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## Chapter 21. Sustainability

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### 21.1 Overview

This chapter describes existing strategies and practices related to sustainability at ARC. It also summarizes the regulations applicable to environmental, energy, and transportation management. Information and data presented in this chapter was obtained from the 2009 NASA ARC ERD (NASA 2009) and other sources.

### 21.2 Regulatory Background

#### 21.2.1 Federal Regulations

- 42 USC 6901, *Resource Conservation and Recovery Act*
- 42 USC 8251 et. seq., *Federal Energy Management*
- 42 USC 13101–13109, *Pollution Prevention Act of 1990*
- Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*
- Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*
- Executive Order 13150, *Federal Workforce Transportation*
- Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds
- 40 CFR Part 247, *Comprehensive Procurement Guidelines*
- 10 CFR Part 435, *Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings*
- U. S. Energy Policy Act of 1992

#### 21.2.2 State Regulations

- California Code of Regulations Title 13, *Air Resources Board*
- California Code of Regulations Title 22, *Environmental Health*
- California Code of Regulations Title 23, *Waters*
- California Code of Regulations Title 24 Part 6, *California's Energy Efficiency Standards for Residential and Nonresidential Buildings*
- California Health and Safety Code

#### 21.2.3 NASA Policy and Procedures

- NPD 8500.1C, *NASA Environmental Management*



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- APD 8500.1, *Ames Environmental Policy*
  - APR 8500.1, *Ames Environmental Procedural Requirements*
  - NASA Strategic Sustainability Performance Plan

## 21.3 Current Sustainability Strategies and Practices

### 21.3.1 Facilities Sustainability

To promote sustainable development<sup>23</sup>, there is a body of practical advice on how to plan, design, construct, operate, and maintain buildings to balance facility lifecycle<sup>24</sup> cost, environmental impact, and occupant health, safety, security, and productivity.

The essential elements of sustainability include:

- Energy and resource efficiency, including water conservation
- Site selection to minimize impacts to the environment (e.g., through transportation)
- Optimization of energy, environmental, and lifecycle costs associated with construction, operation, and decommissioning of facilities
- Use of sustainable materials (that is, reused, recycled, recyclable, nontoxic, low-embodied energy content, renewable, long lifecycle, resource efficient, harvested on a sustained yield basis, and least polluting)
- Emphasis on durability and efficiency of materials and equipment
- A healthy environment, including indoor air quality
- Features in support of enhanced worker productivity
- Design for personnel safety and security
- Design for decommissioning and disposal
- A philosophy that defines facility operational objectives, then tests and verifies that all building systems and components have been properly installed and perform to the level intended (that is, building commissioning)

### 21.3.2 Meet LEED Standards

The LEED Green Building Rating System<sup>®</sup> developed by the USGBC, evaluates a building's design, construction, operation and maintenance over its lifecycle for environmentally responsible elements and efficient use of resources. The system provides a recognized standard for building sustainability by designating levels of green building certification as certified silver, gold, or platinum. Development at ARC should strive for the highest

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<sup>23</sup> *Sustainable development*, as it relates to “green buildings” or “environmentally responsible facilities,” refers to structures and designs that cause no net environmental burden or deficit.

<sup>24</sup> *Lifecycle* of a product includes procurement of the original raw materials, processing, manufacturing, transportation, use, reuse, and recycling or disposal.



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possible LEED rating in building design, and must meet at least the minimum elements required to achieve LEED Silver certification.

### 21.3.3 Use Resources Efficiently and Purchase Environmentally Preferable<sup>25</sup> Products

Elements that promote efficient resource use and environmental purchasing include:

- Encourage purchasing of products that create less waste
- Choose products that are durable, repairable, and recyclable
- Avoid over packaging
- Encourage purchase of goods made from recycled materials
- Discourage purchase of environmentally-damaging or polluting materials, such as tropical hardwood, peat, formaldehyde-based laminates, PVC, or ozone-depleting substances
- Support and promote projects and enterprises for the repair and reuse of furniture, clothes, and other goods
- Encourage people to use hiring/lending services, such as libraries, tool hire, and car hire, in preference to buying new goods
- Address the impact of the building industry on resource use and waste by specifying reused materials in construction contracts and planning policies, and encouraging adaptable and durable building designs

### 21.3.4 Design for the Environment

Products designed for the protection of the environment are available. Such products are made from renewable resources<sup>26</sup> harvested in a sustainable manner, fabricated with recyclability goals, and produced using energy efficiently. Make purchases that favor sustainability. Buy items that are designed for the environment.

### 21.3.5 Sustainable Development

Sustainable development projects differ from typical construction projects because a multidisciplinary design and construction team is formed early in the process. This team cooperatively plans and integrates the project's functional and operational requirements to achieve of specific environmental and economic goals. Members of the team could include planners, architects, engineers, construction quality assurance specialists, contractors, building occupants, and environmental and energy managers. An outline of the principal stages and essential concerns for each stage follows.

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<sup>25</sup> *Environmentally Preferable* means products or services with limited or no impact on human health and the environment as compared with other products and services that serve the same purpose.

