TECHNICAL INFORMATION PAPER

APHC U.S. ARMY PUBLIC HEALTH CENTER

PUBLIC HEALTH REVIEW OF NET ZERO AND SUSTAINABILITY PROJECTS

TECHNICAL INFORMATION PAPER NO. 37-014-0617

PURPOSE.

To provide an approach for conducting a public health review of installation and medical treatment facility (MTF) Net Zero and sustainability projects in order to assist Army leaders with identifying and mitigating risks to public health.

REFERENCES.

See Appendix A for a list of references applicable to this publication.

POINTS OF MAJOR INTEREST AND FACTS.

Background.

Army's Net Zero policy builds on sustainable practices and incorporates emerging best practices to minimize energy use, water consumption, and waste generation on its installations. Energy use, water consumption, and waste generation are also focus areas of the Department of Defense's (DOD) Strategic Sustainability Performance Plan. Garrison and MTF projects to reduce net energy use, net water use, and net waste disposal will benefit public health on a large scale but may have inadvertent public health effects on a local scale. Installations must review net zero and sustainability projects to identify and mitigate any adverse health and safety risks associated with those projects. Mitigation efforts should be performed by garrison environmental, safety, industrial hygiene, and public health programs and should comply with Federal, state, and Army regulations. In practice, this means creating or revising applicable plans and procedures for construction, health and safety, material and waste management, and equipment operation and maintenance; providing applicable training; and overseeing the effectiveness of plan requirements and training in protecting public health.

Net Zero Objectives.

The overall objective of the Army's Net Zero initiative is to implement the following measures to the maximum extent possible when fiscally prudent:

- Reducing overall energy use, maximizing efficiency, implementing energy recovery and cogeneration opportunities, and offsetting the remaining demand with the production of renewable energy from onsite sources with the ultimate goal of producing as much renewable energy as is used over the course of a year.

- Reducing overall water use, increasing use of technology that uses water more efficiently, recycling and reusing water, shifting to the use of non-potable sources as much as possible, and minimizing interbasin transfers of water, so that an installation recharges as much water into the aquifer as it withdraws.

- Reducing, reusing, recycling/composting, and recovering solid waste streams and converting them to resource values with the ultimate goal of zero landfill disposal.

Adverse Public Health Effects.

While there are large-scale environmental benefits to implementing net zero and/or sustainability projects, there can also be a potential for adverse public health effects at the local level that may require mitigation. For example, there can be indoor air quality concerns with retrofitting a building's heating, ventilation, and air conditioning system; health concerns with treating water reclaimed from a wastewater treatment plant; vector concerns with composting organic waste; or food safety concerns with donating food.

Public Health Hazard and Risk Analysis.

Net zero projects should undergo a public health hazard and risk analysis. Army Regulation (AR) 40-10 (*Health Hazard Assessment Program in Support of the Army Acquisition Process*) provides a framework for completing a risk analysis. While AR 40-10 is specifically geared toward weapons systems and other combat equipment and materiel, the general principles still apply. Proper hazard identification for net zero and sustainability projects requires consideration of the following:

- Applicable public health standards in Army regulations and applicable engineering references. Appendix B provides a list of publications applicable to public health related to energy conservation, water conservation, and waste minimization projects.

- Interface considerations among various elements of new and existing systems, to include equipment layout, material compatibilities, electromagnetic interference, fire or explosion initiation, hardware or software controls, mass flow, and electrical power flux.

- Environmental considerations such as indoor air quality, lighting, noise, vibration, and shock.

- Operating, testing, maintenance, emergency, and contingency procedures. Include garrison public works entities during the planning process to ensure their ability to service new equipment.

- Effect of radiation (ionizing or non-ionizing) from the equipment.

- Exposure to biological substances (food, water, and vector-borne diseases).

- Potential exposure to hazardous or infectious materials and waste.

Appendix C provides some example risk analyses for a variety of typical net zero/sustainability projects.

ACTIONS.

- Identify public health concerns during project planning and ensure mitigation of concerns during construction, operation, and maintenance by means of appropriate plans, procedures, training, and oversight.

- Identify those proposals or situations requiring additional technical evaluation from U.S. Army Public Health Center (APHC) or other technical subject matter experts.

- Request net zero/sustainability project reviews from safety, industrial hygiene, occupational health, and environmental management personnel.

Point of Contact.

For more help, contact the APHC Waste Management Branch 410-436-3651.

