



ARMY NET ZERO PROVE OUT

Final Net Zero Waste Best Practices

November 20, 2014

Distribution A - Approved for public release, distribution is unlimited

Requests for this document shall be referred to:

Office of the Deputy Assistant Secretary of the Army for
Energy and Sustainability (ODASA[E&S])
110 Army Pentagon, Room 3D453
Washington DC 20310-0110

Contract No. W91ZLK-10-D-0005
Task No. 0818
CDRL No. A007

Submitted by



Concurrent Technologies Corporation

*100 CTC Drive
Johnstown, PA 15904*

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for information operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, D.C. 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE November 20, 2014		3. REPORT TYPE AND DATES COVERED Final ((5/23/13 – 11/22/2014))
4. TITLE AND SUBTITLE Net Zero Waste Best Practices			5. FUNDING NUMBERS Contract: W91ZLK-10-D-0005 Task: N.0818	
6. AUTHOR(S) Caroline Harrover, Elizabeth Keysar, Karen Downs, Arielle Wait and Heidi Kaltenhauser				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) National Defense Center for Energy and Environment Operated by Concurrent Technologies Corporation 100 CTC Drive Johnstown, PA 15904			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) NDCEE Program Office (Office of the Assistant Secretary of the Army for Installations and Environment) 5850 21 st Street, Building 211, Second Floor Fort Belvoir, VA 22060-5527 Program Manager: Mr. Erik Hanageland, NDCEE Program Manager, 410-306-3184			10. SPONSORING/MONITORING AGENCY REPORT NUMBER NDCEE-CR-2014-089	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Distribution A - Approved for public release, distribution is unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) In support of Task No. 0818, "Army Net Zero Prove-Out," the National Defense Center for Energy and Environment (NDCEE), operated by Concurrent Technologies Corporation (CTC), was tasked to provide the Office of the Deputy Assistant Secretary of the Army for Energy & Sustainability (ODASA[E&S]) outreach material consisting of Net Zero Waste Best Practices. Information required to develop these Best Practices was collected over the course of this Task 818 and the NDCEE leveraged previous work with the NZ Waste Pilot Installations under Task 0755 and Material Flow Analyses and Waste Characterization activities under Task 774.. During the Period of Performance (POP) of T-0755 and since the commencement of this Task, monthly collaboration calls have been held between the Army Net Zero Waste Team leaders, external resources, NDCEE and the Army Net Zero Waste Pilot Installations (recently, participation has expanded beyond the pilot installations). These monthly calls accounted for the majority of Best Practices collected and were also included in the NZ Implementation Guide. The enclosed brochure found at Appendix A is intended to facilitate a comprehensive perspective for the institutionalization of NZ across the Army and aid in the transition of the NZ Pilot Installation Initiative concepts to a wider Army audience. Appendix B is a text version of the brochure to facilitate review.				
14. SUBJECT TERMS			15. NUMBER OF PAGES 20	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified		20. LIMITATION OF ABSTRACT None

TABLE OF CONTENTS

	Page
LIST OF ACRONYMS AND ABBREVIATIONS	ii
EXECUTIVE SUMMARY	iii

LIST OF APPENDICES

Appendix A:	Net Zero Waste Best Practices Brochure
Appendix B:	Text version of the Net Zero Waste Best Practices Brochure

LIST OF ACRONYMS AND ABBREVIATIONS

ACOM	Army Command
CTC	Concurrent Technologies Corporation
Dem/Val	Demonstration and validation
DRU	Direct Reporting Unit
MFA	Material Flow Analyses
NDCEE	National Defense Center for Energy and Environment
NZ	Net Zero
ODASA(E&S)	Office of the Deputy Assistant Secretary of the Army for Energy & Sustainability
POP	Period of Performance
QRP	Qualified Recycling Program

EXECUTIVE SUMMARY

In support of Task No. 0818, “Army Net Zero Prove-Out,” the National Defense Center for Energy and Environment (NDCEE), operated by Concurrent Technologies Corporation (CTC), was tasked to provide the Office of the Deputy Assistant Secretary of the Army for Energy & Sustainability (ODASA[E&S]) written summaries of significant, demonstrated best practices of Net Zero Waste that can be used to guide Army installations in their pursuit of Net Zero Waste and facilitate the institutionalization of Net Zero across the Army enterprise.

On April 19, 2011, the Assistant Secretary of the Army for Installations, Energy and Environment, the Honorable Katherine Hammack announced the sites for the Army Net Zero Pilot Installation Initiative – eight (8) of which were selected for Net Zero Waste:

- Fort Detrick, Maryland
- Fort Hunter Liggett, California
- JB Lewis-McChord, Washington
- Fort Hood, Texas
- Fort Polk, Louisiana
- USAG Grafenwoehr, Germany
- Fort Carson, Colorado
- Fort Bliss, Texas

These sites served as test beds for the Army’s Net Zero Initiative, specifically, Net Zero Waste, and the Army provided technical support to the Pilots, by way of developing baselines, material flow analyses and developing Net Zero plans (or Roadmaps). The intent was to transition and institutionalize Net Zero concepts, responsibility, methods, and implementation activities from the pilot installations to the appropriate Army Commands (ACOMs)/Direct Reporting Units (DRUs) and all Army installations. The purpose of this task was to support that transition by documenting Net Zero Waste best practices identified that can be shared with other Army installations and advance the Net Zero concept across the Army.

