepositioned Ship Operational Ration Stocks

The Army stores 517K boxes of MREs aboard prepositioned ships to support the force during the first 30 days of deployment. The majority of these stocks are aboard two container ships with the remainder (approximately 35K boxes) spread over five Large Medium Speed Roll-on Roll-

off (LMSR) ships. The container ships are scheduled for rotation with new MRE stocks every 24 months and the LMSR ships every 30 months. The rotation of these ships is usually done in Charleston, SC during 70°F to 90°F weather. The MRE containers coming off or going on the ships are exposed to this weather for two to three weeks during the off-loading/loading process. On the container ships the MRE containers are stored in the ship holds at temperatures between 70°F to 80°F. On the LMSRs, the MRE containers are moving from above deck refrigerated containers (frequently lost due to refrigeration malfunctions) to hold storage. Temperatures in the holds of these ships may climb to over 100°F in the summer. These ships may also be delayed in their rotation schedule for up to a year due to mission or funding. As MREs are rotated off these ships into Albany, DSCP strives to have them inspected and shipped to customers as quickly as possible.

The MREs aboard the prepositioned ships are the only anticipated subsistence for sustainment available during the first 21 days of a MTW. Surface resupply from CONUS is not predicted to arrive in the MTW until after D+30. Airlift must be used to move the Heat and Serve into theater for consumption by Day 22. The MRE is the only operational ration stored on prepositioned ships. There is no WR storage at all of the LRP and minimal storage of the RCW by the U.S. Marine Corps.

Army estimates for the rotation of one container ship to be \$1M every 24 months. The MRE shelf life determines the 24-month rotation. If the MRE life were not considered, the rotation would be 36 months. Cost and rotation time of the LMSR minus the effects of the MRE shelf life is unknown.

Ration Capabilities

The LRP is lighter and less bulky than the MRE, has a longer shelf life and is equal in durability, transportability and nuclear, biological, and chemical (NBC) resistance.

Table 1. Case Requirements of the MRE, LRP, and RCW for One Million Ration Equivalents

	<u>MRE:</u>	<u>LRP:</u>	<u>RCW:</u>
Weight/Meal (lb):	1.5	1.0	2.75
Weight/Case (lb) (gross):	22.7	20.0	34.65
Kcal/Ration:	3600	1560	4500
Rations/Case:	4	16	6
Cases/Pallet:	48	30	48
Rations/Pallet:	192	480	288
Weight/Pallet (lb) (gross):	1,150	633	1,663
Cases/1 million Rations:	5,208	2,083	3,472

DoD requirements represent virtually all MRE demand. In peacetime, MREs are purchased in sufficient quantities to feed military combat personnel during training and contingency

operations and to be stored as WR stocks in the U.S. and various parts of the world. The war reserve stocks are rotated periodically to meet peacetime feeding needs and to maintain adequate quality.

DoD Peacetime Procurement Requirements

MRE procurement levels are adjusted annually by DSCP based on present and projected peacetime and contingency consumption. In any given year the MREs actually consumed were purchased and produced several years earlier and rotated through war reserve inventory. To avoid quality degradation during storage of any product or shortages in the War Reserve inventory, the procurement quantity in a given year is calculated based on demand history, inventory levels and input from the MS regarding proposed training and available funding.

To date, the current inventory is 4.5M cases (equivalent to approximately a 60 day supply), which is down from 4.6M cases in 1995. In an effort to provide fresher MREs to the warfighter, Quartermaster Center & School recently proposed a two-year rotation of MREs to avoid usage of three to five year old rations.

Cost/Benefit Analysis

Goal: To minimize the Total Cost (TC). To determine the optimum mix of rations (i.e., MRE, LRP, and RCW) and length of the rotation cycle. To assure the availability of the highest quality of rations.

Storage costs vary between DLA depots and the commercial storage facilities. Costs also vary by region and environmental storage conditions. Average cost for DLA storage facilities is \$0.53 per case per day and commercial cold storage facilities are \$0.57 per case per day. Location and transportation cost are considered for access to sealift and CONUS peacetime consumer locations.

The number of prepositioned ships of all the MS and ship rotation cost is unknown. However, the saving could be significant. Army estimates the container ship rotation cost to be \$1M per rotation every 24 months. If MREs were replaced in part with a longer shelf life ration rotations would probably be adjusted to every 36 months. Ration quality and loss due to heat stress and refrigeration failure would be reduced.

Table 2. Cost Inputs

1. Purchase Cost (PC)(as of12/98):

	Cost/ <u>Case:</u>	Cost/ISM/ <u>Day:</u>	Cost/ISM/ <u>Year:</u>
MRE (4 rations/case):	\$73.03	\$18.26	\$6,664
LRP (16 rations/case):	\$125.13	\$7.82	\$2,855
RCW (6 rations/case):	\$85.72	\$14.29	\$5,215

2. **Storage Cost (SC):**

MRE:

Depot Storage:	\$0.53	\$0.133	\$48
Cold Storage:	\$0.57	\$0.143	\$52

LRP:

Depot Storage:	\$0.53	\$0.033	\$12
Cold Storage:	\$0.57	\$0.036	\$13

RCW:

Depot Storage:	\$0.53	\$0.088	\$32
Cold Storage:	\$0.57	\$0.095	\$35

3. **Disposal Cost (DC):** None.

