



NASA Post Occupancy Evaluation Guidebook



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Executive Summary

Center activities are driving the evolution - incorporating industry best practices to insure the most economic life cycle cost with the least impact to the environment. Through shared lessons among NASA's established community of practice and sustainability leaders, our Centers have been successful in delivering facilities that are maximizing the environmental, energy, health, safety, and productivity benefits. As NASA's ideas and successes spread further across the agency, NASA is also realizing the benefits of cost savings while achieving energy reduction goals.

The intent of the NASA Sustainable Buildings Post Occupancy Evaluation (POE) Guidebook is to continue on the successes at the Center level and share the practice of Post Occupancy Evaluations to further our knowledge on the impact our investment in sustainability has on users and buildings. The Guidebook has been created to illustrate and teach NASA facility project managers, design teams, construction teams, and other key stake-holders the POE process. The results of the POE process enables NASA to better plan, develop, construct, occupy, and maintain current and future LEED facilities, as well as assist in the implementation of the agency's sustainability initiatives in the future.

Four major chapters comprise this Guidebook, outlined in chronological order as one would approach the POE process. The main components are the "Introduction," "POE Planning and Preparation," "Performing the POE (Site Visit)," and "Writing the Report." A brief description follows:

Introduction:

The POE is an assessment of the design and delivery process from initiation (procurement and pre-design stages) to facility turnover and through the early stages of occupancy. This Chapter describes the purpose and benefits of a POE.

POE Planning and Preparation:

This section outlines the tasks that should be accomplished before performing the POE site visit enabling the evaluation process to proceed smoothly. It discusses understanding the scope of project, bringing together and collaborating with all Project Team members, scheduling in-brief meetings, developing agendas and site visit schedules, obtaining and reviewing data prior to the site visit, understanding benchmarks, and general POE preparation.

Performing the POE (Site Visit):

Performing the POE (Site Visit) involves the activities at the project location. This is one of the last times the entire Project Team is brought together to discuss the project process, as well as how the building functions compared to the intended design. Components include conducting in-brief and out-brief meetings, facility walkthroughs, obtaining additional data, reviewing documents on site, and

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conducting the interview surveys. The interview surveys are further elaborated upon in the Guidebook, and include:

- Process Evaluation Survey
- The Facility Manager Survey
- O&M Survey
- Building Occupant Survey

Writing the Report:

This section focuses on final preparation and organization of the report, discussing how to review, analyze, and synthesize information received throughout the POE process, and compare facility consumption readings and operation & maintenance data with national and regional benchmarks.

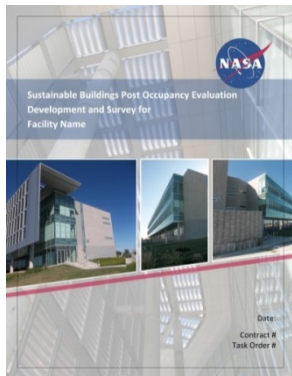


Figure 1 – Report Cover

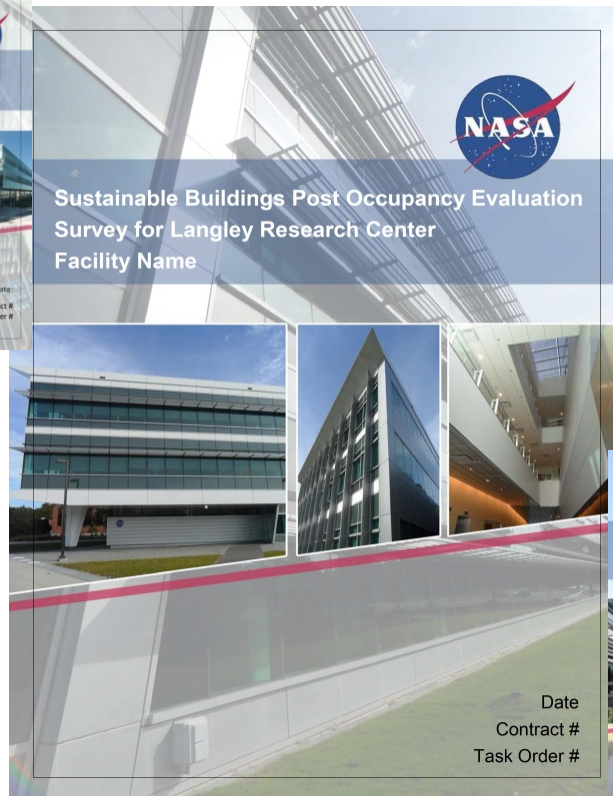


Figure 3 – Report Cover



Figure 2 – Report Cover

Once completed the goal is to have a comprehensive NASA POE Report written to educate all administrative, facilities, design and construction team members on the lessons learned/best practices, the procurement process, project communication, occupant environment, and operating sustainable facilities.

1. Introduction

1.1 NASA Facilities and Sustainability

In January 2006, National Aeronautics and Space Administration (NASA), along with 21 other federal entities, signed a Memorandum of Understanding (MOU) for the *Federal Leadership in High Performance and Sustainable Buildings*. Through this MOU, NASA committed to Federal leadership in the design, construction, and operation of high performance, sustainable buildings. Also in 2006, NASA began carrying out a 2004 directive requiring new construction or major renovation projects over to attain the minimum certification level of “Silver” from the U.S. Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) program.



Figure 4 – LEED Platinum Plaque

A primary goal of LEED and sustainable design is to improve building performance and maximize occupant comfort and satisfaction, while minimizing environmental impact and costs. Through this POE process, NASA is attempting to better understand the actual performance of its sustainably designed buildings and to acquire Lessons Learned/Best Practices which can be applied to future sustainable projects throughout the Agency.

1.2 The POE - Overview

The POE is an assessment of the design and delivery process from initiation (procurement and pre-design stages) to facility turnover and into building occupancy. The assessment evaluates the actual performance of the building in terms of energy and water use, carbon emissions, ease of operation and maintenance, and building occupant satisfaction and comfort. Many performance criteria are benchmarked against industry-accepted national and regional standards. The Benchmarking process involves collecting annual facility consumption data including annual water usage, annual energy usage, and annual O&M costs. The data is analyzed and compared to nationally and regionally recognized industry standards. Findings and data collected through the POE process are benchmarked against:

- Water efficiency – Federal water use index
- Energy – Commercial Building Energy Consumption Survey (CBECS)
- Greenhouse Gas Emission – ENERGY STAR Carbon Emissions from Building Energy Use

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- Operations and Maintenance Costs – International Facility Management Association (IFMA) Research Report 32: O&M Benchmarks and Building Owners and Managers Association International (BOMA) Experience Exchange Report
- Occupant Satisfaction – Center for the Built Environment (CBE) IEQ survey

The assessment also uses the input of key stakeholders involved in the development and ongoing care of the building. The following are the surveys used to gather pertinent building information.

- The Process Evaluation Survey: evaluates the design and the delivery process from procurement and pre-planning phase to the occupancy of the facility.
- The Facility Manager Survey: an evaluation tool for the Facility Manager who has regular contact with the occupants and Operations / Maintenance (O&M) teams.
- The O&M Survey: for personnel who are involved in the day-to-day operation and maintenance and repair of the facility and its direct surroundings.
- The Building Occupant Survey: a survey of a percentage of people who spend the majority of their day working in the facility. The survey is intended to capture input from a hierarchy of positions regarding their surroundings throughout the facility.

Another critical component of the assessment is the facility walkthrough with team members intimately knowledgeable about the workings of the facility. A facility walkthrough is conducted in two stages: an initial walkthrough to allow the POE Team to become better acquainted with the POE facility and a second in-depth walkthrough after the completion of the surveys.

1.3 Benefits of the POE

The POE helps NASA to:

- Measure a project's success or failure from a variety of perspectives including but not limited to pre-design, building planning, LEED implementation, construction, and occupation
- Identify short and long-term problems in the building and outline possible solutions
- Improve building energy and utilization performance
- Establish a design and team strategy baseline for future projects of similar nature
- Improve space utilization based on feedback from building occupants
- Acquire Lessons Learned/Best Practices for new construction and major renovation of similar NASA facilities
- Improve aesthetics for future projects
- Improve project delivery processes for future projects



Figure 7 - Charging Station for Electric Vehicle

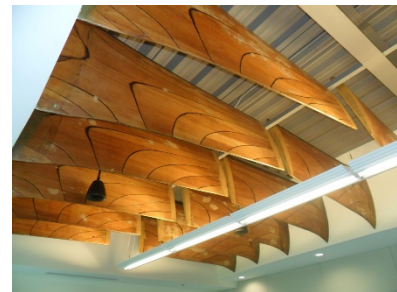


Figure 6 - Reclaimed Wind Tunnel Blades



Figure 5 – Photovoltaic Panel Array

2. POE Planning and Preparation

The success of a POE is highly dependent on how well the POE planning and preparation is executed. Having knowledge about the scope of the project, knowing contacts at the Facility, identifying key stakeholders in the project, scheduling site visits, organizing survey respondents, creating meeting agendas and itineraries, obtaining data, and reviewing all project documents helps the evaluation process to proceed smoothly.

2.1 When Should the POE be Conducted

The entire Project Team should commit to conducting the POE during the inception of the project. This way all team members have the contractual understanding what is required of them during the course of the design, construction, and occupancy periods. Having this commitment early allows a greater database of Lessons Learned / Best Practices assembled as the project is developed.

The Project Team can start compiling both challenges and successes, and begin tracking them while they are still fresh in the teams' mind after the completion of each phase of the design and construction process. The most pertinent challenge and success topics are those which can be relayed throughout NASA and potentially considered on future facility projects. Suggested design phases:

- Procurement and pre-planning
- Planning and design phase
- Construction
- LEED crediting
- Closeout and occupancy

NASA's intent of the POE is to evaluate the design and delivery process as well as to evaluate the overall building performance (operational, maintenance and occupant satisfaction) of the completed facility. 12-18 months after occupation is the best time to conduct the POE itself given the facility's systems has cycled through all four seasons, the O&M teams are intimately familiar with the operations of the building, and occupants have acclimated to their new surroundings. People begin to forget issues, concerns, and lessons learned (and personnel turnover can occur) if the POE is conducted much longer past full occupancy.



Figure 8 – LEED Building / Sustainable Education Signage



Figure 9 – Conference Room

2.2 Who Conducts the POE

Each NASA Facility can choose to perform the POE Assessment using their own staff or contract with a third party to perform this service. At the inception of the project, the Center undertaking the project should determine whether they want to leverage the expertise of available in-house staff or use an unbiased third party to perform the work after occupancy.

2.3 Who Should be Involved with the POE Interview

The interviewing process of the POE involves many groups of people such as the Center Administration, Facility Manager, CoF Project Manager, the Architect / Engineering team, Contractor or Construction Manager, O&M staff actively maintaining the facility, and its occupants. The involvement of differing disciplines and areas of expertise over the lifetime of the project is imperative in conducting a Post Occupancy Evaluation. Bringing about multiple perspectives from participants allows personnel feel more comfortable their issues are being heard and possibly addressed.



Figure 10 – General office spaces

The POE interviews involve:

- NASA HQ and NASA Center Administration Key Stakeholders
- The POE Assessment Team
- Facility Point of Contact (POC)
- The NASA Project Team
 - Procurement Managers
 - CoF Project Managers (NASA)
 - Facility Manager(s)
 - Any other personnel involved with the facility design
- The Design Team (will vary based upon project delivery method)
 - Criteria Architect Team
 - A/E Contract Documents Team
 - LEED Specialist(s)
- Contractor or Construction Manager Personnel
 - Project Manager
 - Site Superintendent

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- Operations and Maintenance Personnel
 - Building mechanical, electrical, and plumbing maintenance (hot/cold)
 - Custodial maintenance
 - Site maintenance
- Building Occupants

2.3.1 NASA Facility Role

Currently, POE assessments are assigned and developed through the NASA HQ Facilities Engineering Division. The intent of this Guidebook is to transfer the knowledge from NASA HQ to the Centers so they can implement the POE on their own. NASA Center's role:

- Assign a budget figure for this work to the overall Project cost.
- Develop a scope of work including required deliverables and schedule.
- Identify the objectives and focus of the project and communicate them to other NASA team members.
- Procure or Assign the POE Team.
- Assign appropriate in-house staff to the project and a NASA Facility POC for the POE assessment. Generally someone who has good working knowledge of the facility to be assessed should serve as the POC.
- Provide support to the POE Team.
- Review and accept the POE reports.
- Share the Lessons Learned / Best Practices with the Agency.

2.3.2 The POE Assessment Team

The POE Assessment Team (also known as the POE Team) is the group of professionals from the Design and Construction industry who will conduct the evaluation. The POE Team is comprised of:

- Architect
- Interior Designer
- LEED Specialist
- Mechanical / Plumbing Engineer
- Electrical Engineer
- Specialty Engineer if required



Figure 11 – Landscaping

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- Technical Writer/ Quality Control
- Admin Support

Unless otherwise directed, the POE Team generates and conducts the entire POE on behalf of NASA, including all agendas and itineraries, scheduling, sign-in sheets, interviews, site visitation, data collection coordination, benchmarking, and draft and final report writing. The POE Team lead represents the entire POE Team, coordinating between NASA HQ, the POC, and other pertinent personnel.



Figure 12 – Meeting Room

2.3.3 NASA Facility Point of Contact (POC)

The facility POC is the key person who represents the in-house NASA facility project Team. The POC is appointed by the individual NASA Center and must have strong knowledge of the facility. Prior to the POE site visits, the POE Team lead will send the POC the surveys to allow the individuals to be surveyed time to remember and research questions. The POC will be responsible for following:

- Providing access to the Center and facility.
 - All NASA facilities are secured, so the POE Team is subject to stringent security procedures before they are allowed to enter the site. These procedures differ from Center to Center, but the facility POC should communicate well in advance with the POE Team to gather required security background information (i.e. full names, country of citizenship, social security number, one or two photo IDs, etc.) - at least two weeks prior to the schedule POE site visit.
- Define the lines of communication between the team members and the POE Team. This should be established at POE kick-off meeting.
- Work with the POE Team lead to create the site visit itinerary, interview schedule, and meeting agendas.
- Ensure the proper POE survey participants have reviewed the surveys (distributed by the POE Team lead), and are organized and prepared to support the POE process.
- Provide the POE Team with a full directory of participants with name, title, phone number & email address, brief statement on project involvement, and job description.