Net Zero builds on longstanding sustainable practices and incorporates emerging best practices in building and community management of energy, water and solid waste at Army installations. With the 28 January 2014 issuance of the Army Net Zero Installation Directive, it became Army policy that all installations will implement Net Zero Waste to the maximum extent practical and fiscally prudent by reducing, reusing, recycling/composting and recovering solid waste streams and converting them to resource values, resulting in zero landfill disposal.

The Net Zero Waste Best Practices brochure (Appendix A) and the text version of the Net Zero Waste Best Practices Brochure (Appendix B) developed for this task captures significant, demonstrated best practices at the Net Zero Waste pilot installations. Previous experience from

NDCEE Task 0755, the Material Flow Analyses (MFA) Task 774, and Waste Characterization activity, ongoing collaboration calls, and Net Zero meeting support was leveraged to capture achievements of the pilot installations, identify those projects that can be replicated at other installations and help the transition of the Net Zero Pilot Installation Initiative concepts to a wider Army audience.

APPENDIX A

Net Zero Waste Best Practices Brochure



waste_Net Zero
Brochure_19NOV2014



Waste





Fort Hood Recycling Center



Waste

Net Zero Waste is a holistic approach to solid waste management that involves reducing, reusing, recycling, composting, and recovering solid waste streams, converting them to resource values, resulting in zero landfill disposal.

THE ARMY'S NET ZERO INITIATIVE:

Net Zero is a strategy for sustainably managing energy, water, and solid waste programs on Army installations in a way that ensures the Army of tomorrow has the same access to energy, water, land and natural resources as today's Army. Net Zero installations will reduce energy and water usage and solid waste generation, exceeding goals set by Executive Orders, Department of Defense (DoD) Directives and Army Policies, where fiscally responsible. The journey towards Net Zero will provide greater energy and water security and increase operational flexibility.

Introduction

To date, the Army has made substantial progress in the areas of Net Zero Energy, Water, and Waste. A number of federal mandates coupled with the risk of compliance penalties have challenged the Army to step up and lead by example with its Net Zero Initiative. The Army rose to this challenge with the Net Zero Pilot Installation Initiative which has allowed the Army to identify best practices and lessons learned that can be used to guide all installations in achieving Net Zero goals. Capturing lessons learned and incorporating best practices in installation operations and management is a crucial step in institutionalizing Net Zero across the Army enterprise. This document summarizes those Net Zero Waste best practices, which can decrease costs and increase operational capability and resiliency. The following best practices are organized into four groups: **1)** Existing Management Tools, **2)** Potential Strategies, **3)** Outreach, Education and Awareness, and **4)** Pilot Programs and New Technologies. While this document is specific to waste, some of the listed best practices are programs, policies, and strategies that can also be applied to Net Zero Energy and Water, as well as integrated efforts to align Energy, Water and Waste.

There are many Net Zero Waste actions and initiatives that can be easily implemented to gain momentum. These 'quick-wins' can boost an installation's Net Zero Waste program and build support to initiate more challenging actions. Most of these initiatives are low-cost actions and some simply need Command support (e.g., site-wide distribution of a policy signed by the Senior Mission or Garrison Commander). All Army installations have existing source reduction and waste minimization programs that can be leveraged to implement new Net Zero Waste initiatives. Implementation of Net Zero best practices will enhance or add focus to these programs.

Existing Management Tools

Sustainable Procurement Program – Because source reduction is the highest level of the Net Zero Waste hierarchy, installation sustainable procurement programs have an important role in achieving Net Zero Waste goals. These programs should be emphasized to reduce packaging waste, buy recycled-content materials (which boosts recycling markets), buy recyclable materials, institute take-back clauses in procurement contracts including packaging and pallets, etc.

Characterize and Quantify Waste Streams – Periodic waste stream analysis enables the installation to establish its 'baseline' waste composition and to more readily target waste streams for elimination, minimization, or diversion. The DoD Integrated Solid Waste Management Policy (1 Feb 2008) recommends annual waste stream analysis as a best practice for installation solid waste management. Waste stream analysis can be accomplished using installation personnel or via contractor support, using traditional 'sort and weigh' methods or less labor-intensive visualization methods. A combination of weighing/sorting and visualization may be ideal, if time and resources allow. In any case, the characterization should include building numbers and information about the 'generating activity' for each dumpster. Real Property facility/category codes or building occupant information can be used to determine the 'generating activity' for the waste in the dumpster.