4. **Total Cost (PC+SC+DC):**

MRE:

Cold Storage:	\$73.60	\$18.40	\$6,716
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LRP:

Depot Storage:	\$125.66	\$7.85	\$2,867
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RCW:

Depot Storage:	\$86.25	\$14.37	\$5,247
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Considerations

A. Due to the different number of meal bags per shipping container for each of the rations (i.e., MRE 12; LRP 16; RCW 12) and the number of meal bags needed per day to feed one ISM (i.e., MRE 3; LRP 1; RCW 2) the costs are very different.

B. Storage costs are almost negligible compared to the purchase costs. Whether depot (uncontrolled) or refrigerated storage is used has almost no impact.

C. Disposal costs were stated by DPSC to be zero.

D. The cost to serve all LRPs would be 57% less than to serve all MREs. The cost to serve all RCWs would be 22% less than to serve all MREs.

E. The cost per year of using 100% MREs is \$331.2 million; 100% LRPs is \$141.4 million; and 100% RCWs is \$258.8 million.

F. Considerable savings would be realized by the substitution of the LRP for part of the MRE or realized by increasing the time between prepositioned ship rotations. The LRP has a greater resistance to heat and a longer shelf life making it an ideal ration for the prepositioned ship program. The substitution of the LRP for part of the MRE aboard these ships could increase the time between rotations by one year, saving up to \$2M over ten years on one container ship.

G. The proposed substitution might be possible with little impact on the MRE industrial base by tailoring LRP WR program to rotate stock through peacetime training within the ten year shelf life.

H. MREs must meet nutritional requirements more stringent than that required for commercial products, and are approved by Office of The Surgeon General for consumption up to 21 days as the sole diet.

I. The LRP is considered by Army Regulation 40-25 to be a nutritionally restricted ration approved for use at an issue of one packet per ISM per day for not more than ten days.

J. A factor not considered might be the type and amount of storage available. This was not a calculated constraint.

K. Another factor to be considered would be acceptability. The LRP has proven field test and historically high acceptability.

Conclusions

The MRE is the only PWR stocked ration listed in the Theater Feeding Plan (TFP) that is employed to minimize transportation delays and to supply the deployed force until the MRE industry can ramp up production to meet wartime demand. The current ODCSLOG TFP requires a 60-day supply of MREs be prepositioned. We recommend that no more than a 44 day supply (i.e., 3.33 million cases MRE) of MREs should be prepositioned. (Note: When evaluating the types and mix of rations to be prepositioned, we were sensitive to the economic and readiness impact our proposed alternative would have on the future MRE industrial base.)

The LRP and RCW are both longer shelf life rations that do not require cold storage and are good alternatives to substitute part of the MRE. Thus, it might be recommended that both be prepositioned for the remaining required 16-day supply of PWRs. However, since the RCW is more expensive than the LRP, there would be no cost advantage to using the RCW as a substitute for part of the MRE. Thus, the RCW was not pursued further. Instead, recommending the use of the inherently stable freeze dried and dehydrated components of the LRP for the remaining prepositioned 16 day supply (i.e., 0.29 million cases LRP) would provide for cost effective utilization of products stored around the world in all environmental conditions. Prepositioning

LRPs assures their use as a critical stopgap ration during initial deployment of troops should the 44-day supply of prepositioned MREs prove inadequate. In addition, the alternative ration prevents the MRE from being diverted into storage for longer periods rather than into the field for immediate consumption. This ensures that ISMs are eating MREs of optimum quality during peacetime and MTW.

As the theater of operations develops, the competition for transportation assets means that deploying forces may initially be confronted with limited logistics support. Consequently, the only source of subsistence available to the ISM is what can be carried (i.e., a basic combat load). Prepositioning a war reserve materiel stock mix of MREs and LRP in the theater (in nearby ports, or afloat) reduces the subsistence demand on transportation assets. As the theater matures and stabilizes, LRP can supplement the feeding program in the rear areas. MREs will continue to provide the primary source of food for forward troops. Insufficient refrigeration, transportation, storage, and food service personnel hinder serving three hot meals every day, even in the rear areas. The flexibility of the MRE to be eaten anywhere, anytime, makes it useful to feed combat support personnel (e.g., truck drivers) who are away from their unit, while the LRP is available the first 10 of 21 days of wartime feeding to be consumed by combat support personnel who are more able to prepare its freeze-dried and rehydratable components or special forces who must minimize the weight they carry.