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- Re-confirm specific times in advance with Facility Manager, O&M personnel, building occupants, and other required employees for in person interviews and facility walkthroughs.
- Notify building occupants in advance of the POE site visit.
- Coordinate and schedule access to all controlled sections of the building during site visit.
- Organize and reserve conference rooms for all interviewee meetings.
- Request, receive, and disseminate required facility data to the POE Team including water and energy consumption and maintenance costs.

2.3.4 The NASA Project Team

The NASA Project Team includes the Procurement Manager, CoF Project Manager, Facility Manager, Center O&M personnel with input into the building design, and other key staff involved in the design or construction of the facility. These team members have intimate knowledge on behalf of NASA as owner in terms of contracting methodology, scope of services, A/E team oversight, project management, customer interaction, operations and maintenance staffing, building startup, occupancy, and ongoing concerns. One of the most important roles in the POE process is the Facility Manager or Facility Manager Alternate (this terminology differs Center to Center). This person is normally a good option as a facility POC. The Facility Manager is typically responsible with the coordination of space, infrastructure, work orders, and building occupant concerns associated with the facility. Either the Facility Manager or the Alternate is a key person leading the facility walkthroughs and are the only participants in the Facility Manager Survey.



Figure 13 – Exterior View of Facility

2.3.5 The A/E Design Team

The Project Design Team includes all disciplines who were involved in the design and delivery of the facility from procurement stages through construction. They are the key participants in the process evaluation survey and provide insight into construction documents, specifications, calculations, contracts, addendums, as-built drawings, building theory and methodology, Lessons Learned/Best Practices, LEED documentation, etc.



Figure 14 – Exterior Steel Structure

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2.3.6 Contractor or Construction Manager

The Contractor or Construction Manager, depending on delivery method, should participate in the Process Evaluation Survey. They can be invaluable to discuss construction processes, methods, costing, materials or building components, Lessons Learned/Best Practices, facility turnover, warranty reviews / repairs.

2.3.7 Facility Manager and Facility Manager Alternate

The Facility Manager and Facility Manager Alternate (this terminology differs Center to Center) is the person(s) responsible for the operation of the Facility and is normally a good option as a facility POC. The Facility Manager is typically responsible with the coordination of space, infrastructure, work orders, and building occupant concerns associated with the facility. Either the Facility Manager or the Alternate is a key person leading the facility walkthroughs and are the only participants in the Facility Manager Survey.

2.3.8 Operations & Maintenance Personnel

The O&M personnel are persons involved in day-to-day operation, maintenance and repair of the facility and its direct surroundings, which keeps the facility and its surroundings in working order. This includes mechanical, electrical, and plumbing maintenance, as well as grounds and custodial maintenance. They are the vital stakeholders for smooth facility operation, so it is important to involve them in the Process Evaluation Survey, as well as the O&M Survey in which they are the primary participants. Whenever possible, O&M personnel can be pivotal in the walkthroughs to point out specific areas of concern. With direction from the facility POC, the O&M team provides – where applicable - the following data:

- O&M building costs and records
(12 months record minimum)
- Utility consumption data and costs for water, electrical, and natural
(12 months record minimum)
- Utility consumption data for central steam and/ or chilled water
(12 months record minimum)



Figure 15 - Recycling Bins



Figure 16 - Recycling Bins Options

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- Grounds maintenance costs and records
(12 months history minimum)
- Custodial costs and records
(12 months history minimum)

2.3.9 Building Occupants

Building occupants are those who spend the majority of their work day within the facility undergoing the evaluation, and whom utilize the facility more often than any other stakeholder. Comfort and satisfaction of building occupants are important for good performance, higher productivity, and ingenuity. The occupant satisfaction survey is done in one-on-one interviews scheduled by the facility POE and Facility Manager. 10% of the building population – or a maximum of 10 building occupants – are to be interviewed unless otherwise required by the Center.

2.4 Meetings & Agendas

Formal meetings during the POE process include the following:

- Pre-site Visit Conference Call – first collaboration meeting between the POE Team and the NASA Center.
- In-Brief Meeting – first meeting during the POE visit otherwise known as the kick-off meeting.
- Out-Brief Meeting – final meeting during the POE visit.

2.4.1 Pre-Site Visit Conference Call

The pre-site visit conference call is arranged at the latest two weeks before the site visit by the POE Team and formalized with an agenda. It is organized by the POE Team in coordination with the NASA POC. Personnel to be invited to the conference call are: NASA HQ representative, NASA Center POC, the POE Team, and other pertinent key stakeholders. Individuals from the Project Design Team, Facility Manager, and O&M personnel may be valuable to have on the conference call, but are optional.

The conference call should be led by the POE Team lead and covers:

- Overview of the POE process: review with all participants what the POE is and outcomes.
- Discuss agenda for the POE site visit: Review the proposed schedule agenda (Refer to 2.5 Scheduling for the agenda schedule example) and work hours.

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- Confirm timeframe and responsible party who provides drawings and data to the POE Team.
- Specify contact information, identify the Facility POC, and identify any security challenges for the Center including type of information required in order for the POE Team members to receive badges.

Refer to Figure 18 for sample POE pre-site visit conference call agenda.

NASA POST OCCUPANCY EVALUATION (POE) Conference Call for:
Center Name, Building Name/No. – Month Day, Year

I. Overview of POE

- a. What is the POE?
 - i. The Post Occupancy Evaluation (POE) is to help develop a report with a focus towards assessing the sustainability aspects of facilities. This will help NASA better plan, develop, construct, occupy, and maintain LEED facilities.

II. Discuss Agenda for POE Site Visit

- a. Any issues with dates, personnel, or anything else? Typical work day hours?
- b. List of Building Occupants to be interviewed – schedule? Just show up at desk?

III. Recommended drawings to be provided to POE Team. Digital preferable.

- a. Before visit on week of (Month Day, Year): PDFs of site plan, floor plans, and design analysis.
- b. Before, during, or after visit: CDs of PDFs with as-built, utilities data (cost and consumption amounts of water, electricity, gas, steam, chilled water, etc. per month for minimum 1 year), specifications, LEED documentation, "bulletin" or "change order" list, building brochures/ literature, historical work orders, and operations and maintenance costs (broken down costs for minimum 1 year).
- c. Additional, when available: Lessons learned and best practices gathered through the project design process by the Design Team and/or NASA.

IV. Contact information

- a. Where to meet for all meetings and interviews – prefer within Building to evaluate- Name/no.
- b. Main point of contact for POE Team at Building to Evaluate- Building Name/no.?
- c. Escorts for walkthrough?
 - i. Facility/Building Manager and one OM personnel familiar with the building systems preferable.
- d. Badges and other security information

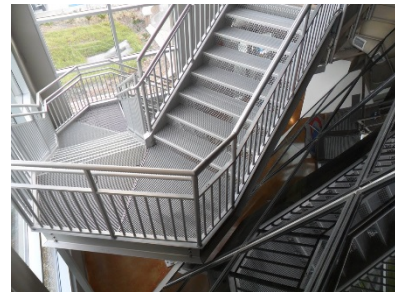


Figure 17 – Stairway

Figure 18 - Sample POE Pre-Site Conference Call Agenda
(Refer Appendix – J for full size document)

2.4.2 In-Brief Meeting

The In-brief meeting is held on site as the first meeting of the POE. The Agenda and minutes therefrom is prepared by the POE Team. Personnel to be invited to the meeting include the NASA HQ representative, NASA Center Administration, the NASA Facility POC, the POE Team, the Project Design Team, Facility Manager(s), O&M personnel, Contractor / Construction Manager, and other pertinent key stakeholders. Building occupants – such as managers or directors – may be involved, but are not required. The NASA POC confirms attendance with all participants (exclusive of the POE Team) and reserves a meeting space. Holding the In-Brief Meeting in the facility undergoing the POE is recommended if space allows. The POE Team Leader is responsible for conducting the meeting. The In-Brief meeting agenda should cover:

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- Team introductions.
- Review of scope of work and objectives of the POE (typically led by the NASA HQ representative).
- Additional project communication procedures.
- On-site POE schedule (Refer 2.5 Scheduling for the agenda schedule example).
- Project report completion milestones.
- Expectations for document collection not yet received.
- Open Forum – ability for any type of open discussion relative to the POE process.

PROJECT TEAM IN-BRIEF MEETING AGENDA
POST OCCUPANCY EVALUATION (POE) CENTER NAME – BUILDING NAME/NO.

Project Name: Post Occupancy Evaluation **Center Name- Building name & number**
Date: **Month Day, Year**
Time: Duration
Meeting Location: **Building, Floor, Room no.**

The following items are discussion topics for the POE Project Team Kickoff meeting:

- Team Introduction – name, company, project role
- NASA to review project objectives and priorities (Pete Aitcheson)
 - NASA's POE goals
- Project Communication – best communication method for each team member, best time to reach you
- Evaluation of the Overall Agenda / Schedule for Survey
- Project Schedule – benchmark / milestone dates and project report prepared by **Firm/Department**
 - Draft Report – 4 weeks – **Month Day, Year (Submission Date)**
 - Government Review –3 weeks – **Month Day, Year (Receiving Date)**
 - Final Report –3 weeks – **Month Day, Year (Submission Date)**
- Project Reviews –Identify who should NASA HQ send additional copies at NASA building for Draft Report review?
- Existing Document Review Expectations
 - RFQ, Construction Drawings (as-built), Record Specifications, Final LEED Submission, Utility Data and Bills, Value Engineering, Change Orders Documentation, Bulletins (affecting scope of work), O&M Work Orders, O&M Costs (mechanical systems and custodial), Lessons Learned Report
 - Identify, how/from whom do we obtain additional information outside of this meeting?
- Open forum/Discussion



Figure 19 – Salvaged Turbine Blades

Figure 20 – Sample POE In-Brief Meeting Agenda
(Refer Appendix – J for full size document)

2.4.3 Out-Brief Meeting

The POE Out-Brief meeting is held on site at the end of the POE site visit. The Agenda is prepared by the POE Team. Anyone involved or invited to the previous In-Brief meeting should be included in the Out-Brief. The Out-Brief meeting agenda includes:

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- Summary of events of the site visits.
- Identify outstanding issues and procedure for follow up communication.
- General discussions.
- Review of next steps/schedule for the report.
- Open forum discussion.

PROJECT TEAM OUT-BRIEF AGENDA
POST OCCUPANCY EVALUATION (POE) CENTER NAME-BUILDING NAME/NO.

Project Name: Post Occupancy Evaluation Center Name-Building name/no.
Date: Month Day, Year
Time: Duration
Meeting Location: Building Name, Floor, Room No.

The following items are discussion topics for the POE Project Team Out-brief meeting:

- Introductions – of those persons not present in the kick-off meeting or interviews
- Next Steps
 - Project Schedule – benchmark / milestone dates and project report prepared by Firm/Department
 - Draft Report – 4 weeks Month Day, Year (Submission Date)
 - Government Review – 3 weeks Month Day, Year (Receiving Date)
 - Final Report – 3 weeks Month Day, Year (Submission Date)
- Identify, how/from whom do we obtain additional information outside of this meeting?
- Open forum/Discussions
 - Questions
 - Comments
 - Concerns

Figure 21 – Sample POE Out-Brief Meeting Agenda
 (Refer Appendix – J for full size document)

2.5 Scheduling

2.5.1 Project Schedule

The following is a typical project schedule associated with the procurement of a third party POE Team. The durations below are defined in calendar days / weeks and should be established by NASA in the Statement of Work (SOW).

<u>Project Milestone</u>	<u>Duration</u>	<u>Activity</u>
Award/Start date		NASA awards the project
Planning	4 weeks	Data Collection
Site visit	3 days	Timing is dictated by NASA Center
Draft Report	4 weeks	Commences after the site visit
NASA Review	3 weeks	
Final Report	3 weeks	After NASA review

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The POE Team lead prepares the proposed project schedule with specific dates for review by the Center and the Facility POC. NASA’s responsibility is to approve the schedule prior to the site visit so expectations of all team members can be established at the In-Brief Meeting.

Date:

National Aeronautics and Space Administration (NASA)
 300 East Street, SW, Suite 5H79
 Washington, DC 20546

RE: NASA Post Occupancy Evaluation (POE) at Facility Name & No.

Dear Address POC,

The proposed schedule is as follows:

Schedule		Dates Range
Award/ Start Date		07/03/2012
Site Visit	3 days	09/18/2012 – 09/20/2012
Draft Report	4 weeks	09/21/2012 – 10/19/2012
NASA Review	3 weeks	10/19/2012 – 11/09/2012
Final Report	3 weeks	11/09/2012 – 12/04/2012

**Schedule to remain flexible per centers' requirements.
 **All dates are based off Time Commitment Services Proposal.

Please review the project schedule and provide any thoughts or comments.

Best Regards,



Figure 22 – Natural Day Lighting in Office Area

Figure 23 – Sample POE Project Schedule
 (Refer Appendix – J for full size document)

2.5.2 POE Site Visit Activities

The POE site visit activities typically require three days to complete. This agenda is confirmed by the Facility POC who schedules all NASA personnel and contractors accordingly. This agenda should also be distributed to all POE Team members. Activities typically include the following in order:

- Gain access to site Day 1
- In-Brief Meeting Day 1
- Quick walkthrough Day 1
- Additional Document Collection & Review Day 1
- Process Evaluation Day 1
- Facility Manager Survey Day 2
- O&M Survey Day 2

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- Building Occupant Survey Day 2 and 3
- FM and O&M Surveys Day 2 and 3
- Site visit and Tour Day 3
- Out-Brief Meeting Day 3

Along with the above activities, the site visit agenda should also be provided by the POE Team, and utilized during the pre-site visit conference call and on-site kick-off meeting. Allowing the NASA Center and POC to review the site visit agenda prior to the site visit aids the POC in scheduling necessary personnel for the interviews.

NASA POST OCCUPANCY EVALUATION (POE) Visit Agenda:
Center Name, Building Name/number – Month Day, Year

7:30 am - Gain access to Center - *Schedule herein to remain flexible*

I. In-brief – Kick-off, Review of Scope of Work

a. Tuesday (8:00am-9:00am Room 227)

i. Objectives, Process, Expectations, Schedule.

II. Quick walk-through of N232

a. Tuesday (9:15am-9:45am)

i. Quick tour and highlights of building to get POE Team acquainted with facility.