Qualified Recycling Program (QRP) – Qualified Recycling Program (QRP) – Every Army installation should establish a Qualified Recycling Program (QRP). At its most basic level, a QRP enables the installation to receive and utilize the proceeds



Army Net Zero Best Practices



Establish Recycling Challenge Programs and Contests - A portion of an installation's QRP proceeds can be used to challenge one unit to recycle more than another unit, and receive funds and other rewards.

generated from its scrap metal sales via their servicing Defense Logistics Agency Disposition Services (DLADS) office. This level of QRP can be established without additional staff, facilities, or equipment; however, the scrap metal proceeds can then be used to expand the installation's recycling program to collect and sell other recyclables (e.g., aluminum, cardboard) where cost-effective, based on available local and regional markets. The QRP also benefits the installation's Morale, Welfare, and Recreation programs.

Deconstruction & Recovery/Diversion of Building Materials – The Army's sustainable design and development policy requires the evaluation of deconstruction (vs. traditional demolition) to increase reuse opportunities for building materials. Recovery and diversion of usable building materials can be implemented to recover building materials for little to no cost using partnerships and community organizations (e.g., Habitat for Humanity). Building materials that can't be readily reused can typically still be recycled/diverted (e.g., steel, asphalt, masonry, soil).

Food Waste Donations – Food waste donation programs have been established through partnerships with community "food rescue" and food bank organizations. Excess food from Army food operations can be donated rather than landfilled or composted. To donate excess food, a formal food donation MOA must be established with approved community "food rescue" and food bank organizations. The Army Food

Donations Procedures Memorandum (July 2014) strengthens the Army's commitment to food donation programs and establishes procedures for providing excess food to food recovery and distribution organizations.

Setting Printers to Double-Sided Printing – The DoD Strategic Sustainability Performance Plan (SSPP) has a goal to reduce printer paper use/waste. Setting printer defaults to double-sided printing is an easy way to achieve that goal. Printing double-sided can prevent an estimated 61 billion sheets of paper from entering the waste stream annually government wide, an excellent example of source reduction.

Environmental Management Systems (EMSs) – EMSs can track and measure the installation's progress in reducing waste sources and increasing waste diversion rates, and can be leveraged for implementing Net Zero Waste initiatives.

Potential Strategies

Strategies that have a direct impact on a particular waste stream

Bring Your Own Bag Campaigns – Plastic disposable shopping bags are a major source of film plastic waste on installations. Following the Net Zero Waste hierarchy, the reduction of this waste stream should first be addressed through source reduction. Substituting re-usable shopping bags, and promoting them through installation-wide campaigns, can effectively achieve source reduction.

Shop Rag Cleaning/Reuse Programs – Shop rags represent a large textile waste stream at many installations. As a source reduction action, cleaning and re-using shop rags is a best practice. Typically, a contract is arranged with a vendor, and the cleaning and re-use of rags is offset by the cost savings on new shop rags.

Furniture Diversion & Donation – Installations have successfully diverted large amounts of used furniture, particularly when large amounts of used furniture are generated at one time (e.g., a building renovation or whole-barracks furniture replacement project). One Net Zero Waste installation diverted five (5) tons of used barracks furniture by working with its legal office, servicing DLADS, and local non-profits. Installations

are advised to proceed with caution; however, as the authority to donate furniture may still be an on-going debate. Installations may want to follow this lead and engage the Command or legal counsel for written clarification and approval. This approach relates to the Net Zero Waste hierarchy areas of reduction.

"Blue Wrap" Recycling – Hospitals typically generate large quantities of used woven polypropylene blue sterilization wrap which is used to cover sterilized surgical instruments. Blue Wrap is made from a petroleum-based plastic that, when discarded, does not degrade. Most curbside recyclers won't accept Blue Wrap which is a #5 plastic – but with a little research and/or community engagement, there can be a market for this material. Some companies are reusing Blue Wrap by making them into tote bags, wash buckets, and other useful products. This best practice relates to the recycling approach of the Net Zero hierarchy.

Packaging Materials Elimination/Reuse – Packaging is a broad category of material that makes up a significant portion of an installation's total waste, and many opportunities exist to re-use, eliminate or find substitutes for this priority waste stream. Expanded Polystyrene Foam (Styrofoam™), Insta-Pak™ foam, and film plastics can be recycled using densification equipment, re-used or replaced with paper or cardboard substitutes, and some film plastics can be reduced or eliminated depending upon packaging design. Similar approaches can be used for cardboard and cellulose-based packaging materials. This approach is in line with the Net Zero Waste hierarchy in terms of reducing, re-purposing and recycling waste.

Textiles and Linens Reuse (particularly in medical activities) – Hospitals and clinics generate large quantities of this waste stream. Textiles that are degraded from ink stains can be dyed to obscure the stains. Linens can be repaired until they cannot be used anymore, then donated to be repurposed (e.g., rags, bedding for veterinary clinics and animal shelters).