The number of MREs to be procured in 1998 is 2.2 million cases. Based on historical data it is projected approximately 3.0 million cases of MRE will be served in 1998. Hence, limitations on the PWR mix were that 74% had to be MRE in order to maintain the industrial base. An additional constraint was that no more than 48% LRP could be substituted for the MRE as the LRP is considered by AR 40-25 to be a nutritionally restricted ration, therefore, can be consumed solely only for the first 10 of 21 days of wartime feeding. This proved to be irrelevant when compared to the constraint of maintaining the MRE industrial base. Thus, the optimum PWR mix would be 74% MRE and 26% in equivalent LRP as depicted in Figure 2. The total cost of the optimum PWR mix would be \$281.8 million as provided in Table 3.

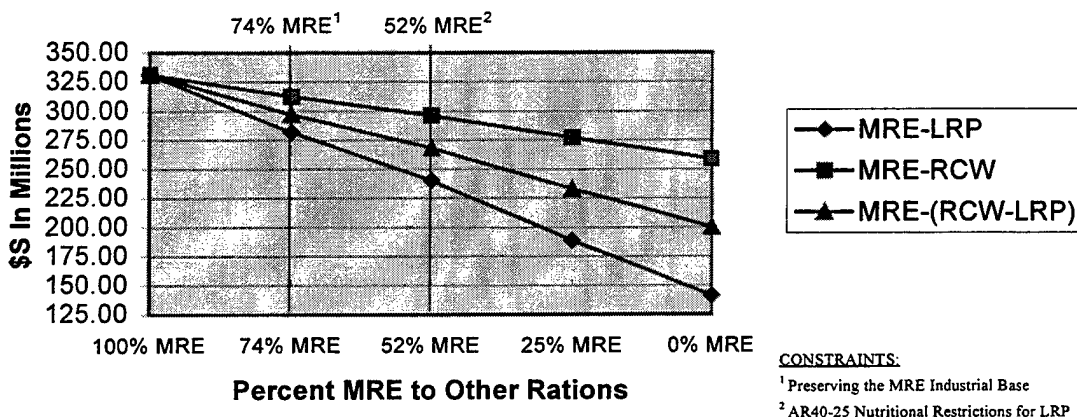


Figure 2. PWR Ration Mix Costs

Table 3. PWR Ration Mix Costs in Million \$ Per Year

100% MRE \$331.2	74% MRE* 26% LRP \$281.8	52% MRE 48% LRP** \$240.1	25% MRE 75% LRP \$188.8	100% LRP \$141.4
100% MRE \$331.2	74% MRE 26% RCW \$312.3	52% MRE 48% RCW \$296.4	25% MRE 75% RCW \$276.9	100% RCW \$258.7
100% MRE \$331.2	74% MRE 13% LRP 13% RCW \$297.1	52% MRE 24% LRP 24% RCW \$268.25	25% MRE 37.5% LRP 37.5% RCW \$232.8	50% LRP 50% RCW \$200.1

* Constraint required to preserve the MRE industrial base.

** Constraint required for using a nutritionally restricted alternate ration for the MRE.

Note: The RCW is not recommended, as it is more expensive than the LRP.

The rotational cycle would be to replace 26% of the MRE with the equivalent LRP over a 3.18 year period as is depicted in Figure 3. This is based on the industrial capabilities of the freeze-drying industry. They can manufacture a maximum of 1.47 million meals per year, which includes the necessary packaging lead-time.

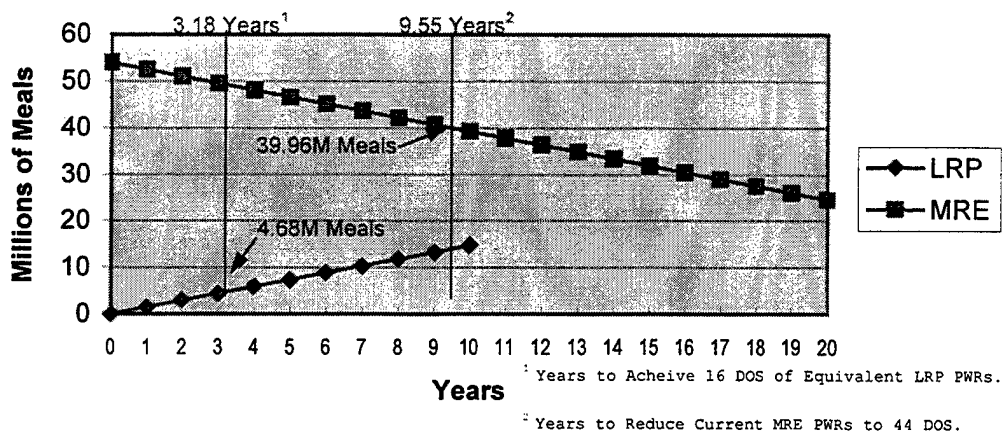


Figure 3. Annual LRP Production Capacity