III. Document Collection and Review

a. Tuesday (10:00-11:00am Room 227)

i. Quick Review of physical Drawing Set for POE Team. Collect CDs of PDFs with as-builts, utilities data (water, electricity, gas, etc.), operations and maintenance costs, specifications, LEED documentation, historical work orders (bulletin or change order list), and lessons learned and best practices gathered through the project design process.

1. All information to be provided electronically when possible.

2. NASA to gather additional documents after site visit as required.

IV. Process Evaluation

a. Tuesday (1:30-4:30 pm Room 227)

i. Team members from AE and LEED AP (if available); NASA Project Design Team for Project including Project Manager, Facility Manager, O&M personnel involved on Project Design, and Construction Manager; and others pertinent to the design of the facility.

V. Survey Assignments

a. Wednesday Team 1 (9:00-11:30am Room 225) Facility Manager(s) Survey

1. Facility/Building Manager and Facility/Building Manager Alternate of N232.

b. Wednesday Team 1 (1:30-3:30am Room 225) Operations & Maintenance Survey

1. O&M personnel with day-to-day HVAC, electrical/telecom, plumbing, and other applicable building systems.

c. Wednesday Team 1 (4:00pm-4:30pm Room 225) O&M Survey – Custodial/Site

1. Custodial and Site personnel involved with the upkeep of interior and exterior maintenance.

d. Wednesday Team 2 (8:00pm-4:30pm Room TBD) Building Occupant Survey – 10 building occupants

VI. Site Visit and Tour

a. Thursday (8:00am-10:00am)

i. POE Team to be escorted for facility tour – FM, PM, and one OM personnel.

b. Thursday Team 2 (8:00am-10:00am Room TBD)

i. Continue Building Occupant Surveys (if necessary).

VII. Out-brief

a. Thursday (10:00am-10:30am Room 227)

i. Summary of Events, Follow up communication / outstanding issues, Open Forum.

VIII. General Logistics

a. Access (keys, escorts), Facilities Personnel, Internet Access at Facility

**Figure 26 – Sample POE Site Visit Schedule
 (Refer Appendix – J for full size document)**



Figure 25 – Native Plants in Landscaping



**Figure 24 – Window Treatment/
 Automated Shades in Conference Room**

2.6 Facility Documents, Data, and Costs Collection, Review, and Benchmarking

This section describes the collection and review of all facility documentation, data, consumption, and cost information. It is preferable to the POE Team to receive information from the Facility POC prior to the site visit so that it can be reviewed and referenced during the site visit. This enables the POE Team to be prepared prior to conducting the evaluation. At a very minimum the following documentation is required prior to the site visit:

- Site Plan
 - Complete site plan, preferably from the as-built drawing set, showing parking and landscaping around the facility and included within the project's scope. Allows the POE to become acquainted with the building's surroundings.
- Floor Plans
 - Preferably as-built floor plans showing a general overall layout of the facility, to allow the POE Team to become acquainted with the building's general layout. If Contract Documents are provided prior to the site visit, both the site and floor plan requirements are satisfied.
- Design Analysis
 - Summary typically required to be written by the Architect and/or Engineer of Record, although sometimes provided by the Center, briefly describing the project's goals, intent, and scope. Also known as the design summary, and usually provided within the contract documents. Usually gives the POE Team a good first over-reaching idea of the facility's concept and environmental technologies.
- General Facility Data
 - Basic breakdown of the facility to be provided by the Center. See 4.2.1 for the type of information to be provided.
- LEED Documentation
 - All LEED documentation used in USGBC submissions including checklists, diagrams, and simulation model images. The final accepted checklist is required and previously submitted or rejected checklists are beneficial.



Figure 27 – Exterior Views from Open Office Area

acquainted with the

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Information required either before, during, or immediately after the site visit:

- Complete As-Built Drawings.
 - Full contract document set – also known as design documents - including architectural, interior design, mechanical, electrical, plumbing, security, data/telephone, structural, civil, landscaping, and other discipline drawings. If as-built drawings are not available, the final submission “for construction” set will suffice. A complete set of drawings is crucial for the assessment team to ascertain building sections, details, etc. not visible during the site visit.
- Consumed Utilities Data.
 - All utility costs and consumption data associated with the facility undergoing the POE including water, electricity, gas, steam, chilled water, and other energy directly consumed by the facility. There should be at least twelve months of data available to the POE Team (hopefully at least one full seasons of heating and cooling), but additional months are helpful. Costs may be provided in a unit measurement (dollar per unit of measure), or the Center will provide a monthly balance. This data is used in benchmarking alongside O&M costs.
- Generated Utilities Data.
 - Any energy generated by the facility and consumed within the facility including, but not limited to, solar cells, fuel cell systems, and wind turbines. One caveat: if energy is generated at the facility but 100% consumed elsewhere (or added back to the grid), this energy generation will have no effect on building energy consumption. Performance of the energy generators may be evaluated, but their output has no bearing on the facility. If part of the energy is consumed at the facility undergoing the POE and the rest goes back to the grid (or other facility), then this generation should affect the consumption data. It is important for the POE Team to collaborate with the POC and break down the consumption and generation numbers – is generated energy included in the consumption numbers, or is it metered completely separate?
- Specifications.
 - Technically a part of the Contract Documents. Full format specifications are preferred.
- Bulletin or Change Order List.

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- Any construction logs containing at least: the reason for the change during construction (error and omissions, value-engineering, contractor mistake, etc.), the responsible party, and the cost incurred.
- Building Brochures/ Literature.
 - Brochures and literature used to market the facility undergoing the POE. This can be literature the Center has sent out internally to Center personnel; literature the facility has sent out internally to the facility personnel; literature the Center distributed to media; literature on the NASA website; educational boards used within the facility; and/or any information used to educate people on the facility's environmental aspects and goals. Generally, this takes the form of a PDF, PowerPoint presentation, or web page. A lot of the information for "General Facility Data" above can be gathered from this documentation.
- Historical Work Orders.
 - These include work orders from custodial maintenance issues not covered in the base custodial contract (like an overnight toilet overflow) to a mechanical system shutting down. A minimum of twelve months is needed for a full year cycle, but additional months are advantageous. It is important for the POE Team to understand there may be large, expensive work orders within the first year of occupancy covered under building warranty. Work orders provided by the Center which were covered under warranty and therefore not paid for by NASA should not be included in any operations costs calculations. These are used in conjunction with O&M costs below for benchmarking, as well as to see if there are any reoccurring maintenance issues.
- Operations and Maintenance Costs.
 - Operation and maintenance costs are comprised of mechanical, electrical, plumbing, custodial, site, and other building maintenance-related expenditures. A sum total of all these expenditures are used in O&M benchmarking per 2.6.2.7 and 4.2.4.3.5.
 - Building Systems: these include historical work order costs for mechanical, electrical, and plumbing issues. The work orders should be adjusted accordingly per inapplicable work orders – based on the POE Team's judgment (see Historical Work Orders above). The Center may provide these costs as either a total annual sum, and/or provide the work order list over the previous year. Receipt of the work order list is more beneficial since it allows the POE Team to review the expenses.
 - Custodial Maintenance: these are generally provided as an annual lump sum based on the custodial contract. The Center may not have

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each individual building as separate line-items, but should be able to make a good estimate based on square footage of the facility. Addition work performed by custodial due to unforeseen circumstances is usually provided in the work orders. Custodial maintenance contract requirements vary.

- Site Maintenance: similarly to custodial maintenance, this is usually provided as a lump sum by the Center based upon the Center's site maintenance contract.
- Data Benchmarks (national/ federal standards and local guidelines), gathered by the POE Team, which serve as benchmarks for the specific building information collected. Refer to section 2.6.2 Facility Annual Utility consumption Data.
- O&M Manual.
 - If available electronically, the POE Team seeing the O&M manual(s) allow the team to assess what was provided after facility turnover per adequate parts lists, troubleshooting guides, maintenance instructions, etc. The manuals sometimes may only be provided as a hard copy, and therefore can only be viewed on site. It is not necessary for the Center to provide the POE Team and hardcopy O&M manual.

Additional information, if available:

- Lessons Learned/Best Practices from the A/E Design Team, Construction Team, and NASA PM.
 - Any Lessons Learned throughout the entire life of the project is helpful in the POE report. If available, these are usually generated/ collected during the construction phase and post occupancy phase through an e-mail or Word DOC. Since pre-design and construction phases may have occurred years prior to the POE, these may hold very clear, poignant insight into the process.

2.6.1 General Facility Data

General Facility Data like building location, function, size, number of floors, number of occupants, hours of operation, total building costs, utility sources, structure type, roof type, building systems, etc. is information which can be collected before the POE site visit, and confirmed during or after the visit with the Facility POC.

2.6.2 Facility Annual Utility Consumption Data

The facility annual utility usage and costs are collected from the Facility POC. They represent at least a 12 month profile for all utilities. If available any additional monthly data is helpful to verify trends in utilities consumption. Utility consumption and costs are then benchmarked against industry standards. It is at the discretion of the POE Team engineers to determine any information gaps and present solutions so the POE Team lead and Facility POC can work to resolve them.

2.6.2.1 Annual Potable Water Usage¹

Annual water usage is calculated in gallons per month and is analyzed and compared with the Federal Water Use Index for similar types of facilities. Water data is obtained from the Facility POC through:

- Water utility metered data
- Facility sub-meter data
- On-site water production metered data

Refer Figure 31 for an example of water consumption data obtained from a facility.



Figure 28 –Sprinkler Lines



Figure 29 – Hand-Sensing Low Flow Faucet



Figure 30 – Water Efficient Fixtures

¹ The Federal Baseline & Annual Water Use Guidance

http://www1.eere.energy.gov/femp/program/waterefficiency_baseline.html

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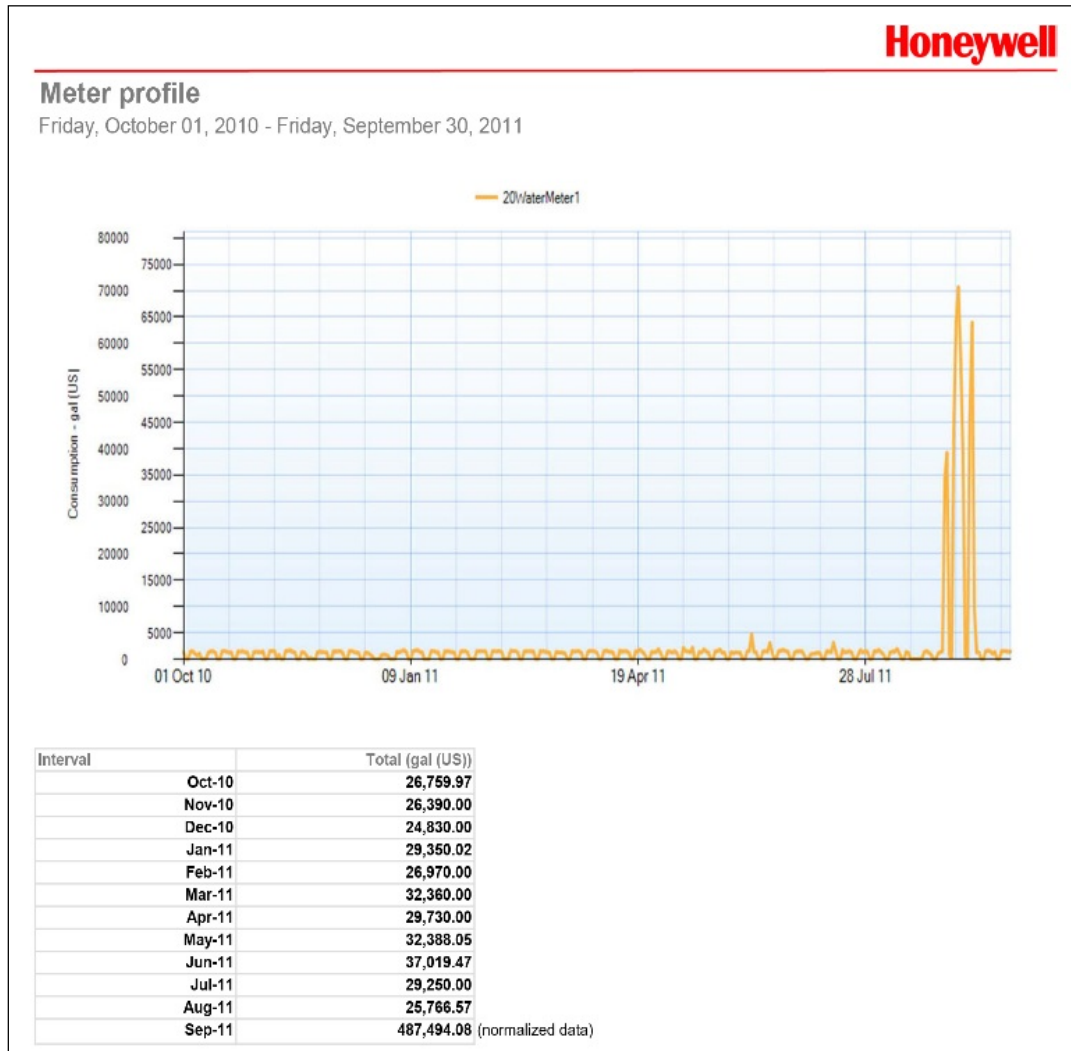


Figure 31 – Example of Water Meter Data Obtained from Facility

Annual water usage is benchmarked against the Federal Water Use Index.

Federal Energy Management Program (FEMP) has Federal Water Use Indices² (sourced from American Water Works Association 1996) as a guide for Federal agencies. They are a rough estimate of water usage at different building types and number of occupants in the facility, in gallons per unit per day. Refer to Figure 32 for an image from the FEMP website.