Drain Plastic Bottles before Baling – Shredders can be used to cost-effectively drain plastic water bottles before they are baled, thereby increasing the profit margin for sale of these plastic bales. Better yet, use awareness campaigns to reduce/eliminate the number of plastic water bottles used on Post.

Wood Chipping and Baling – Sending wood-based waste, such as unusable pallets, to an installation wood chipper reduces waste sent to the landfill, the activity results in 'repurposing' the waste stream and generates wood chips that can be used in landscaping, as a road base, or feedstock for biomass plants. Chippers and balers can also help manage tumbleweed debris.

Electronic Waste Recycling – While government-generated waste electronics are recycled through DLADS, recycling of personally-owned waste electronics can be more challenging. Net Zero Waste pilot installations have partnered with other entities (e.g., UNICOR) to offer free recycling of personally-owned waste electronics. Personnel should also be encouraged to explore retailer 'turn-in/trade-in' options when purchasing new personal electronics.

Strategies that promote general source reduction and recycling

Recycling Bin Size & Placement Optimization – Placing recycling bins in convenient locations (e.g., next to waste bins) and high-traffic areas is crucial for successful source separation. Numerous studies have concluded that the proximity of recycling containers to refuse containers has a substantial impact on recycling and diversion rates. Similarly, recycling bins should be appropriately sized (including openings/slots) and clearly labeled for the targeted recyclable material. Recycling is high on the Net Zero Waste hierarchy list of approaches.

Recycling Contests/Challenges – Establishment of highly-publicized recycling contests/challenges are a proven method of raising awareness of and participation in the installation's recycling program. The simplest 'challenge' may track Unit diversion rates and report those statistics at quarterly Senior Leader meetings, providing motivation to be the 'best' (or improve from the 'worst'). Cash prizes and other rewards (funded through the installation's QRP) can be used to provide additional motivation. This relates to source reduction and recycling approaches of the Net Zero Waste hierarchy.

Free-Issue Programs – Installations have operated various types of free-issue programs for years to varying degrees of size, success and types of materials. The most common free-issue materials are cleaning products, paints, and office supplies. Units turn in these good reusable materials that would have otherwise been thrown away and other units who have a need are issued the material.

Expanded Recycling Program – Waste characterization study results can be used to expand the installation's existing recycling program. Installations may: **1)** Target additional recycled materials (e.g., 3-7 plastics) and find new vendors as needed. **2)** Work with the installation refuse/recycling contractor



Army Net Zero Best Practices

to identify opportunities to utilize Single Stream Recycling. **3)** Evaluate new sorting procedures and equipment to improve waste stream homogeneity. **4)** Add or upgrade other processing equipment (e.g., shredders, balers, sorters) to expand reuse/recycling opportunities. **5)** Increase storage options/capacity, particularly for less common or less valuable materials. **6)** Promote new initiatives that leverage the participation of other organizations in the QRP (e.g., drop-offs from tenant organizations).

Performance-Based Contracting for Solid Waste and Recycling Collection – Performance-based waste management or recycling contracts, particularly when a single vendor provides both services, can be used to incentive recycling/diversion versus landfill disposal. Contract clauses should be included to require weighing of each dumpster before emptying, waste data collection, and reporting that data to the installation.

Outreach, Education and Awareness

Successful implementation of Net Zero best practices requires outreach, education, and awareness campaigns. Installations can leverage existing outreach efforts by providing Net Zero-focused information and engagements. Social media, newspaper articles, workshops, recycling events, fliers, posters, and mock-billing programs have all been used by pilot installations to support their Net Zero efforts. Examples include:

Recycling and Re-Use Events – Recycling events are a hands-on method to raise awareness of recycling and Net Zero Waste initiatives. Events range from America Recycles Day and Earth Day events, installation-wide garage sale days, and recycling collection events for electronics waste, aluminum cans, and household recycling.

Social Media – Awareness campaigns using social media are effective in quickly reaching large audiences. Net Zero Waste content can be added to existing installation social media sites, and new sites can be used to promote reuse of waste materials (e.g., a Pinterest site for arts and crafts made from re-used materials).

Single Soldier and Barracks Awareness Campaigns – On-going targeted efforts may be needed in barracks and other areas with significant occupant turn-over. Conventional media (e.g., posters and signage) can be used, along with innovative ideas and interactive events (e.g., spontaneous dumpster dives with unit leadership).

Pilot Programs and New Technologies

Pilot programs and demonstration projects can support Net Zero Waste efforts. Before new technologies are deployed widely across an installation they are often demonstrated on a smaller scale through pilot and demonstration and validation (Dem/Val) projects. Dem/Val projects may involve new technologies, while pilot projects may simply involve working with new partners. The focus is on temporarily implementing a new approach or technology, or leveraging external stakeholders with similar interests, to evaluate the action's results before it is more permanently or widely adopted.