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Prepared by: Waste Management Branch

APPENDIX A
REFERENCES

Army publications are available online at http://armypubs.army.mil. DOD United Facilities Criteria (UFC) and US Army Corps of Engineers Public Works Technical Bulletins (PWTB) are available online at http://www.wbdg.org/ffc/federal-facility-criteria.

ANSI/ASHRAE 62.1-2016
Ventilation for Acceptable Indoor Air Quality

AR 40-5
Preventive Medicine

AR 40-10
Health Hazard Assessment Program in Support of the Army Acquisition Process

AR 420-1
Army Facilities Management

AR 608-10
Child Development Services

DA Pam 40-11
Preventive Medicine

DA Pam 40-501
Army Hearing Program

DA Pam 40-506
Army Vision Conservation and Readiness Program

DA Pam 385-16
System Safety Management Guide

DOD SSPP
2016 DOD Strategic Sustainability Performance Plan

MEMORANDUM, 31 JULY 2014
Army Food Donation Procedures

MIL-STD-3006
Sanitation Requirements for Food Establishments

PWTB 200-1-75
Rainwater Harvesting for Army Installations

PWTB 200-1-101
Graywater Application for Army Installations

PWTB 200-1-104
Implementing a Water Conservation Program on Army Installations

PWTB 200-1-105
Water Efficient Installations

PWTB 200-1-142
Applicable Guidelines for Water Reuse at Army Installations

Technical Bulletin, Medical (TB MED) 530
Tri-Service Food Code

TB MED 561
Pest Surveillance

TB MED 576
Sanitary Control and Surveillance of Water Supplies at Fixed Installations

UFC 1-200-02
High Performance and Sustainable Building Requirements

UFC 3-230-02
Operation and Maintenance: Water Supply Systems

UFC 3-400-01
Energy Conservation

UFC 3-410-01FA
Heating, Ventilating, and Air Conditioning

UFC 3-420-01
Plumbing Systems

TIP 37-014-0617

UFC 3-440-01
Facility-Scale Renewable Energy Systems

UFC 3-520-05
Stationary Battery Areas

UFC 3-530-01
Interior and Exterior Lighting Systems and Controls

UFC 4-510-01
Design: Military Medical Facilities

APPENDIX B
PUBLICATIONS CONTAINING PUBLIC HEALTH STANDARDS OR GUIDANCE

Project	Reference	Section or Page	Standard/Guidance
Disinfectants	DA Pam 40-11, Preventive Medicine	Appendix D-4, Facility Sanitation	Requires use of disinfectants approved by Environmental Protection Agency (EPA), Food and Drug Administration (FDA), and/or U.S. Department of Agriculture (USDA) and provides selection criteria
Energy and water conservation	AR 420-1, Facilities Management	Chapter 22	Energy and water management and conservation program requirements including Energy Star® purchase requirements Heating and cooling set points Water temperature set points
Water supply and wastewater policy	AR 420-1, Facilities Management	Chapter 23, Section 4	Policy and criteria for the operation, maintenance, repair, and construction of distribution, collection, treatment, and disposal facilities for water supply and wastewater
Energy conservation	Unified Facilities Criteria (UFC) 3-400-01, Energy Conservation	Section 2-3	Section 2-3 notes: "However, features that will adversely impact the mission or comfort, health, and productivity of the occupants shall not be included. In addition, system selection and incorporation of energy conserving features shall be closely coordinated with the facility user and maintenance staff."
Food donation	Memorandum, 31 July 2014, Army Food Donation Procedures		Food donation procedures for Army and Joint Base installations

Project	Reference	Section or Page	Standard/Guidance
Food sanitation	Technical Bulletin, Medical (TB MED) 530, Tri-Service Food Code		Public health standards for food service operations, including food donation
Food sanitation	Military Standard (MIL-STD)-3006, Sanitation Requirements for Food Establishments		Sanitation in food establishments
Graywater use	Public Works Technical Bulletins (PWTB) 200-1-101, Graywater Application for Army Installations		Health considerations Graywater collection, piping, and treatment
HVAC	American National Standards Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 62.1, Ventilation for Acceptable Indoor Air Quality	2-4	Specifications for acceptable IAQ
Lighting	Department of the Army Pamphlet (DA Pam) 40-506, Army Vision Conservation and Readiness Program	Tables 6-1 and 6-2	Recommended task illumination; energy conservation standards; and lamp efficiency, color rendition, and use recommendations
Lighting	AR 420-1, Facilities Management	22-12d	Recommends illumination standards of the Illuminating Engineering Society of North America (IESNA)
Lighting	UFC 3-530-01, Interior and Exterior Lighting Systems and Controls	Section 2	Primary reference for lighting design and renovation and includes guidance going beyond illumination standards. Includes daylight, controls, and hazardous materials in lighting.
MTF design	UFC 4-510-01, Design: Military Medical Facilities		Overall MTF design guidance
Noise	DA Pam 40-11, Preventive Medicine	Table 4-1	Acceptable building interior noise levels
Noise	DA Pam 40-501, Army Hearing Program		Standards for implementing, managing, and enforcing the