² http://www1.eere.energy.gov/femp/program/waterefficiency_useindices.html#commercial

As a basis of understanding Federal annual water usage = baseline data for the type of facility X number of occupant on the facility to be benchmarked X days in a year (365)

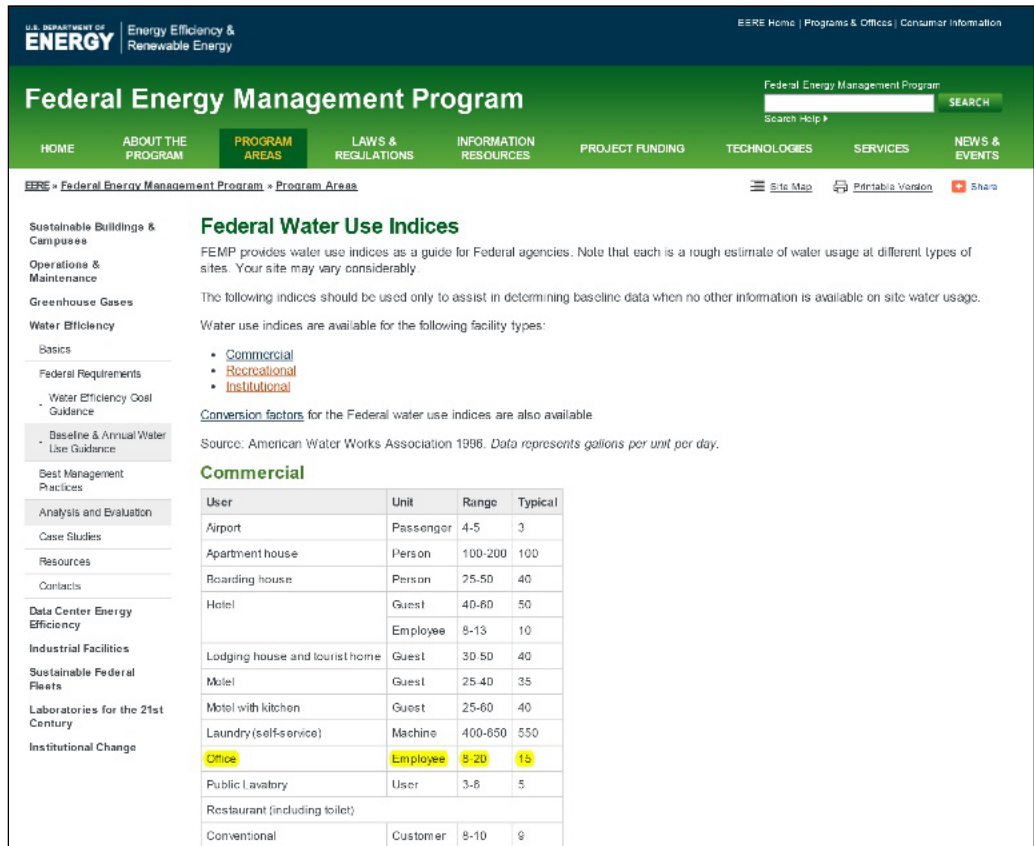


Figure 32 – Federal Water Use Indices for Commercial Facilities

2.6.2.3 Annual Energy Usage

A facility's energy usage is derived from a variety of typical energy consumptions such as power, lighting, heating, and cooling. Additionally, chilled water or steam from central plant must be considered in a facility's energy consumption. Gas is used for heating or powering specialized equipment. When measuring gas usage, the POE Team engineer must convert the facility data to kWh so it can be compared with CBECS benchmarking data. It is also beneficial for the POE Team to obtain metering at the sub panel level to differentiate lighting loads and receptacle loads if the electrical system is designed to provide this information.

In addition to power consumption, some facilities generate power through solar PV panels, fuel cells, wind turbines, and other renewable

resource methods. Power generation should be taken into account per total building annual energy usage as many facilities use this power to run equipment in the building.

Figure 34 below is a sample electrical usage and production data sheet received from a facility.

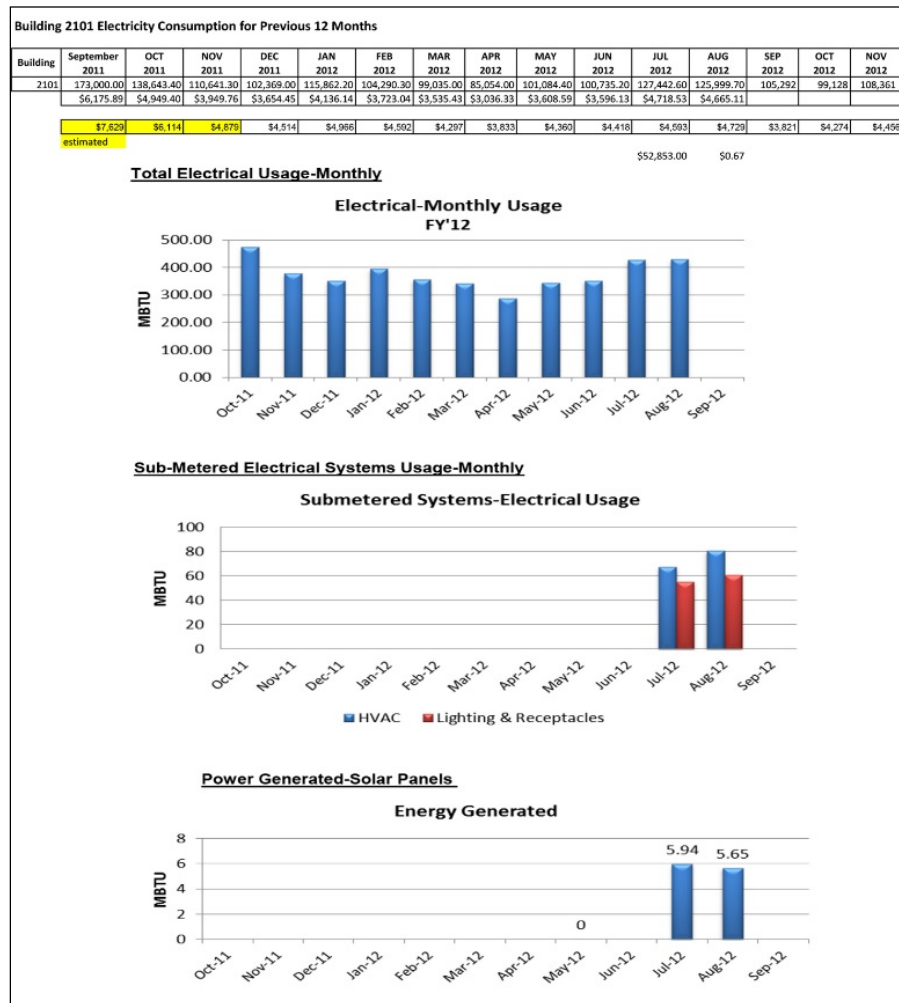


Figure 33 – Sample Electrical Usage and Power Generated Data Received from Facility

2.6.2.4 Energy Usage Benchmarking

U.S. Energy Information Administration’s (EIA) Commercial Building Energy Consumption Survey (CBECS) data is a national and regional level source of data on energy use in commercial buildings authored by Department of Energy. Benchmarked data is based on following:

- Building size

- Age of the facility
- Structural characteristics
- Building activity
- Occupancy
- Operating hours
- Number of employees
- Energy sources and uses
- Energy related equipment
- Energy use and cost data from one year for electricity, natural gas, fuel oil, and/ or central (district) steam

The latest version of CBECS national and regional annual energy consumption benchmark data, based off proprietary, weighted average of variables is used to benchmark against facility energy (kWh) consumption.

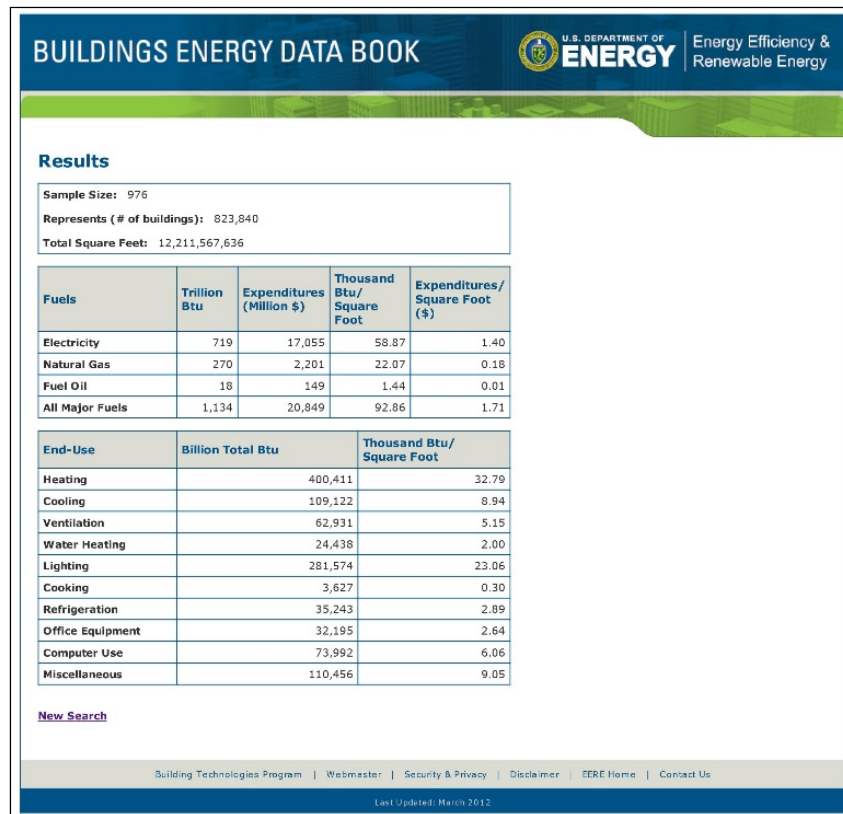


Figure 34 - CBECS National Average Energy Consumption Data

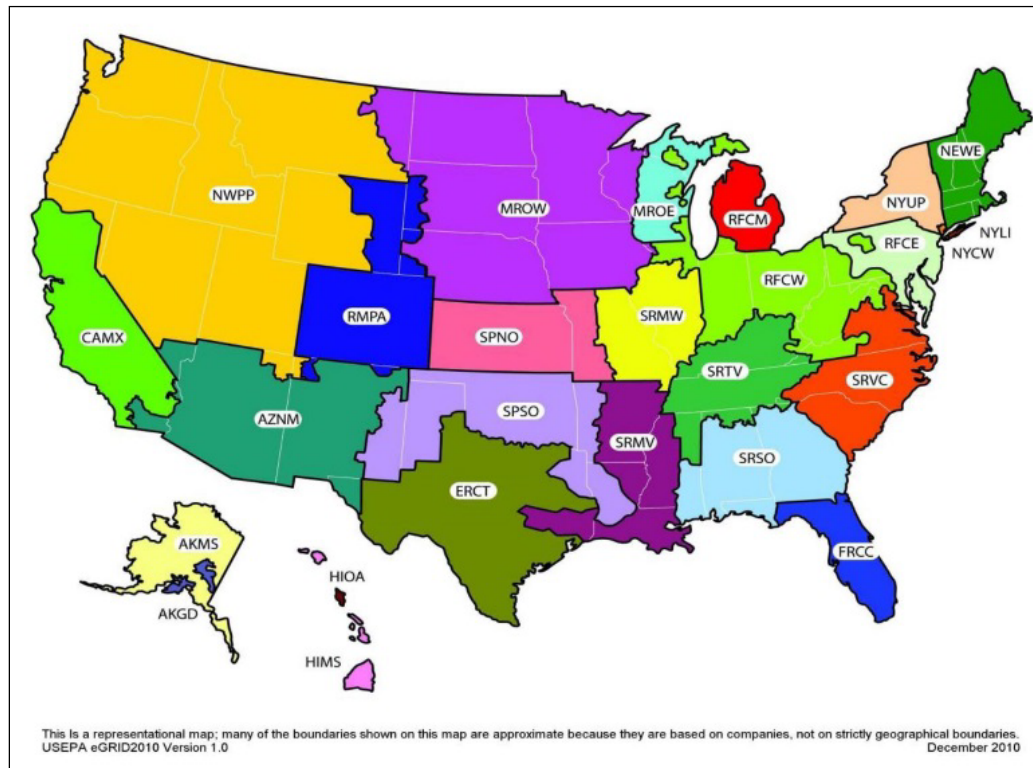


Figure 37 - EPA eGrid Sub-Region Map

2.6.2.7 Facility Annual Operations & Maintenance Data

- The facility operations and maintenance costs should be collected and obtained from the Facility POC. Areas of costs include:
- Facility maintenance and operations cost (12months min history)
- Custodial costs (12months min history)
- Ground maintenance costs (12months min history)

The Facility O&M data is benchmarked against IFMA and BOMA standards for comparable facilities. Refer Figures 38, 39, and 40 for sample work orders and O&M costs obtained from the facility.

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Facility Name Grounds Maintenance Cost

Facility name Grounds Maintenance Cost (12 months) = \$6569.14

Total **Center name** Research Center = 14185630 sq.ft. = 325.66 acres = 100%

Facility name grounds footprint = 124938 sq.ft. = 2.87 acres = 0.88%
(These numbers include parking areas to the south and west of the building and the lawn areas immediately surrounding it)

Total Grounds Maintenance Cost for **Center Name** Research Center (12 months) = \$745,403.20

- Grounds maintenance \$521,878.20
- IDIQ for Salt \$101,127.00
- IDIQ for Snow plowing \$122,398.00

Total cost for grounds maintenance divided by the total acreage of **Center Name** Research Center

- \$745,403.20 / 325.66 acres = \$2,288.90 unit cost

Unit cost times the acreage of **Facility Name** and the parking area/grass area

- \$2,288.90 x 2.87 acres = \$6,569.14 **Facility Name** Grounds Maintenance Cost (12 Months)