Pilot programs (e.g., the Net Zero Pilot Installation Initiative or the Fort Carson Net Zero Building Pilot) can raise awareness about Net Zero Waste or foster culture change that leads to increased recycling and source reduction. Dem/Val projects might include new organic waste digestion or dehydration technologies in line with the Net Zero Waste hierarchy. Examples of pilot programs and Dem/Vals that can be leveraged to support Net Zero Waste goals include:

Pilot programs and Dem/Vals that can have a direct impact on a particular waste stream

Food Waste Technologies – Dining facilities generate a large amount of post-consumer food waste, which can be processed using land-based composting, in-vessel composting systems, digesters, and dehydrators. Challenges with composting post-consumer food waste include waste segregation from non-compostable materials such as plastic or foam food service ware products, collection and handling, and the potential for transmitting pathogens. Safe handling procedures can avoid pathogen risks. The use of compostable biobased food service ware items can reduce separation requirements; these items should be demonstrated to determine their performance in the dining facilities and their compostability in the installation's composting process. Some municipalities accept post-consumer food waste in their curbside compost collection.

Pilot programs and Dem/Vals that can have a direct impact on many waste streams

Anaerobic Digesters – Although anaerobic digestion is not a new technology and has been used on a large-scale basis in wastewater treatment, the use of the technology should be demonstrated with other biodegradable materials. This approach is in line with the Net Zero Waste hierarchy to reduce and recycle/compost waste.

Composting – Open static pile and covered aerated static pile methods of composting have been successfully demonstrated at Army installations. The Army has published guidance on composting and this has resulted in increased use of this approach to address Net Zero Waste.

On-line Recycling Service Demonstrations – The ability to recycle materials depends on the local and regional capabilities of recyclers to accept and process materials. Open market software tools (e.g.,

RecycleMatch) allow installations to post materials for bid and leverage different regional capabilities for recycling. Preliminary feedback from the ongoing RecycleMatch demonstration shows that the service provides the most benefit to installations with hauling and baling capabilities at their QRP. This approach is in line with the Net Zero hierarchy in reducing waste and creating awareness of Net Zero Waste.

Manufacturer Take-Back Programs – Although manufacturer take-back programs are growing widely in Europe and the United States, the Army has only begun to implement this type of program. Several installations have worked successfully with manufacturers to take back modular furniture components, packaging materials, and re-usable pallets. This approach represents source reduction and possibly repurpose and energy recovery of the Net Zero Waste hierarchy.

Fort Hood partners with one of its tenants in a used furniture donation program





Vision for the future...

Although we do not know what missions our Nation will ask of the Army in the future, we know that to remain 'cost-effective' we must carefully manage limited resources to ensure facility utilization to the fullest potential. Sustainably operating our installations enables us to properly organize, equip, train and deploy Soldiers. Sustainability is necessary both in an operational and installation environment. It ensures future operational flexibility by giving the Army of tomorrow the same access to energy, water, land and natural resources as today's Army.

– 2014 Green Book. *"The costly consequences of excess Army infrastructure and overhead."* September 30, 2014.
By Katherine G. Hammack.

Resources

ASA (IE&E) home page:
www.army.mil/asaiee

Energy and Sustainability Webpage:
www.asaie.army.mil/Public/ES

Army Energy Program Net Zero Vision:
<http://www.asaie.army.mil/Public/ES/netzero/index.html>



Appendix B

Text Version of the Net Zero Waste Best Practices Brochure



Waste text.docx

Army Net Zero Best Practices

Net Zero Waste

Net Zero Waste is a holistic approach to solid waste management that involves reducing, reusing, recycling, composting, and recovering solid waste streams, converting them to resource values, resulting in zero landfill disposal.

THE ARMY'S NET ZERO INITIATIVE: Net Zero is a strategy for sustainably managing energy, water, and solid waste programs on Army installations in a way that ensures the Army of tomorrow has the same access to energy, water, land and natural resources as today's Army. Net Zero installations will reduce energy and water usage and solid waste generation, exceeding goals set by Executive Orders, Department of Defense (DoD) Directives and Army Policies, where fiscally responsible. The journey towards Net Zero will provide greater energy and water security and increase operational flexibility.

Introduction

To date, the Army has made substantial progress in the areas of Net Zero Energy, Water, and Waste. A number of federal mandates coupled with the risk of compliance penalties have challenged the Army to step up and lead by example with its Net Zero Initiative. The Army rose to this challenge with the Net Zero Pilot Installation Initiative which has allowed the Army to identify best practices and lessons learned that can be used to guide all installations in achieving Net Zero goals. Capturing lessons learned and incorporating best practices in installation operations and management is a crucial step in institutionalizing Net Zero across the Army enterprise. This document summarizes those Net Zero Waste best practices, which can decrease costs and increase operational capability and resiliency. The following best practices are organized into four groups: 1) Existing Management Tools, 2) Potential Strategies, 3) Outreach, Education and Awareness, and 4) Pilot Programs and New Technologies. While this document is specific to waste, some of the listed best practices are programs, policies, and strategies that can also be applied to Net Zero Energy and Water, as well as integrated efforts to align Energy, Water and Waste.