<sup>26</sup> *Renewable Resource* is a resource such as energy, water, or a raw material, which is consumed at a rate that does not exceed its ability to naturally replenish or regenerate itself.



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### **21.3.5.1 Planning**

Project concepts, goals, sustainability, and budgets are established. This is where the project team should begin considering and incorporating sustainable development practices. Federal acquisition regulations require contractor selection criteria to include specialized experience and technical competence in the type of work required, including, where appropriate, experience in energy conservation, pollution prevention, waste reduction, and the use of recycled materials.

### **21.3.5.2 Requirements Analysis**

Information is gathered in preparation for design. The project team should review operations and maintenance requirements. Review of environmental impact studies, pollution prevention plans, energy use, budgets, and site surveys create a foundation that helps ensure an optimal design for human and natural environments.

### **21.3.5.3 Project Definition**

For most projects, a conceptual design is created during a collaborative, multidisciplinary work session during which the project design, plan, and major systems are defined. Since these decisions set the direction for the design, they largely determine the team's ultimate success in meeting the project's design-for-environment goals.

### **21.3.5.4 Contract Document Development**

Construction plans and specifications are developed at this stage. Useful tools at this stage are checklists of sustainable development actions related to site work, water quality and conservation, energy efficiency, building material selection, and waste management.

### **21.3.5.5 Construction**

Installation practices that maintain good air quality, water quality, conservation of natural resources, and waste reduction are high priorities during construction of sustainable facilities. Contractors should be educated about these priorities and their role in achieving them. Quality assurance evaluators play an essential role in ensuring that sustainable design provisions in contract documents are translated into finished projects.

### **21.3.5.6 Occupancy, Operations and Maintenance**

A sustainable facility cannot fulfill its environmental and economic potential without the cooperation of knowledgeable occupants and maintainers. If personnel are educated about sustainability and have been involved throughout the process, the transition will be increasingly smooth and the project team's sustainability goals closer to realization.

### **21.3.5.7 Post-Occupancy Evaluation**

Facility managers, in cooperation with environmental engineers can perform evaluations to measure the facility's water and energy consumption, indoor air quality, and waste generation. Maintenance requirements and operational costs should also be considered.



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This performance data measures the sustainability of construction and establishes a benchmark for future projects.

#### 21.3.5.8 *Facility Reuse*

Existing facilities are thoroughly evaluated before deciding whether to reuse or demolish.

#### 21.3.6 **Education and Training**

Sustainability-focused education and training work toward developing high levels of awareness of sustainability among ARC employees to provide a workforce well prepared for delivering quality, environmentally sustainable services and products.

#### 21.3.7 **Walk, Bike, or Take Public Transportation**

The ACAP assists civil servants, contractors, and visitors in choosing transportation other than single-occupant vehicles. General acceptance of transportation alternatives to the single-occupant vehicle would reduce air, soil, water pollution, traffic congestion, and vehicle accident deaths. Through ACAP, ARC has information on car and vanpool, mass transit, and telecommuting. Past and current ACAP activities include:

- ARC employees have participated in and won the North Bayshore Bike toWork Challenge. “Bike to Work” is a community-wide celebration and public education effort that provides incentives for people to commute by bicycle. Biking is an inexpensive, healthy, and fun way to alleviate gridlock and reduce air pollution. Ames continues to have good participation in each Bike to Work Day and throughout the year.
- The NASA shuttle service is provided by ACAP in compliance with the BAAQMD’s former trip reduction law, Regulation 13. This law required employers to provide commute incentives to reduce traffic congestion and air pollution. The shuttle transports commuters to and from the Mountain View Caltrain Station and the VTA light rail in the morning and afternoon. Shuttle service is available to ARC civil service and contractor employees only. All shuttles are wheelchair accessible and have bicycle accommodations. A NASA badge is required to board the bus.
- “Spare the Air Tonight” starts in mid-November and extends through the end of January. This program targets the reduction of carbon monoxide and particulate matter that can reach unhealthy concentrations on cold nights with little air movement. Every winter, the BAAQMD asks Bay Area residents to cooperate to improve air quality on days when pollution threatens to reach unhealthy levels. When a Spare-the-Air-Tonight advisory is issued, residents are requested to avoid driving and refrain from lighting fireplaces and woodstoves (unless the stove or fireplace, containing an insert, is a clean-burning EPA-certified model).
- The BAAQMD donates Santa Clara County bus or CalTrain tickets to anyone not already using public transportation. The tickets are good for any day announced as a spare-the-air day. This provides an opportunity for people unfamiliar with public transit to experience the benefits of stress-free commuting.



### 21.3.8 Reduce, Reuse, and Recycle

ARC employs a strategy of reuse, reduce, recycle, treat, then dispose hierarchy to manage wastes, including hazardous waste, non-hazardous commercial waste, and construction/demolition waste. ARC recycles materials such as used oil, paint, solvents, antifreeze, batteries, and florescent light tubes. ARC also recycles all paper, cardboard, plastic, glass, and aluminum containers, and construction/demolition debris.