Figure 38 – Sample Ground Maintenance Cost Obtained from Facility

FACILITY WORK ORDER HISTORY							
Work Order	Description	Status	Work Type	Reported Date	Actual Finish	Actual Cost	
11-1580803	680/CONDENSATE HIGH LEVEL ALARM, MAY BE ON AHD	CLOSE	TC	7/7/11	8/2/11	229.95	
11-1580979	680/LOSE SLIP STRIP ON FIRST STEP, FRONT OF BUILDING	CLOSE	TC	7/11/11	8/17/11	229.95	
11-1582850	680/CUBE 150G WINDOW/CAULK HOLE BY WINDOW, WANTS ARE COMING IN	CLOSE	TC	7/13/11	7/14/11	229.95	
11-1585025	680/1ST FL OVER ZEROX WAC LINE BY MAIL BOXES/REPLACE BURNT OUT LIGHTS, VERY DARK, HARD TO SEE	CLOSE	TC	7/13/11	7/19/11	229.95	
11-1585800	680/1ST FL LADIES RM/CLOGGED TOILET	CLOSE	TC	7/13/11	7/27/11	229.95	
11-1585480	680/EXTERIOR STEPS FRONT OF BLDG/RCK BULLDOGS ON STEPS, REPLACE RUSTED SCREWS & SECURE ALL OTHERS	CLOSE	TC	7/13/11	8/1/11	229.95	
11-1589559	680/BACK FLOW NEEDS AIR GAP & DRAIN LINE, CALLED IN BY STEVE SYNK	CLOSE	TC	7/18/11	9/7/11	229.95	
11-1591008	680/2ND FL BY RM213 & 220, WATER LEAKING DOWN TO 1ST FL	CLOSE	TC	7/19/11	7/26/11	229.95	
11-1591248	680/DOCK TOP A/B/REPLACE CENTER BURNT OUT LIGHT	CLOSE	TC	7/19/11	7/26/11	229.95	
11-1601255	680/SHOWER IN 700 GROSS SQ FT. SHOWER ROOM/NO	READYCLOSE	PW	7/20/11	8/11/11	617,000.00	
11-1592345	680/2ND FL MEN'S RM/URINAL NOT DRAINING PROPERLY	CLOSE	TC	7/20/11	7/27/11	229.95	
11-1594661	680/2ND FL LADIES RM/SINK CLOSSTO WINDOW, SLOW TO DRAIN	CLOSE	TC	7/21/11	7/26/11	229.95	
11-1602400	680/ELEVATOR PIT WATER ALARM	CLOSE	TC	7/25/11	7/26/11	229.95	
11-1605370	680/WINDOW SILL IN CUBE 250G/ANT PROBLEM	CLOSE	GC	7/25/11	7/25/11	406.38	
11-1605921	680/1ST FL DOOR THAT LEADS TO THE BACK BY ELEVATOR/DOOR SLAMMING, CLOSER MAY NEED TO BE ADJUSTED	CLOSE	TC	7/27/11	8/19/11	229.95	
11-1612677	680/CUBE 150G/WANTS ON WINDOWSILL	CLOSE	GC	7/29/11	8/2/11	37.34	
11-1629856	680/DOCK/REPAIR CRUMBLING CONCRETE ON TOP OF DOCK	CLOSE	TC	8/1/11	8/10/11	229.95	
11-1629851	680/DOCK/REPAIR CRUMBLING CONCRETE ON DOCK STAIRS	READYCLOSE	TC	8/1/11	11/24/11	229.95	
11-1628659	680/STAIRWELL BTWN 1ST & 2ND FL SW CORNER/REPAIR LOOSE HANDRAIL	CLOSE	TC	8/5/11	8/19/11	229.95	
11-1631490	680/WINDOW SILL IN CUBE 250G/SPRAY FOR ANTS, TRAPS DID NOT WORK	CLOSE	GC	8/8/11	8/17/11	38.21	
11-1643108	680/RM230/REPLACE BURNT OUT LIGHTS	CLOSE	TC	8/8/11	9/23/11	229.95	
12-1045055	SMOKE DETECTION & BLDG EVACUATION SYSTEMS SEMI-ANNUAL PM	READYCLOSE	PW	6/21/12	7/3/12	21.70	
12-1048155	SMOKE DETECTION & BLDG EVACUATION SYSTEMS SEMI-ANNUAL PM	READYCLOSE	PW	6/21/12	7/2/12	21.70	
12-1050071	AUTOMATIC SPRINKLER & STANDPIPE/HOSE CABINETS MONTHLY PM	APPR	PW	6/26/12	IW	35.15	
12-1050029	AUTOMATIC SPRINKLER & STANDPIPE/HOSE CABINETS MONTHLY PM	APPR	PW	6/26/12	IW	35.15	
12-1050062	PMVC ELEVATOR FIRE SRVS CHECK MONTHLY MAINTENANCE	APPR	PW	6/26/12	Sched 8/25/12	68.86	
12-1050079	AUTOMATIC SPRINKLER & STANDPIPE/HOSE CABINETS MONTHLY PM	APPR	PW	6/26/12	IW	35.15	
12-1052309	680/ELEVATOR NOT WORKING, I/O/IDICAP OCCUPANT NEEDS TO RETURN TO 1ST FL	READYCLOSE	TC	6/29/12	7/6/12	229.95	
Number of Records:						272,549.46	
Saved Where Clause:							
Dynamic Where Clause:							
<p> IW = In Work IS = In Shop Sched = scheduling DM Sched = Deferred scheduling cancl = cancelled WAPPR = Waiting for approval from FOS APPR = Approved Red highlights indicate RPO pending action due to placement based on 7-19-11 </p>							
						TOTAL W/C FLOOR	60,158.46

Figure 39 – Sample Work Order History Obtained from Facility

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Facility Name Custodial Specifications Routine Janitorial Services, Emergencies, IDIQ's 7-1-11 through 7-1-12	
Task	Minimum Frequency
Empty all trash receptacles (inside and outside). Reline if necessary.	1/day
Empty all paper recycling containers	1/day
Dust mop all hard surface floors with treated or electrostatic dust mop	1/day
Dust all exposed surfaces. All surfaces shall be dusted using a microfiber dusting cloth to capture dust. These surfaces shall include all furniture including desks, file cabinets, shelving units, chair bases, tops of wall hung objects, window sills and frames, grills and grates, door frames, etc	1/week
Damp mop all floors	1/week
Clean both sides of all glass doors and side glass	1/week
Police stairs and pick up litter	1/week
Dust mop stairs, dust railings, ledges and spot clean	1/week
Vacuum all carpeted 1st floor entryways, walk-off mats and hallways.	3/week
Vacuum all carpeting and walk-off mats (wall to wall).	1/week
Vacuum/clean recessed floor mat and damp wipe recessed area	1/week
Clean and polish all drinking fountains.	1/day
Clean all carpet	1/year
Clean all carpeted 1st floor entryways and hallways	3/year during winter months 1/month from April thru October, 2/month from November thru March
Clean all walk-off mats	
Wash interior and exterior windows	1/year
Clean ceiling HVAC vents	1/year
Clean smokers' outposts outside building entrances	As needed
Empty multicompart ment recycling stations (glass, plastic, newspaper, aluminum cans). Glass, plastic and aluminum cans taken to Gate 219. Newspapers in designated recycling	

Figure 40 – Sample Custodial Data Obtained from Facility

2.6.2.8 IFMA Data

Facility O&M costs and utility costs are benchmarked against the International Facility Management Association (IFMA) Research Report 32: O&M Benchmarks. These benchmarks can be purchased through the IFMA website.⁵

The report is separated into several sections, including janitorial, operations and maintenance, and utility costs by facility type, industry, age, region, climate zone, and other area on a dollar per gross or net square foot.

2.6.2.9 BOMA

In addition to IFMA, facility O&M costs and utility costs are benchmarked against the Building Owners and Managers Association (BOMA) International Experience Exchange Report (EER) available online. To use this information we recommend the following steps be taken:

Step 1 - Go to www.bomaeer.com

Step 2 - Create account

Step 3 - Select All Markets

Step 4 – Purchase access to the EER and begin use

The EER can be adjusted per multiple categories including between government and private sectors, building size, and location of the facility.

The BOMA EER provides costs similar to the IFMA benchmarks; however, the data can be more specific to a city (market). A report specific to the government (Federal) sector nationally and regionally should be used in the POE report. Occasionally, data for a market is not available in a certain sector or market on the EER due to the lack of benchmarked buildings (there must be at least five buildings benchmarked to attain results). When this occurs, select more than



Figure 41 - Landscaping



Figure 42- Green roof

⁵ <https://www3.ifma.org/pv/Core/Orders/product.aspx?catid=32&prodid=147>

one market in the same region until results are available. If data under the government section is not available after selecting several markets, data in the private sector may be used.

Experience Exchange Report ®

Report Year: 2010 Sector: Government Building Size: All Sizes Unit of Measure: Square Feet
 Country: USA Building Type: 75% or More Government Occupied Public Transit: Any Proximity Location: All Locations
 Market: All Markets Ownership Type: Government All Electric: Any Building Age: All Ages
 Zip Code: All Zip Codes Number of Floors: All Heights Agency Managed: Any

Repair / Maintenance									
Payroll, Taxes, Fringes	50	1.34	1.12	0.78	1.92	1.40	1.14	0.81	1.92
Elevator	46	0.24	0.12	0.08	0.21	0.25	0.12	0.08	0.22
HVAC	44	0.48	0.17	0.10	0.50	0.50	0.18	0.11	0.50
Electrical	288	1.37	1.26	0.77	1.89	1.64	1.57	1.00	2.41
Structural / Roofing	20	0.01	0.02	0.01	0.06	0.02	0.02	0.01	0.06
Plumbing	35	0.07	0.03	0.01	0.06	0.08	0.03	0.02	0.06
Fire / Life Safety	45	0.08	0.07	0.03	0.11	0.08	0.07	0.03	0.11
General Building Interior	47	0.46	0.08	0.02	0.55	0.48	0.08	0.02	0.69
General Building Exterior	36	0.16	0.02	0.01	0.09	0.16	0.03	0.01	0.09
Parking Lot	15	0.30	0.06	0.02	0.29	0.35	0.06	0.03	0.29
Miscellaneous / Other	52	0.91	0.17	0.04	0.48	0.95	0.17	0.05	0.64
Utility									
Total Electricity	53	1.67	1.53	1.19	1.90	1.72	1.59	1.24	2.01
Gas	234	0.24	0.26	0.09	0.46	0.28	0.32	0.11	0.56
Fuel Oil	20	0.07	0.03	0.00	0.27	0.09	0.03	0.00	0.36
Steam	54	1.01	0.73	0.55	1.35	1.18	0.88	0.64	1.51
Chilled Water	20	0.65	0.71	0.52	0.88	0.79	0.83	0.57	1.12
Water / Sewer	293	0.14	0.11	0.06	0.17	0.17	0.13	0.08	0.21
Roads / Grounds									
Landscaping	42	0.09	0.07	0.03	0.18	0.09	0.07	0.03	0.20
Snow Removal	20	0.05	0.01	0.00	0.09	0.06	0.01	0.00	0.10
Miscellaneous / Other	31	0.14	0.05	0.02	0.13	0.16	0.06	0.02	0.13
Security									
Payroll, Taxes, Fringes	7	1.00	0.91	0.33	1.86	1.02	0.93	0.34	2.00
Contracts	29	0.86	0.61	0.34	1.27	0.89	0.65	0.34	1.27
Equipment	17	0.04	0.02	0.01	0.05	0.04	0.02	0.01	0.05

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Figure 45 - Sample BOMA EER report



Figure 44 – Bicycle racks

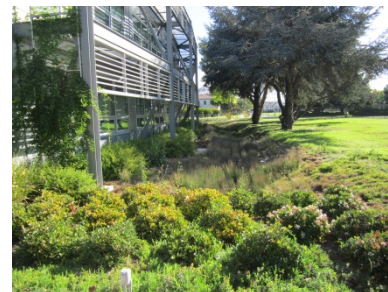


Figure 43 – Native Landscaping

2.6.3 Drawing Documentation

The drawings and documents the evaluation team should receive electronically in PDF, excel, or Word form, when applicable, are:

- Master plan
 - An overall NASA Center-wide master plan and/or a localized master plan around the LEED facility undertaking the POE.
- Criteria documents
 - Pre-design documents explaining the scope of work of the facility and the purpose of the project. Also known as a scope of work and scope of services.
- Design analysis
 - Summary typically required to be written by the Architect and/or Engineer of Record, although sometimes provided by the Center,

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briefly describing the project's goals, intent, and scope. Also known as the design summary, and usually provided within the contract documents.

- Contract documents
 - Full contract document set – also known as design documents - including architectural, interior design, mechanical, electrical, plumbing, security, data/telephone, structural, civil, landscaping, and other discipline drawings.
- Specifications
 - Technically a part of the contract documents. Full format specifications are preferred.
- LEED documentation and energy calculations
 - All LEED documentation used in USGBC submissions including checklists, diagrams, and simulation model images. The final accepted checklist is required and previously submitted or rejected checklists are beneficial.
- Bulletin or change order list
 - List of change orders produced during the construction phase which include the cost of the change order, reason for the change order, and solution provided for the change order.

A complete as-built drawing set is important to have as it represents the actual conditions versus the building as original designed. In addition to as-built drawings, construction change order documentation can also be valuable if available.

2.6.5 Building Brochures/ Literature

If available, facility literature and brochures are very beneficial for the POE Team to ascertain general facility sustainability knowledge for the POE report.



Figure 47 - Sample Poster

2.6.6 Lessons Learned/Best Practices through Construction

If available, Lessons Learned/Best Practices analysis developed by the design team, construction team, and NASA CoF / FM teams should be obtained prior to conclusion of the POE site visit. It is a best practice to record Lessons Learned/Best Practices throughout the design/construction process while they are still fresh in in the Team's memory.

Facility Lessons Learned				
Item	Description	Comments	Action	Assigned
1	Asbestos Identification on Drawings	???	Include on Constructability Checklist	Architectural Working Group
2	Communications Rooms	These rooms require special HVAC and door locking. Rooms need to be laid out by ODIN personnel to ensure proper size and functionality. Rooms should be stacked vertically on multiple floors. Rooms are first to be activated during outfitting.	Consult with Code V; Define requirements for server rooms	Architectural Working Group
3	Elevators	Elevators need special design consideration. Review latest code requirements and provide proper details on drawings, determine wsprinkler and venting requirements.	Incorporate in Engineering Standard Details.	Architectural Working Group
4	Finalized Furniture Floor Plans and Show Hallway Clearance	Obtain finalized furniture floor plans from LTID during design to ensure electrical, mechanical and communications service mesh with layout. Ensure that adequate safety clearance is maintained after systems furnishings and file cabinets are installed.	Discuss with Code C (Amy Fennel). Is this realistic to complete during design with clearance demensions?	Architectural Working Group
5	Folding Partitions	The folding partitions in the basement (panel style) are difficult to open and close. When the partition is closed, the VITS room that is created is far too small. Noise transmission across or around the folding panel door in Conference Room 028 makes it difficult to hold meetings in adjacent segmented spaces. Ensure seals at top and bottom of folding partitions are adjusted to ensure noise is reduced. If req'd to maintain the NTC rating of a folding partition, ensure that the wall detail above the door continues to the structure above.	Team to investigate. Use these conference rooms. Try it out. Understand why the doors are hard to operate and the noise transmission between rooms is high	Architectural Working Group
6	Handicap Lift	Ensure that the building occupancy is considered in order to determine if additional ADA measures are required.	Code Review of Designs?	Architectural Working Group

Figure 48 - Sample Lessons Learned/Best Practices Provided by Center

2.6.7 Center for the Built Environment (CBE) Building Occupant Satisfaction

The building occupant satisfaction survey is performed by the POE Team through one-on-one interviews with the building occupants. The survey was partially developed using benchmarks based on the CBE⁶. Because CBE benchmarking data is not readily available, CBE benchmarking requirements is gathered through multiple online resources which utilize the CBE data.