Project	Reference	Section or Page	Standard/Guidance
			Army Hearing Program
Non-potable water use	UFC 3-420-01, Plumbing Systems	Page A-15 Section B	Inserts a non-potable water exception into the International Plumbing Code, Chapter 6
Preventive medicine	AR 40-5, Preventive Medicine	1-5e 1-5g	Requires composite risk management to minimize health impacts and operate medical surveillance
Radiation	DA Pam 40-11, Preventive Medicine	Appendix G	Survey and control of ionizing and non-ionizing sources
Rainwater harvesting	PWTB 200-1-75, Rainwater Harvesting for Army Installations		Toxins and contaminants from roof, piping, storage tanks; screens, diversion of first flush, preventing mosquito breeding; treatment, testing
Risk analysis	DA Pam 385-16, System Safety Management Guide		Composite risk analysis
Solar power	UFC 3-520-05, Stationary Battery Areas		Design, safety, fire prevention for battery rooms
Solar preheat systems	UFC 3-440-01, Facility-Scale Renewable Energy Systems	Section 4.6 and others	Safety considerations include fall prevention during maintenance, energy equipment lockout, pressure and temperature relief valves, prevention of user scalding/steam from high temperatures due to stagnation, propylene glycol in heat transfer
Water conservation	PWTB 200-1-105, Water Efficient Installations		Federal Energy Management Program (FEMP) Best Management Practices (BMPs) and lessons learned
Water reuse	AR 420-1, Facilities Management	23-18k	Water reuse for non-potable water
Water supply	UFC 3-230-02, O&M Water Supply Systems	10	Cross-connection control
Water supply temperature	AR 420-1, Facilities Management	23-39	Domestic Hot Water Supply point of use temperature
Water supply	AR 608-10, Child Development Services	4-33	Child care center point of use temperature

Project	Reference	Section or Page	Standard/Guidance
temperature			
Water supply temperature	UFC 3-420-01, Plumbing Systems	Page A-11 Section 506, Sizing Hot Water Systems. Page A-20, section 607.1.1, Legionella	Water heater set point to prevent Legionella growth and water service temperatures for general service, dishwashers, and laundry Additional guidance to prevent Legionella growth in stagnant service segments such as faucet aerators, shower heads, or parts of storage-type water heaters
Water supply temperature	UFC 4–510–01, Design: Military Medical Facilities	9-2.6.2	Hot water temperatures for medical equipment

APPENDIX C
EXAMPLE RISK ANALYSES (FOR TYPICAL PROJECTS)

Project	Interface considerations[1]	Environmental considerations[2]	Operating, test, maintenance, emergency and contingency procedures	Radiation	Biological substances	Hazardous substances
Composting		Odor Storm water runoff control	Feed contamination Feed transport		Vector control Composite end use requirements for sterility and contaminants	
Daylighting, including smart windows		Meets illumination levels for room/pod Seasonal glare Impact of opening windows	Department of Public Works (DPW) experience in maintaining equipment Control of outside vegetation			
Geo-thermal (air conditioning, hot water, lighting).		Impacts of geothermal on radon release, contaminant transport, contaminant reaction and breakdown, and				

Project	Interface considerations[1]	Environmental considerations[2]	Operating, test, maintenance, emergency and contingency procedures	Radiation	Biological substances	Hazardous substances
		vapor intrusion from contaminated areas				
Green roof	Contamination, corrosion, or blockage of water reuse systems Weight of soil, plant material, and water on roof during dry and wet weather	Fire/lightning strike Dust risk in extreme drought	Wildlife and insect control Water ingress if not installed or maintained correctly Roof repairs may be more difficult		Mold or allergy risk from soil, plants, mold	Pesticides in underlying barrier material
Improve building envelope	Water infiltration at interfaces or penetrations leading to mold	Indoor air quality	Meet guidelines to prevent too-tight building			Exposure to cellulose insulation Offgassing from spray--polyurethane foam