There are many Net Zero Waste actions and initiatives that can be easily implemented to gain momentum. These 'quick-wins' can boost an installation's Net Zero Waste program and build support to initiate more challenging actions. Most of these initiatives are low-cost actions and some simply need Command support (e.g., site-wide distribution of a policy signed by the Senior Mission or Garrison Commander). All Army installations have existing source reduction and waste minimization programs that can be leveraged to implement new Net Zero Waste initiatives. Implementation of Net Zero best practices will enhance or add focus to these programs.

EXISTING MANAGEMENT TOOLS

Sustainable Procurement Program – Because source reduction is the highest level of the Net Zero Waste hierarchy, installation sustainable procurement programs have an important role in

achieving Net Zero Waste goals. These programs should be emphasized to reduce packaging waste, buy recycled-content materials (which boosts recycling markets), buy recyclable materials, institute take-back clauses in procurement contracts including packaging and pallets, etc.

Characterize and Quantify Waste Streams – Periodic waste stream analysis enables the installation to establish its ‘baseline’ waste composition and to more readily target waste streams for elimination, minimization, or diversion. The DoD Integrated Solid Waste Management Policy (1 Feb 2008) recommends annual waste stream analysis as a best practice for installation solid waste management. Waste stream analysis can be accomplished using installation personnel or via contractor support, using traditional ‘sort and weigh’ methods or less labor-intensive visualization methods. A combination of weighing/sorting and visualization may be ideal, if time and resources allow. In any case, the characterization should include building numbers and information about the ‘generating activity’ for each dumpster. Real Property facility/category codes or building occupant information can be used to determine the ‘generating activity’ for the waste in the dumpster.

Qualified Recycling Program (QRP) – Qualified Recycling Program (QRP) – Every Army installation should establish a Qualified Recycling Program (QRP). At its most basic level, a QRP enables the installation to receive and utilize the proceeds generated from its scrap metal sales via their servicing Defense Logistics Agency Disposition Services (DLADS) office. This level of QRP can be established without additional staff, facilities, or equipment; however, the scrap metal proceeds can then be used to expand the installation’s recycling program to collect and sell other recyclables (e.g., aluminum, cardboard) where cost-effective, based on available local and regional markets. The QRP also benefits the installation’s Morale, Welfare, and Recreation programs

Deconstruction & Recovery/Diversion of Building Materials – The Army’s sustainable design and development policy requires the evaluation of deconstruction (vs. traditional demolition) to increase reuse opportunities for building materials. Recovery and diversion of usable building materials can be implemented to recover building materials for little to no cost using partnerships and community organizations (e.g., Habitat for Humanity). Building materials that can’t be readily reused can typically still be recycled/diverted (e.g., steel, asphalt, masonry, soil).

Food Waste Donations – Food waste donation programs have been established through partnerships with community “food rescue” and food bank organizations. Excess food from Army food operations can be donated rather than landfilled or composted. To donate excess food, a formal food donation MOA must be established with approved community “food rescue” and food bank organizations. The Army Food Donations Procedures Memorandum (July 2014) strengthens the Army’s commitment to food donation programs and establishes procedures for providing excess food to food recovery and distribution organizations..

Setting Printers to Double-Sided Printing – The DoD Strategic Sustainability Performance Plan (SSPP) has a goal to reduce printer paper use/waste. Setting printer defaults to double-sided printing is an easy way to achieve that goal. Printing double-sided can prevent an estimated 61

billion sheets of paper from entering the waste stream annually government wide, an excellent example of source reduction.

Environmental Management Systems (EMSs) – EMSs can track and measure the installation’s progress in reducing waste sources and increasing waste diversion rates, and can be leveraged for implementing Net Zero Waste initiatives

POTENTIAL STRATEGIES

Strategies that have a direct impact on a particular waste stream:

Bring Your Own Bag Campaigns - Plastic disposable shopping bags are a major source of film plastic waste on installations. Following the Net Zero Waste hierarchy, the reduction of this waste stream should first be addressed through source reduction. Substituting re-usable shopping bags, and promoting them through installation-wide campaigns, can effectively achieve source reduction.

Shop Rag Cleaning/Reuse Programs - Shop rags represent a large textile waste stream at many installations. As a source reduction action, cleaning and re-using shop rags is a best practice. Typically, a contract is arranged with a vendor, and the cleaning and re-use of rags is offset by the cost savings on new shop rags.