⁶ <http://www.cbe.berkeley.edu/research/briefs-survey.htm>

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2.7 Checklist of To Do Items - POE Planning and Preparation

- POE Team and Team Lead appointed
- Become Familiar with the Scope of the Project
- Project Participants identified, create project directory (Full list of participants with name, title and brief job description collected before site visit)
- Facility Point of Contact selected
- Invitation to the participants
- Information sent to gain access to NASA Centers
- Pre-site visit meeting agenda prepared and meetings conducted
- In-Brief and Out-Brief meeting agendas prepared
- Site visit itinerary prepared and coordinated
- Facility Data requested and received
 - O&M Manuals
 - Annual O&M Data
 - Annual Utility Data
 - AOR/EOR Construction Documents
 - Drawing Documentation
 - Building Fact Sheets: Brochures, On-line Literature
 - Lessons Learned/Best Practices collected
- Benchmark Data
 - Federal Water Use Index
 - CBECS Data
 - Energy Star CO₂ emission
 - IFMA benchmarks
 - BOMA benchmarks
 - CBE (Building Occupant Satisfaction)

3. Performing the POE (Site Visit)

The POE is a systematic evaluation of the facility, from the perspective of Project delivery team, Facility managers, O&M personnel, users/occupants, and the facility key stakeholders. The POE site visit is one of the most important parts of the POE process and is performed by the POE Team which involves process evaluation, interviewing & surveying, and walk-throughs of the facility. The agenda for the POE site visit should be prepared in advance of a visit and coordinated with the Facility POC to ensure all the Project Team members and key stakeholders are available during the POE site visit. Refer to Section 2.5.2 for a sample site visit schedule.



Figure 49 – Interior Wall Glazing

Before arriving on site the POE Team should be prepared with the following:

- Personal identification card (driver's license or other documents as required by the NASA Center). Badges will be issued to each POE Team member to gain access to the Center.
- Proper attire and shoes
- Survey tools including cameras, voice recorders, flashlights, clipboards, paper, pens, pencils etc. with them
- Copies of Survey forms, meeting agendas etc. for their use.
- Contact information of Facility personnel.
- List of participants and their contact information.

3.1 In-Brief Meeting

The In-Brief meeting agenda is prepared in advance by the POE Team lead and distributed by the Facility POC to all participants aforementioned. This meeting is held on site as a kick-off to the site visit. The POE Team should bring enough copies of meeting agendas and a sign-in sheet. The meeting should take approximately one hour in duration. Refer to Section 2.4.2 for a typical agenda.

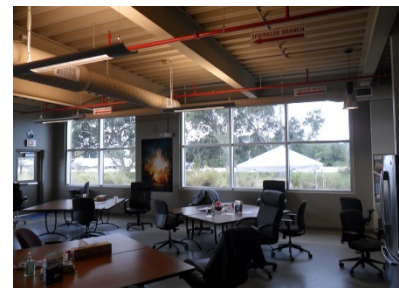


Figure 50 – Break Room

Following the In-Brief Meeting, the POE Team does the quick walkthrough of the Facility to make itself familiar with the Facility. This should be done before the surveying and interviewing process. This quick walkthrough should take on average 30 minutes depending on facility size. As per the escorts'

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requirement leading the POE Team on the tour we recommend having one or two staff with general knowledge about the facility. The goal of the walkthrough is a visual understanding and orientation of the building.

3.2 Reviewing Facility Data

Facility data, which was not collected before the site visit, is collected at this time and a review is performed by the POE Team. Refer to Section 2.6 for detail information on required Facility data.

3.3 Surveying and Interviewing

The surveying and interviewing process are important for collecting the first-hand data for the POE. The data collected is analyzed and used in preparing final report.

All responses given should remain anonymous. The survey and final report are not to undermine or disparage the facility or anyone who participate on the survey, but simply to obtain and accumulate data to assist future NASA facilities.

The following POE Surveys have been developed:

1. Process Evaluation Survey
2. Facility Manager Survey
3. Operations and Maintenance Personnel Survey
4. Building Occupant Survey
5. Field Observation Form – Exterior
6. Field Observation Form – Interior

3.3.1 Process Evaluation Survey

The process evaluation survey inquiries into a broad, open-ended set of questions ranging from the performance of the design to positive and negative Project Team building strategies from procurement stages through building turnover. Although very broad-based, this survey is extremely important in understanding all the team building (communication) strategies and construction techniques implemented alongside LEED - per the opinion of varying disciplines.

The survey should include following people from the Project Team: Project Managers, Facility Manager, Operations and Maintenance, Construction of Facility personnel, LEED Specialist, Procurement staff, Architects and Engineers of Record, the design team, and other key stakeholders. Interviewing the Project Team will give a better awareness of what went well and what did not go well pertaining to internal NASA strategies. Interviewing the Construction Manager or Contractor will give insight into the constructability of the facility. The Contractor will also be able to explain key

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change orders requiring modifications to the design, site issues, etc. NASA staff from procurement to operations will also provide insight on the processes employed by each as it relates to this facility.

Why Conduct a Process Evaluation

The process evaluation will help NASA and future project/construction managers better procure, plan, design, construct, occupy, and utilize facilities more effectively. Information gathered by this survey will help in preparing a post occupancy evaluation report which will discuss Lessons Learned/Best Practices. The evaluation is not to undermine or disparage any persons or projects, but simply to obtain and accumulate data for better planning, contracting, designing, constructing and operating of sustainable facilities.

How to Conduct Process Evaluation Survey

The Process Evaluation survey form and questionnaires should be used as a guide to perform the process evaluation survey. The survey is done in person and the survey should be filled out by the interviewer. All answers are to remain anonymous. Refer Appendix D for sample Process Evaluation Survey Form.

Survey Key Evaluation Topics are:

- Initiating Process: focus on the procurement and pre-planning phases including developing a project directory and identify key stakeholders.
 - Procurement strategies
 - Sustainability in the beginning stages
 - Contracts
 - Risk management
- Planning Process: includes the project planning and design phases including collect requirements for the project, defining the scope, defining activities, sequence of activities, schedule, quality of project, communications, risk management, qualitative and quantitative risk analysis, and construction procurement method for the project.
 - Defined team roles
 - Site selection
 - Pre-project planning procedures



Figure 51 – Shading

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- Executing Process: involves the construction of the building from project management, project execution, quality reviews, procurement of FFE, and managing stakeholder expectations.
 - LEED credit tasks
 - Project Team meetings
 - Sustainable product concerns
 - LEED requirement concerns per building systems
 - Value-engineering
 - Team communication strategies
- Monitoring and Controlling Process: is a function of the construction phases to monitor and control project work, perform change orders, cost control per products and labor, verify scope, schedule, quality control, contractor performance, monitor and control risk, and administer procurement. This blends into “Executing Process,” but largely encompasses physical construction phases of the project.
 - Project Team communication issues
 - Contractors and sustainable building practices
 - LEED product and labor costs
 - Soft costs per LEED requirements
 - Cost control techniques
 - Project schedule and delays
 - Bulletins, addendums, and change orders
 - Project end budget
- Closing Process: discuss building turnover, closing out the project, and final receipt of documentation.
 - LEED credit attainment
 - LEED lessons learned per certification

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3.3.2 Facility Manager Survey

The Facility Manager Survey is a survey for the Facility Manager whom has direct contact with the building personnel within the facility undergoing the POE, and deals with the day-to-day operation of the facility. The Facility Manager is also known as the Building Manager and Facility Systems Manager.

How to Conduct a Facility Manager Survey

The Facility Manager Survey form and questionnaires should be used as a guide to perform the Facility Manager survey. The survey should be conducted in person, and filled out by the interviewer presenting the survey. All responses given are to remain anonymous. Refer Appendix E for sample Facility Manager Survey Form.

Why Conduct a Facility Manager Survey

The Facility Manager Survey will aid NASA to better plan and design future facilities pertaining to overall operations of facilities. Information gathered by this survey will help in preparing a post occupancy evaluation report.

Survey Key Evaluation Topics:

- Appropriateness of Facility on the site: sustainability of site, public transportation, parking spaces, landscaping, exterior signage.
- Space Utilization: in terms of design of space, facility size, flexibility, interior signage, trash collection, noise pollution, sun glare.
- Building Finishes: aesthetics, durability, suitability, maintainability.
- Utilities & Building System: energy usage, water usage, HVAC system, natural ventilation, electrical system, lighting system, plumbing system, elevator/escalator system, service order frequency, sustainable technologies used, noise pollution, security system, physical structure.
- General Facility Operations: compromises with sustainability, O&M staff, warranties, latent defects, modification to physical or operations, utility savings, payback period, lesson learned/best practices.

3.3.3 Operations and Maintenance Survey

Operations and Maintenance survey is the survey for the person(s) involved in day-to-day operations, maintenance, and repair of the facility and its direct surroundings. This includes hot/cold O&M staff, custodial maintenance personnel, and site maintenance personnel.



Figure 52 – Interior Glazed Wall

How to Conduct an Operations and Maintenance Survey

The survey should be conducted in person, and filled out by the interviewer presenting the survey. All responses given should remain anonymous. The Operations and Maintenance Survey form should be used to perform this survey. Refer Appendix F for sample Operations and Maintenance Survey Form.

Why Conduct an Operations and Maintenance Survey

The O&M Personnel Survey will aid NASA to better plan and design future facilities pertaining to day-to-day operation, maintenance, and repair of facilities. It will also assist in understanding how best to turn-over a facility from the construction process.

Survey Key Evaluation Topics are:

- Ground and Landscaping: irrigation system, water conservation, eco-friendly landscaping, maintenance.
- General Facility Maintenance: trash collection, loading dock, truck maneuvering space, freight elevator, storage, accessibility for disabled, maintenance, roof accessibility, maintenance costs.
- Facility Operations and Control Systems (Building Automated System): location, operation, maintenance, system selection.
- Heating, Ventilating, and Air Conditioning (HVAC): replacement provision, accessibility, insulation, air filter, zoning, capacity, system selection.
- Lighting: Lighting system, lighting fixture availability, types, efficiency, controls, maintenance.
- Electrical, Telecommunications, and Data: electrical system, telecommunication and data system, sustainable technologies, expansion provisions, maintenance, electrical and data space.
- Plumbing: accessibility for maintenance, water usage, fire protection system, plumbing systems.

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- General Facility Energy Efficiency: environmental measures, local climate, solar control.
- Facility Operations Turnover: O&M manuals, as-built drawings, warranty reviews, building flush out, commissioning, O&M staff training.
- Custodial Maintenance: general maintainability and serviceability, trash/recyclable sorting and collection area, truck maneuvering, loading dock, freight elevator, storage, custodial closet, ease of maintenance, maintenance cost.

3.3.4 Building Occupant Survey

The Building Occupant survey is a survey intended for persons who spend the majority of their day within the facility undergoing the POE.

How to Conduct a Building Occupant Survey

The survey should be conducted face-to-face, or (when necessary) filled out by the interviewee through an electronic questionnaire. The survey is carried out for 10% of the facility population or maximum of 10 building occupants. The survey measures the satisfaction of the building occupants in terms of Indoor Air Quality within their space. The range for the responses go from -3 (very unsatisfied) through +3 (very satisfied), with 0 being neutral to the subject. The result is compared with CBE survey. All responses given should remain anonymous. Building Occupant Survey form should be used to perform this survey. Refer Appendix G for sample Building Occupants Survey Form.

Why Conduct a Building Occupant Survey

The Building Occupant Survey will aid NASA to better plan and design future facilities pertaining to user comfort and environment.

Survey Key Evaluation Topics are:

- Thermal Comfort: temperature, airflow, humidity.
- Air Quality: odor, dust, building occupant perception/opinion of quality.
- Acoustic Comfort: noise (external/internal), sound privacy.
- Lighting: Controls, quality (natural & artificial), levels.
- General Office Space: work space layout & storage, space arrangement, view, comfort, appearance, quality.

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3.3.5 Interviewing Tips

The POE report will only be a useful tool for future NASA projects if the information gathered during the surveys is honest, accurate, and genuine. It is imperative to remind and reiterate the following points to the person or persons undergoing the POE at each meeting:

1. All information provided will be discreet and anonymous. Names will not be included in the report or the report appendices – this is crucial for honest feedback.
2. The POE report is a tool to be used internally to NASA and not shared on a public forum.
3. Answers are to help NASA develop future facilities on this Center and other Centers. Relating the information to future work indicates the data will go to help other project managers, operation and maintenance personnel, and other project stakeholders prevent mistakes or provide clarity.
4. The project has/is concluded and therefore simply criticizing or airing grievances about a Project Team member is not needed or warranted. However, any issues arisen due to a building practice or construction method can be advantageous as a lessons learned.
5. The POE Team is not there to just learn what went bad with a facility – coax out what went well! People always more easily remember the bad, but if the project is fully complete something had to have gone well.
6. In the O&M and Building Occupant Surveys, there are responses with a range from “very unsatisfied to very satisfied” – with seven options. The range should be expressed as “-3 to +3 with 0 being neutral, -3 being very unsatisfied and +3 being very satisfied.” Having a neutral number (0) gives an option where the respondent was neither impressed nor dissatisfied per the question’s subject. Stating “0 to 8” or just “very unsatisfied to very satisfied” does not give a neutral option.

Additionally, it is just as important to get good information as it is to keep the flow of the meeting moving forward. To keep the meeting from becoming side-tracked, the format of the survey forms are focused on a specific topic and, generally, the survey forms cover most areas of discussion. If the meeting begins to go off topic, it is up to the interviewer to bring the meeting on topic. In most surveys, there is a general open-forum question at which the group can interject any information.

3.4 Conducting the Facility Assessment Walkthrough

The Facility Assessment Walkthrough is completed near the conclusion of the POE site visit. Field Observation Forms should be used during the walkthrough. The walkthrough is led by person from operations & maintenance and the facility managers. It is done in two stages

3.4.1 Exterior Condition of the Facility

Field Observation Forms – Exterior should be used to perform this observation walkthrough. Refer to Appendix H for the sample field observation form for the Exterior. The walkthrough focuses on following exterior features of the Facility:

- Sidewalks: suitability, maintainability, and aesthetic.
- Parking: maintainability, light fixtures.
- Landscaping: plant types, maintainability, drainage, light fixtures, aesthetics.
- Main Entry: signage, maintainability, visibility to public quality.
- Façades: material suitability, maintainability, doors & windows suitability, building light fixtures, aesthetics.
- Roofs: slopes, drains, scuppers & downspouts, snow or ice issue, parapet & coping, rooftop penetration detailing, rooftop HVAC equipment detailing, suitability, maintainability, and aesthetics.