In 2013, ARC generated 838 tons of non-construction solid waste. The agency goal is to Divert 50% of solid waste, excluding construction and demolition debris, away from landfills by CY 2015. As of 2013, ARC's waste diversion rate is 69% for non-construction and demolition waste. In 2013, ARC's recycling and yard waste mulching programs diverted approximately 361 tons of material from the landfills. Table 21-1 shows the breakdown of materials recycled and reused in 2013.

**Table 21-1. Materials Recycled and Reused in 2013**

<b>Materials Recycled</b>	<b>Pounds</b>
Antifreeze	887
Ballast	4237
Batteries	10,725
Cooking Oil/Grease	7040
Diesel Fuel	566
Styrofoam	0
Refrigerant	1,334.24
Toner Cartridges	1091
Drums	3155
Fluorescent Lamps	6639
Incandescent Lamps	67
Lead	78
Mercury Devices	71
Oil Filters	757
Used Oil	30,224
Oily Rags	3,394
Paint	663
Solvents	1,451
Tires	1,475
Electronics	78,956
Mulch	
Green Waste	722,645
Single Stream Materials	
General Solid Waste	1,676,400



Materials Recycled	Pounds
Recycled Single Stream Materials	2,849,880
Source: ERT 2014b.	

Green waste at ARC, including grass clippings, leaves, and tree branches, is collected from on-site grounds maintenance operations and delivered to the on-site composting yard that is operated by the Plant Engineering organization. The program, which began in 1996, incorporates lawn clippings from the Moffett Field Golf Course and takes in approximately 5,000 cubic yards of green waste per year. The finished mulch product is stockpiled and used on-site in planting areas to help control weed growth.

The ACE program diverts hazardous substances from disposal as hazardous waste. Specific guidelines on waste management are provided through an ongoing generator-assistance program. More information on hazardous materials and pollution prevention is found in EWI 5, *Chemical Management*, EWI 17, *Pollution Prevention/Affirmative Procurement (P2/AP)*, and Chapter 17, *Hazardous Materials*.

Surplus equipment, including vehicles, computers, furniture, communication equipment, construction equipment, lab equipment, and other items, are managed at ARC by returning them to a central warehouse/storestock location. Center personnel can select needed equipment from the stock for a period of about one month. Equipment not claimed after this period is donated to area schools. Following selection by the schools, the surplus equipment is sent to the General Services Administration to auction online.

### 21.3.9 Turn Off Computer and Lights When Leaving a Room

To be energy efficient, individual civil servant and contractor personnel are encouraged to practice energy conservation throughout ARC facilities. The use of energy efficient lighting and appliances is highly recommended and generally implemented. Turning off equipment and lights when going home saves energy and reduces costs. Further discussion on energy is in Chapter 15, *Public Services, Utilities, and Energy*.

### 21.3.10 Decrease Use of Water

Individual employees at ARC reduce water consumption and costs by using less water throughout the center. ARC spends more than \$100,000 per year to import fresh water and to dispose of the wastewater. Unnecessary use of potable water is wasteful. To conserve water:

- Do not leave the taps running (unless flushing pipes at the request of the Environment Office).
- Work in partnership with water suppliers to encourage other civil servants and contractors to make the most efficient use of water and become increasingly aware of the impact of water use.
- Install increasingly efficient appliances/processes.



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### 21.3.11 Decrease Use of Paper

ARC has copy machines capable of two-sided copying. ARC also purchases paper with a 100 percent post-consumer recycled content. Employees are encouraged to make double-sided photocopies and to always use two sides of paper before disposing of paper in recycling bins. ARC also encourages the use of email and electronic files instead of creating excess paper copies and paper file systems.

### 21.3.12 Other Tips for Reducing Environmental Impact

Use of coffee mugs instead of Styrofoam or other disposable cups is encouraged. Make sure the vehicles are tuned up, and avoid any leaks or adverse emissions from vehicles.

### 21.3.13 Sustainability at ARC

Accepting the concept that sustainability is the integration of ecological, economic, and cultural concerns, individual and community activities should be conducted in a sustainable manner. It is ARC policy to:

- Have sustainability indicators to evaluate how well ARC activities are conducted to meet desired goals
- Plan for sustainability using objective and subjective information, including hard data and perception of trends
- Minimize environmental impacts on the neighboring community and create a healthy environment for workers, visitors, and neighbors
- Communicate and disseminate the concepts in this and other chapters of this document to ARC employees
- Maximize the reuse of resources, use resources efficiently, and minimize the consumption of raw material resources (energy, water, land, and materials) from construction to the end of facilities' useful lives
- Seek renewable energy sources as opposed to using fossil fuels. Design facilities for long-term durability, flexibility, and eventual reuse. Protect and restore the natural environment
- Move beyond traditional quality criteria involving schedules and budgets and move toward sustainability by including conservation of resources, promotion of a healthy workplace, and avoidance of environmental degradation
- Rent equipment that is only used occasionally and purchase remanufactured office equipment
- Purchase concentrates and products with minimal packaging and reclaim reusable parts from old equipment
- Send meeting minutes via email or post minutes on a server
- Provide and use recycling bins, post waste reduction signs to remind personnel to recycle, and buy recyclable paper byproducts whenever possible