Furniture Diversion & Donation - Installations have successfully diverted large amounts of used furniture, particularly when large amounts of used furniture are generated at one time (e.g., a building renovation or whole-barracks furniture replacement project). One Net Zero Waste installation diverted five (5) tons of used barracks furniture by working with its legal office, servicing DLADS, and local non-profits. Installations are advised to proceed with caution; however, as the authority to donate furniture may still be an on-going debate. Installations may want to follow this lead and engage the Command or legal counsel for written clarification and approval. This approach relates to the Net Zero Waste hierarchy areas of reduction.

“Blue Wrap” Recycling – Hospitals typically generate large quantities of used woven polypropylene blue sterilization wrap which is used to cover sterilized surgical instruments. Blue Wrap is made from a petroleum-based plastic that, when discarded, does not degrade. Most curbside recyclers won’t accept Blue Wrap which is a #5 plastic – but with a little research and/or community engagement, there can be a market for this material. Some companies are reusing Blue Wrap by making them into tote bags, wash buckets, and other useful products. This best practice relates to the recycling approach of the Net Zero hierarchy.

Packaging Materials Elimination/Reuse - Packaging is a broad category of material that makes up a significant portion of an installation’s total waste, and many opportunities exist to re-use, eliminate or find substitutes for this priority waste stream. Expanded Polystyrene Foam (Styrofoam™), Insta-Pak™ foam, and film plastics can be recycled using densification equipment,

re-used or replaced with paper or cardboard substitutes, and some film plastics can be reduced or eliminated depending upon packaging design. Similar approaches can be used for cardboard and cellulose-based packaging materials. This approach is in line with the Net Zero Waste hierarchy in terms of reducing, re-purposing and recycling waste.

Textiles and Linens Reuse (particularly in medical activities) – Hospitals and clinics generate large quantities of this waste stream. Textiles that are degraded from ink stains can be dyed to obscure the stains. Linens can be repaired until they cannot be used anymore, then donated to be repurposed (e.g., rags, bedding for veterinary clinics and animal shelters).

Drain Plastic Bottles before Baling – Shredders can be used to cost-effectively drain plastic water bottles before they are baled, thereby increasing the profit margin for sale of these plastic bales. Better yet, use awareness campaigns to reduce/eliminate the number of plastic water bottles used on Post.

Wood Chipping and Baling – Sending wood-based waste, such as unusable pallets, to an installation wood chipper reduces waste sent to the landfill, the activity results in ‘repurposing’ the waste stream and generates wood chips that can be used in landscaping, as a road base, or feedstock for biomass plants. Chippers and balers can also help manage tumbleweed debris.

Electronic Waste Recycling – While government-generated waste electronics are recycled through DLADS, recycling of personally-owned waste electronics can be more challenging. Net Zero Waste pilot installations have partnered with other entities (e.g., UNICOR) to offer free recycling of personally-owned waste electronics. Personnel should also be encouraged to explore retailer ‘turn-in/trade-in’ options when purchasing new personal electronics.

Strategies that promote general source reduction and recycling

Recycling Bin Size & Placement Optimization - Placing recycling bins in convenient locations (e.g., next to waste bins) and high-traffic areas is crucial for successful source separation. Numerous studies have concluded that the proximity of recycling containers to refuse containers has a substantial impact on recycling and diversion rates. Similarly, recycling bins should be appropriately sized (including openings/slots) and clearly labeled for the targeted recyclable material. Recycling is high on the Net Zero Waste hierarchy list of approaches.

Recycling Contests/Challenges – Establishment of highly-publicized recycling contests/challenges are a proven method of raising awareness of and participation in the installation’s recycling program. The simplest ‘challenge’ may track Unit diversion rates and report those statistics at quarterly Senior Leader meetings, providing motivation to be the ‘best’ (or improve from the ‘worst’). Cash prizes and other rewards (funded through the installation’s QRP) can be used to provide additional motivation. This relates to source reduction and recycling approaches of the Net Zero Waste hierarchy.

Free-Issue Programs – Installations have operated various types of free-issue programs for years to varying degrees of size, success and types of materials. The most common free-issue materials are cleaning products, paints, and office supplies. Units turn in these good reusable materials that would have otherwise been thrown away and other units who have a need are issued the material.

Expanded Recycling Program – Waste characterization study results can be used to expand the installation's existing recycling program. Installations may: 1) Target additional recycled materials (e.g., 3-7 plastics) and find new vendors as needed. 2) Work with the installation refuse/recycling contractor to identify opportunities to utilize Single Stream Recycling. 3) Evaluate new sorting procedures and equipment to improve waste stream homogeneity. 4) Add or upgrade other processing equipment (e.g., shredders, balers, sorters) to expand reuse/recycling opportunities. 5) Increase storage options/capacity, particularly for less common or less valuable materials. 6) Promote new initiatives that leverage the participation of other organizations in the QRP (e.g., drop-offs from tenant organizations).