3.4.2 Interior Condition of the Facility:

Field Observation Forms – Interior should be used to perform this observation walkthrough. Refer Appendix I for the sample field observation form for the Interior. The walkthrough focuses on following interior features of the Facility in terms of its Suitability, Durability, Maintainability and Aesthetics:

- Floor Finishes



Figure 53 - Exterior of Facility

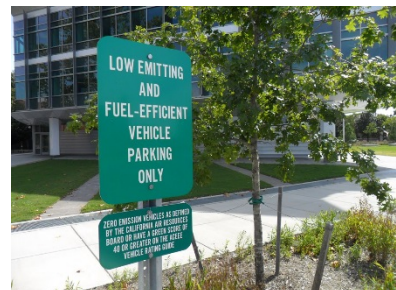


Figure 54 – Eco Friendly Transportation

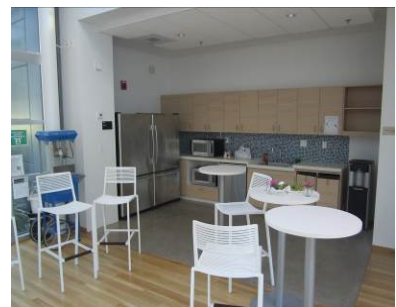


Figure 55 - View of Kitchenette



Figure 56 – Open Office Area

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- Ceiling Finishes
- Wall Finishes
- Casework
- Doors
- Windows/Storefront
- Natural Day lighting
- Artificial Lighting
- Plumbing Fixtures
- Furniture
- Electrical
- Data
- Mechanical System
- Elevators/Escalators
- Stair – Egress
- Stair – Main/Communication



Figure 57 – Indirect/Natural Lighting

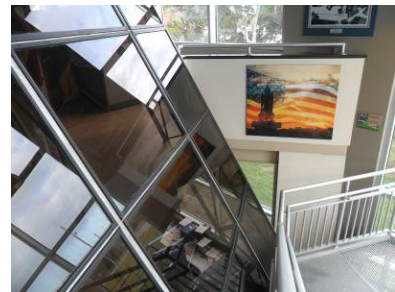


Figure 58 – Repurposed Glazing Materials

3.5 Out-Brief Meeting

The Out-Brief meeting agenda is 30 minute meeting set-up by POE Team lead. The meeting is held on site - concluding the POE site visit. The meeting will require a large conference room to accommodate all the invitees. The POE Team should bring enough copies of meeting agendas and a sign-in sheet.



Figure 59 – Geothermal Well Field



Figure 60 – Shading at Meeting Area

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3.6 Checklists of To Do Items - Performing POE Site Visit

- ID and Badges to gain access to the NASA Center
- Proper attire and shoes
- Cameras and voice recorder
- Clipboard, paper, pens, pencils
- Copies of Survey forms
- Contact information of Facility personnel
- List of participants
- Meeting Agendas for In-Brief and Out-Brief
- Facility plan
- Sign-in sheets
- Site visit agenda should include
 - In-Brief Meeting
 - Quick walk-through
 - Document Collection and Review
 - Process Evaluation
 - Facility Manager Survey
 - Operations and Maintenance Personnel Survey
 - Building Occupants Survey
 - Detail walk-through
 - Out-Brief meeting

4. Writing the Report

After the POE Site Visit, the POE Team prepares a comprehensive report with the results from the POE process. The report should be simple in language and easily understood. Before writing the report, the data/information collected during POE process needs to be analyzed and synthesized to obtain the Findings/Results. The results of the analysis will be used to suggest conclusions and recommendations in the POE report.

Sensitivity Discussions

All POE documents shall state “For NASA Internal Use Only” within the footers of all POE documents including: the report, survey forms, and other documentation which contains secure information. For protection, the names of any individual involved in the interview processes (O&M personnel, PMs, occupants, interviewers, etc.) are not to be used in the final report, and are removed from the survey forms. This also allows an open, free discussion of challenges at the facility, which is imperative for the report because much of the “Lessons Learned” content is received from those who participated in the project itself, as well as those who now physically occupy the space. Refer to 3.3.5 for additional sensitivity concerns per interviews.

4.1 Review, Analyze and Synthesize Data

The data and content developed is organized in four primary areas within the report. Item 1 is the Development Process Evaluation; second is the Functional Performance Evaluation; third is the Energy, Utility, and Operation and Maintenance Profile; and last is Building Occupant Satisfaction Evaluation.

Development Process Evaluation, is the process in which the facility was programmed, planned, designed and constructed. The process is organized in the following sections:

- Procurement and Pre-Project Planning
- Project Planning and Design
- Project Communication
- Construction
- LEED Credits
- Close-out and Occupation

Functional Performance Evaluation, is associated with the physical, functional, and maintainability characteristics of the facility. The evaluation is organized in the following sections:

- Aesthetics and Image
- Landscaping
- Access and Circulation

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- Architectural Systems
- Mechanical, Electrical, and Plumbing systems
- Custodial Management and Serviceability

Energy, Utility, and Operations and Maintenance Profile, is an analysis of the consumption of energy, energy costs, and operations and maintenance costs for Fiscal Year (FY) 20XX, in comparison to industry standards. The profile is organized in the following sections:

- Annual Potable Water Usage
- Annual Energy Usage
- Annual CO2 Emissions
- Annual Utility Costs
- Annual Operations and Maintenance Costs

Building Occupant Satisfaction Evaluation, is associated with the serviceability of the building and satisfaction of the occupants in regard to the building environment and maintainability. The evaluation is organized in the following sections:

- Building Occupant Interview Results
- Thermal Comfort
- Air Quality
- Lighting
- Acoustics
- Office Furnishings
- Office Layout



Figure 61 – Lobby with Reclaimed Materials

Within each topic of the primary area a conclusion or findings statement is provided followed by Successes, Challenges, and Lessons Learned/Best Practices.

- **Successes** are positive aspects from any phase of the project developed or utilized during the project, and are recommended to be shared with the other Centers.
- **Challenges** are issues or concerns brought to the attention of the POE Team by the Project Design Team, and are recommended to be shared with the other Centers.
- **Lessons Learned/Best Practices** are developed from the Challenges and/or Successes discovered during the project. Like the challenges and successes, Lessons Learned/Best Practices should be shared with other Centers and considered on future projects whenever applicable.

4.2 The Report Contents:

The Findings and/or results of data analysis are conveyed through writing a POE Report.

The POE Report should contain the following:

- Project Fact Sheet
- Executive Summary
- Introduction
- Findings (Successes, Challenges and Lessons Learned/Best Practices)
- Conclusions (Compiled Successes and Lessons Learned/Best Practices)
- Appendices (Compiled Completed Survey Forms)

4.2.1 Project Fact Sheet

General facility information/data collected during the course of the POE process, from the pre-site visit to the interviews and survey should be included on the Project Fact Sheet. This data will be used during the analysis process along with the other data to generate the “Findings” section of the Report. It should include following information associated with the Facility.

- Name
- Location
- Size
- Occupancy Load
- Number of Floors
- Building Activity
- Construction Completion Date
- Total Design and Construction
- Structure Type
- Roof Type
- Utility Sources
- LEED Rating
- LEED Certification Date
- LEED Version
- Building Sustainability
- Building Systems
- Acquisition Strategy
- Developer/Owner
- General Contractor
- Architect/Engineer
- Facility Synopsis

Project Features	
Name	LEED Office for Facility Transition (LOFT)
Location	NASA Center, State
Size	83,000 GSF
Occupancy Load	520 persons (maximum)
Number of Floors	3
Building Activity	Office and Administrative
Construction Completion Date	2009
Construction Budget	\$27,000,000
Structure Type	Concrete and Steel
Roof Type	Flat white TPO
Utility Sources	Heating: Electric Cooling: Electric Chilled Water: Electric, from Central Plant System
LEED Rating	Platinum
LEED Certification Date	September 30, 2010
Building Sustainability Highlights	Daylight Harvesting; Natural Daylighting; High Efficiency Water and Electrical Fixtures; HVAC Condensate Recovery; Solar-Assisted Domestic Water Heater; High-Efficiency Building Systems; External Shading; Building Automation System (BAS); Native Landscaping; High-Efficiency Envelope; Sustainable Finish Selection
Building System Highlights	- HVAC system: Consists mainly of a raised floor Underfloor Air Distribution System (UFAD). Underfloor variable air volume (VAV) boxes regulate air flow and pressurize a raised floor plenum. - Energy Recovery Wheel: Enthalpy wheel serving as an energy recovery ventilator system, preconditioning and dehumidifying outside air before it is circulated indoors. - Solar Hot Water Heater.
Acquisition Strategy	Design/Bid/Build
Developer/Owner	NASA
General Contractor	Satterfield and Pontikes Construction, Inc.
Architect	HOK
Civil and Structural Engineer	Walter P Moore
Mechanical, Electrical, Plumbing Engineers	HOK
Facility Synopsis	The Facility houses both transitional office space and the Office of Procurement. The facility design comprises two main wings, a smaller east wing and a larger west wing. The east wing contains the majority of building core functions, including the main entry. The west wing contains transitional office space on the first two floors and a small part of the third floor for the temporary housing of NASA employees during construction projects elsewhere at the Space Center. The majority of the third floor is occupied by the Office of Procurement for NASA. The typical office space consists of an open layout with low partitions between cubicles to allow for the penetration of natural daylight. Private offices, storage, and work rooms create an internal spine that is surrounded by the open office area. The spine wall facing the exterior envelope is largely transparent, using louvers and a shading system.

Figure 64 - Sample Project Fact Sheet



Figure 63 – Building Facade

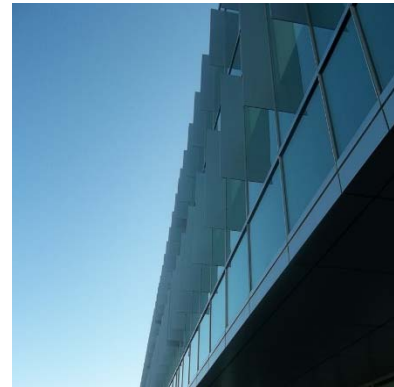


Figure 62 – External Shading

4.2.2 Executive Summary

The Executive Summary of the Report summarizes the entire report in logical order, outlines the purpose, the POE procedure work undertaken, and key findings.

4.2.2.1 POE Purpose

4.2.2.2 POE Procedure

- Process Evaluation
- Facility Manager Survey

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- Operations & Maintenance Survey
- Building Occupant Survey
- Facility Walkthroughs

4.2.2.3 Key Findings

- Process Evaluation Findings
- Functional Performance Evaluation Findings
- Energy use, Water use, CO2 emission Findings
- Operations & Maintenance cost Findings
- Occupant Satisfaction Findings

Key Findings:

- The design and delivery team noted open direct communication between disciplines along with a single point of contact to disseminate information between parties was an advantageous method project communication.
- Annual electricity usage is about 3% lower than the national average and 14% lower than the regional average.
- The low flow plumbing fixtures throughout the building represented a minor challenge with regards to occasional clogs in the water closets and accumulated sedimentation in the water flow, requiring additional maintenance and work orders. However, to a large degree this is a result of a learning curve in industry technology, and low flow water issues continue to be addressed across the

Figure 65 – Example of Key Findings

4.2.3 Introduction

The Introduction of the Report outlines the context, background, and purpose of the POE; limits of the POE; and defines the procedure of POE.

4.2.3.1 Outlines of Focus of the POE

4.2.3.2 The Post Occupancy Evaluation Procedure

- Process evaluation Survey
- Operational and Maintenance evaluation Survey
- Facility manager Survey
- Building Occupant Survey
- Facility Walkthrough

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4.2.4 Findings

The outcome of the POE process evaluation, surveys & interviews, observations and data collections should be reviewed, analyzed, synthesized and compiled in the “Findings” section of the Report. The Findings should be categorized into Successes, Challenges and Lessons Learned/Best Practices for each component evaluated. The presentation of the results is typically done narratively and with visual images such as tables, graphs, and charts.

Successes:

Successes are the positive aspects and those recommend to be shared with other Centers.

Successes:

Open Line of Communication within Project Design Team: The entire Project Design Team agreed that an open line of communication throughout all phases was very important to the success of the project. The Project Design Team agreed this communication was crucial to keep dialogue open and be able to address conflicts when they arise.

Figure 66 – Example Successes

Challenges:

Challenges are issues or concerns brought to attention of the POE Team.

Challenges:

Infrequent Participation of Project Design Team – Construction Phase: A project charter was signed amongst the Project Design Team at the onset of the project. However, the Project Design Team rarely met during the construction phase as various trades and construction team personnel phased in and out of the project

Figure 67 – Example Challenges

Lessons Learned/Best Practices:

Lessons Learned/Best Practices are developed from challenges and successes revealed during the POE. Lessons Learn/Best Practices provide recommendations for consideration on future projects where applicable.

Lessons Learned/Best Practices:

- The Project Design Team should adhere to the charter for the entire length of the project, including through the construction phase and beginning of the occupancy phases. To re-focus the disciplines per the charter, quarterly Team Leader meetings should be instituted.

Figure 68 – Example of Lessons Learned/Best Practices

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4.2.4.1 Process Evaluation Findings

The process evaluation examines the Successes, Challenges and Lessons Learned/Best Practices related to multiple stages of the design and delivery process. Findings will be attained through the process evaluation survey as previously described herein and categorized as Successes, Challenges and Lessons Learned/Best Practices. The evaluation should be organized on following sections:

Procurement and Pre-project Planning: The procurement and pre-project planning stages are important to setting the stage for a smooth development and construction process. Achieving a functional end-result facility involves choosing the most appropriate acquisition and procurement strategies; involvement of key personnel with strengths supporting the project process and delivery; and contracting qualified professionals during this stage.

Challenges:

Lack of Integration in Security Requirements: A challenge during the procurement process was the integration of the security system requirements which required the use of three separate trades. One contract was used to install the conduit (under the electrical contract), another to pull the wiring (under the IT contract), and a third to install security devices. The Project Design Team acknowledged facility security integration was not fully vetted prior to the construction of the facility.