Project	Interface considerations[1]	Environmental considerations[2]	Operating, test, maintenance, emergency and contingency procedures	Radiation	Biological substances	Hazardous substances
LED lighting	Compatible with lighting controls (onsite/remote) Electromagnetic interference with control devices near fixtures	Glare from strength of light-emitting diode (LED) Sufficient illumination				Pin LEDs, especially red, contain toxic metals and may be hazardous waste at disposal
Low-flow fixtures	Interaction with water supply, disinfectant residual time, and wastewater collection systems designed for higher flows	Scald risk from low flow showerheads			Potential for increased bacterial contamination of water supply	
Lowered hot water temperature set point in appliances	Cleaning performance Handwashing effectiveness				Achieving appropriate sanitation/ disinfection standards	

Project	Interface considerations[1]	Environmental considerations[2]	Operating, test, maintenance, emergency and contingency procedures	Radiation	Biological substances	Hazardous substances
Microgrid	Interface between new and old wiring Capacity for critical operations during outage, including building ventilation and lighting	Lightning	DPW experience in maintaining equipment			
Occupancy sensor-controlled lighting and air conditioning	Customizing sensor placement	Mold	Performance during fire, shelter-in-place, etc. Lockout for maintenance and repair			Disposal of sensors
Installing hand dryers		Noise			Wind-blown germs (may be unsuitable for sterile environments)	
Photovoltaic solar power	Isolation from grid/microgrid as necessary	Shock from range activity	Maintenance experience			Batteries may need to be disposed as hazardous waste

Project	Interface considerations[1]	Environmental considerations[2]	Operating, test, maintenance, emergency and contingency procedures	Radiation	Biological substances	Hazardous substances
Repair/ upgrade central or facility boiler, chiller, or distribution	Must meet requirements for any unique work-spaces, i.e., labs, operating rooms, emergency rooms, paint booths	Effect on radon mitigation Effect on vapor intrusion Indoor air quality	Maintenance experience		Legionella Sick building syndrome	
Replace water tanks, water distribution lines, heating, ventilation, and air conditioning (HVAC) tanks, HVAC water or steam distribution	Avoid cross-connection Impact to fixtures or other water-using equipment from pressure change or dislodged silt/rust		Decon and flush at start-up			

Project	Interface considerations[1]	Environmental considerations[2]	Operating, test, maintenance, emergency and contingency procedures	Radiation	Biological substances	Hazardous substances
Solar hot water		Ensure planning weather assumptions match recent weather Freeze risk	Control of outside vegetation		Vectors	Generation of propylene glycol
T8 lighting	Compatible w/lighting controls (onsite and remote) Starter may cause stray radiation, impacting nearby equipment	Sufficient illumination		Ultraviolet emissions if the protective coating is damaged/worn		Mercury release if broken Hazardous waste upon disposal
Thermal energy storage (water, for cooling during day)	Cross-connection control	Mold if system leaks			Water requires treatment with antibacterial agents or fungicides	
Utility or HVAC monitoring and control system	Sensor locations		Operator staffing System complexity requires training			

Project	Interface considerations[1]	Environmental considerations[2]	Operating, test, maintenance, emergency and contingency procedures	Radiation	Biological substances	Hazardous substances
Waste-to-Energy plant	Storage of feed Waste minimization programs		Feed variability			Emerging chemicals' impact to operation and emissions
Water reuse or rainwater harvesting	Rainwater chemistry and contaminants flushed off roof and other surfaces, biofouling, corroding, or scaling Collection and distribution pipes Roof and piping contaminants		Procedures for snow and ice melt, high winds, and heavy precipitation		Contaminants from offsite pollution, from rooftop materials and fecal matter, from collection system	Chemicals to manage water chemistry and prevent scaling, corrosion, or biofouling
Wind power		Noise and vibration	Potential and kinetic ice throw from turbine blades in winter Maintenance experience			

Notes:
[1] Interface considerations may include equipment layout, material compatibilities, electromagnetic interference, inadvertent activation, fire or explosion hazards, and hardware/software controls.
[2] Environmental considerations may include indoor air quality, lighting, noise, vibration, or shock.