Performance-Based Contracting for Solid Waste and Recycling Collection - Performance-based waste management or recycling contracts, particularly when a single vendor provides both services, can be used to incentive recycling/diversion versus landfill disposal. Contract clauses should be included to require weighing of each dumpster before emptying, waste data collection, and reporting that data to the installation

OUTREACH, EDUCATION, & AWARENESS

Successful implementation of Net Zero best practices requires outreach, education, and awareness campaigns. Installations can leverage existing outreach efforts by providing Net Zero-focused information and engagements. Social media, newspaper articles, workshops, recycling events, fliers, posters, and mock-billing programs have all been used by pilot installations to support their Net Zero efforts. Examples include:

Recycling and Re-Use Events - Recycling events are a hands-on method to raise awareness of recycling and Net Zero Waste initiatives. Events range from America Recycles Day and Earth Day events, installation-wide garage sale days, and recycling collection events for electronics waste, aluminum cans, and household recycling.

Social Media – Awareness campaigns using social media are effective in quickly reaching large audiences. Net Zero Waste content can be added to existing installation social media sites, and new sites can be used to promote reuse of waste materials (e.g., a Pinterest site for arts and crafts made from re-used materials).

Single Soldier and Barracks Awareness Campaigns - On-going targeted efforts may be needed in barracks and other areas with significant occupant turn-over. Conventional media (e.g., posters and

signage) can be used, along with innovative ideas and interactive events (e.g., spontaneous dumpster dives with unit leadership).

PILOT PROGRAMS AND NEW TECHNOLOGY

Pilot programs and demonstration projects can support Net Zero Waste efforts. Before new technologies are deployed widely across an installation they are often demonstrated on a smaller scale through pilot and demonstration and validation (Dem/Val) projects. Dem/Val projects may involve new technologies, while pilot projects may simply involve working with new partners. The focus is on temporarily implementing a new approach or technology, or leveraging external stakeholders with similar interests, to evaluate the action's results before it is more permanently or widely adopted.

Pilot programs (e.g., the Net Zero Pilot Installation Initiative or the Fort Carson Net Zero Building Pilot) can raise awareness about Net Zero Waste or foster culture change that leads to increased recycling and source reduction. Dem/Val projects might include new organic waste digestion or dehydration technologies in line with the Net Zero Waste hierarchy. Examples of pilot programs and Dem/Vals that can be leveraged to support Net Zero Waste goals include:

Pilot programs and Dem/Vals that can have a direct impact on a particular waste stream:

Food Waste Technologies. Dining facilities generate a large amount of post-consumer food waste, which can be processed using land-based composting, in-vessel composting systems, digesters, and dehydrators. Challenges with composting post-consumer food waste include waste segregation from non-compostable materials such as plastic or foam food service ware products, collection and handling, and the potential for transmitting pathogens. Safe handling procedures can avoid pathogen risks. The use of compostable biobased food service ware items can reduce separation requirements; these items should be demonstrated to determine their performance in the dining facilities and their compostability in the installation's composting process. Some municipalities accept post-consumer food waste in their curbside compost collection.

Pilot programs and Dem/Vals that can have a direct impact on many waste streams –

Anaerobic Digesters - Although anaerobic digestion is not a new technology and has been used on a large-scale basis in wastewater treatment, the use of the technology should be demonstrated with other biodegradable materials. This approach is in line with the Net Zero Waste hierarchy to reduce and recycle/compost waste.

Composting - Open static pile and covered aerated static pile methods of composting have been successfully demonstrated at Army installations. The Army has published guidance on composting and this has resulted in increased use of this approach to address Net Zero Waste.

On-line Recycling Service Demonstrations - The ability to recycle materials depends on the local and regional capabilities of recyclers to accept and process materials. Open market software tools (e.g., RecycleMatch) allow installations to post materials for bid and leverage different regional capabilities for recycling. Preliminary feedback from the ongoing RecycleMatch demonstration shows that the service provides the most benefit to installations with hauling and baling capabilities at their QRP. This approach is in line with the Net Zero hierarchy in reducing waste and creating awareness of Net Zero Waste.

Manufacturer Take-Back Programs - Although manufacturer take-back programs are growing widely in Europe and the United States, the Army has only begun to implement this type of program. Several installations have worked successfully with manufacturers to take back modular furniture components, packaging materials, and re-usable pallets. This approach represents source reduction and possibly repurpose and energy recovery of the Net Zero Waste hierarchy.

Back Cover Quote:

Vision for the future...

Although we do not know what missions our Nation will ask of the Army in the future, we know that to remain 'cost-effective' we must carefully manage limited resources to ensure facility utilization to the fullest potential. Sustainably operating our installations enables us to properly organize, equip, train and deploy Soldiers. Sustainability is necessary both in an operational and installation environment. It ensures future operational flexibility by giving the Army of tomorrow the same access to energy, water, land and natural resources as today's Army.

2014 Green Book. “The costly consequences of excess Army infrastructure and overhead.”
September 30, 2014. By Katherine G. Hammack.