Lessons Learned/Best Practices:

Designate a primary coordinator of the security integration throughout design / construction.

Figure 69 – Example of Challenges and Lessons Learned/Best Practices – Procurement & Pre-design Phase

Project Planning and Design: The project planning and design stage ensures that design specifications and requirements are properly scoped, created, and adequately address the roles and responsibilities of parties involved in the building construction. A good planning and design process will provide clear design requirements and a smooth transition to the General Contractor's responsibilities.

Successes:

Field Visits to Identify LEED Best Practices: The Project Design Team and key stakeholders visited other LEED-achieving projects and evaluated the sustainable strategies that would be most beneficial to the facility and for NASA. This approach was extremely helpful in the decision-making process for design and planning during the project. In one case, the decision was made to utilize more efficient non-potable urinals rather than waterless urinals based on a field visit to a nearby airport that was fitted with

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waterless urinals.

Lessons Learned/Best Practices:

When possible and practical, arranging site visits to view, experience, and understand new equipment and technology at a LEED building off-site is a worthwhile approach for a Project Design Team during planning and design phases.

Figure 70 – Successes and Lessons Learned/Best Practices – Project Planning and Design Phase

Project Communication: Project communication is imperative for all members of the Project Design Team, particularly during complex projects that present many potential points of failure. Lines of communication that are open, frequent, and constructive are a significant benefit to an integrated design and construction process.

LEED Credits: Project design teams may often experience a learning curve during the LEED certification process. A smooth LEED certification process requires careful participation during project conception, when the commitment to green sustainability is established, followed by USGBC certification level goals. Including a LEED AP on the project handling all aspects of the LEED certification process is advantageous.

Construction: The construction stage is the realization of the contract documents for the building. Coordination between the General Contractor and the Architect of Record is needed to ensure complex building features are installed correctly and that design intent is carried out successfully. Flexibility to adapt to unexpected circumstances, such as an absence of specified materials, owner directed changes, or unanticipated site conditions is required.

Successes:

Budgeting for Sustainable Building Systems: Rooftop PV panels were not proposed in the original design documents and were therefore not included in the construction budget. Value engineering solutions implemented by the Project Design Team on other items allowed the budget to accommodate the PV panels. The Project Design Team was also able to reduce costs by using reclaimed construction materials, alternative low cost furniture and fixtures, and reclaimed lockers without sacrificing quality, due to the proximity of the Facility to nearby demolition sites. These practices assisted the Project Design Team in the achievement of LEED credits for materials.

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Lessons Learned/Best Practices:

- Careful budgeting and alternative design methods allowed rooftop PV panels to fit within the construction budget for Propellants North. Cost reductions included using reclaimed construction materials and alternative low-cost furniture and fixtures purchased through NASA.

Figure 71 – Successes and Lessons Learned/Best Practices – Construction Phase

Close-out and Occupation: The close-out and occupation phase is important to ensure that the building systems and elements are functioning as intended. Additionally, this phase ensures that the building is suitable for occupancy and meets the requirements of the customer who is the end users of the space.

Challenges

Lack of Information in the OEM Manuals: The O&M personnel articulated, during the O&M Survey, the type and amount of information – especially for new system technologies – was inadequate within the OEM manual set. Some of the information in the OEM manuals provided was simple catalogue excerpts and cut sheets where more technical information was needed.

Lessons Learned/Best Practices:

OEM manuals, especially those with new system technologies unfamiliar to O&M personnel, should contain detailed information on those technologies for the OEM manuals to be useful in aiding future system problems.

Figure 72 – Challenges, Lessons Learned/Best Practices – Closeout and Occupation

4.2.4.2 Functional Performance Evaluation Findings

Functional Performance Evaluation should be organized by the following sections. Findings for each section should be categorized in Successes, Challenges and Lesson learn/Best Practices.

- Aesthetics and Image
- Landscaping
- Access and Circulation
- Architectural Systems
- Mechanical, Electrical, and Plumbing Systems
- Custodial Management and Serviceability

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4.2.4.3 Energy, Utility and Operations and Maintenance Profile Observation

The annual data is gathered by the POE Team engineers from the facility for Energy & Water usage, CO₂ emission, Utilities and O&M costs. Profile charts are created benchmarking them against most applicable, data previously mentioned. The results are presented in this section of the Report. Benchmarking standards include:

Facility Data

Water Efficiency

Energy Usage

Facility Greenhouse Gas Emission

Utility Cost

Benchmark Data

- Federal Water Use Index
- Commercial Building Energy Consumption Survey
- ENERGY STAR Carbon Emissions from Building Energy Use
- International Facility Management Association (IFMA) Research report # 32 O&M Benchmarks
- Building Owners and Managers Association International (BOMA) Experience Exchange Report

Benchmarking Profile and Observations:

The following benchmarking profiles are created and results are listed as observation:

- Annual potable water usage benchmarking
- Annual energy usage benchmarking
- Annual CO₂ emission benchmarking
- Annual Utility costs benchmarking
- Annual O&M Costs benchmarking

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4.2.4.3.1 Annual Potable Water Usage:

- Federal water usage index is based on gallons per person per day. Annual Federal water is calculated by multiplying the daily use by the number of building occupant and number of work days.
- Data received from the Facility may be in different units. They should be converted to gallons/building occupant/year.

Below is an example of graph chart for Annual water usage.

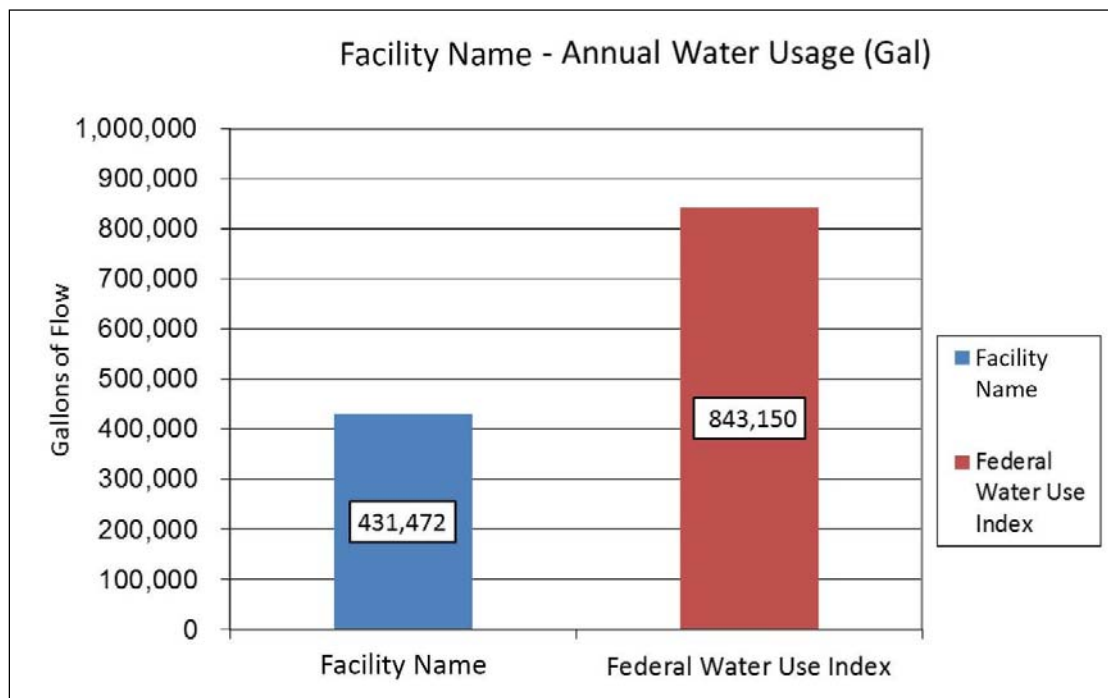


Figure 73 - Domestic Water Readings from Month Year to Month Year

Annual Domestic Water Usage – Observation:

- Observations from the above chart is listed here.

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4.2.4.3.2 Annual Energy Usage

- State Facility energy sources for the heating, cooling, and lighting.
- Energy generation (if applicable).
- CBECS National average data and Regional data based on the location of the Facility and are obtained from CBECS. The CBECS data are in kWh.
- Different facilities may use various energy sources and we may receive those data in different units. The annual energy data for various sources of data are converted to kWh and the data is totaled to find out the annual facility energy usage.

Below is an example of an annual energy usage chart.

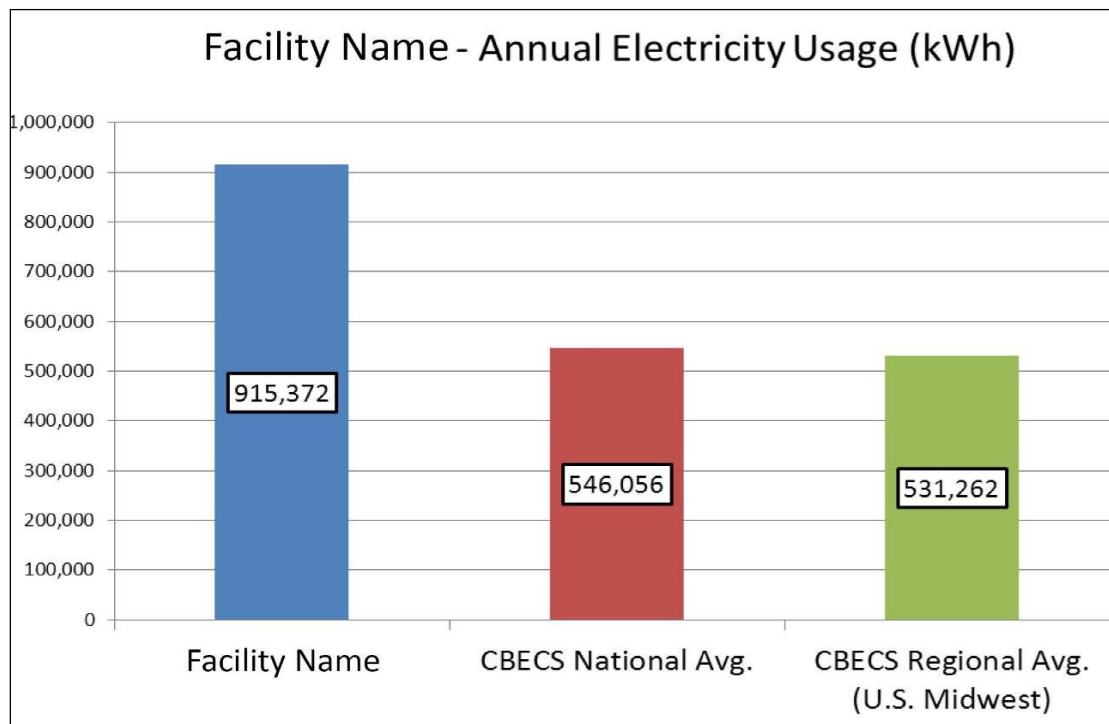


Figure 74 - Annual Electrical Usage Comparison Chart. Readings from Month Year to Month Year

Annual Energy Usage – Observation:

- Observations from the above chart are listed here.

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4.2.4.3.3 Annual CO₂ Emissions

- CO₂ emission for the facility will be calculated, in lbs, using Simplified Greenhouse Gas Emissions Calculator, through converting kWh (total energy use) to CO₂ using eGRID subregion.

Below is an example of chart for annual CO₂ emissions.

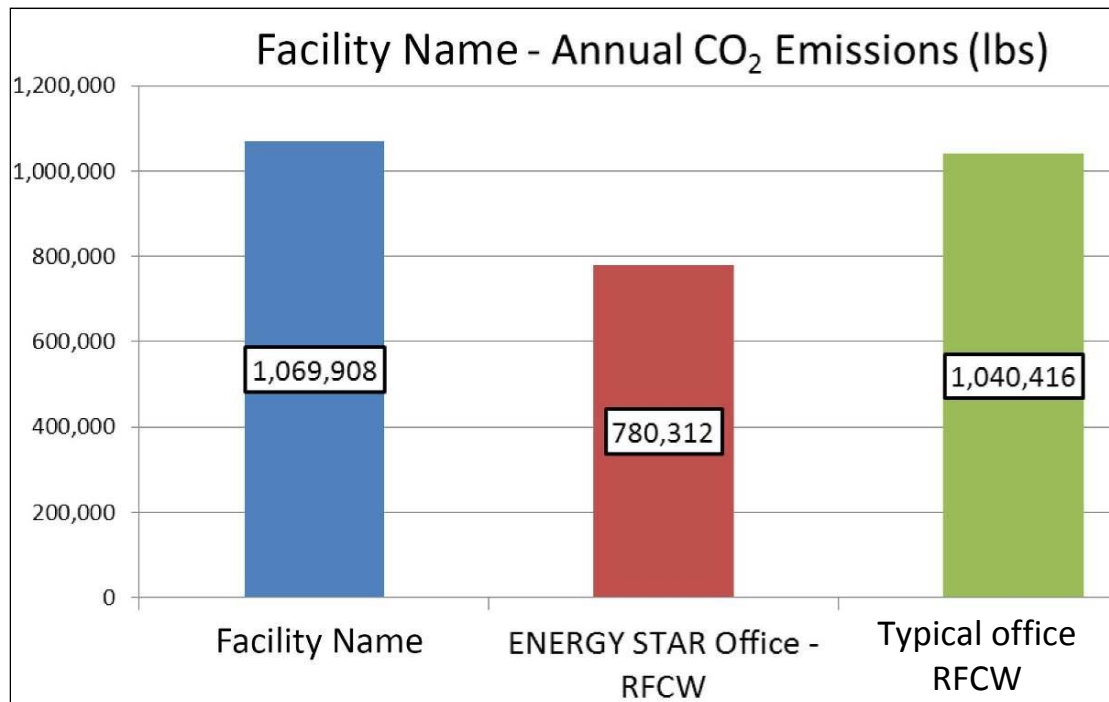


Figure 75- Carbon Dioxide Emissions Comparison Chart

Annual CO₂ Emissions Observation:

- Observations from the above chart are listed here.

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4.2.4.3.4 Annual Utility Costs

- Total utility costs per GSF are obtained by dividing annual total utility cost for the Facility by gross square feet of the facility. The data is compared with BOMA and IFMA, utility costs per GSF (Federal Government and regional) data.

Below is an example of a chart showing annual total utility costs per GSF

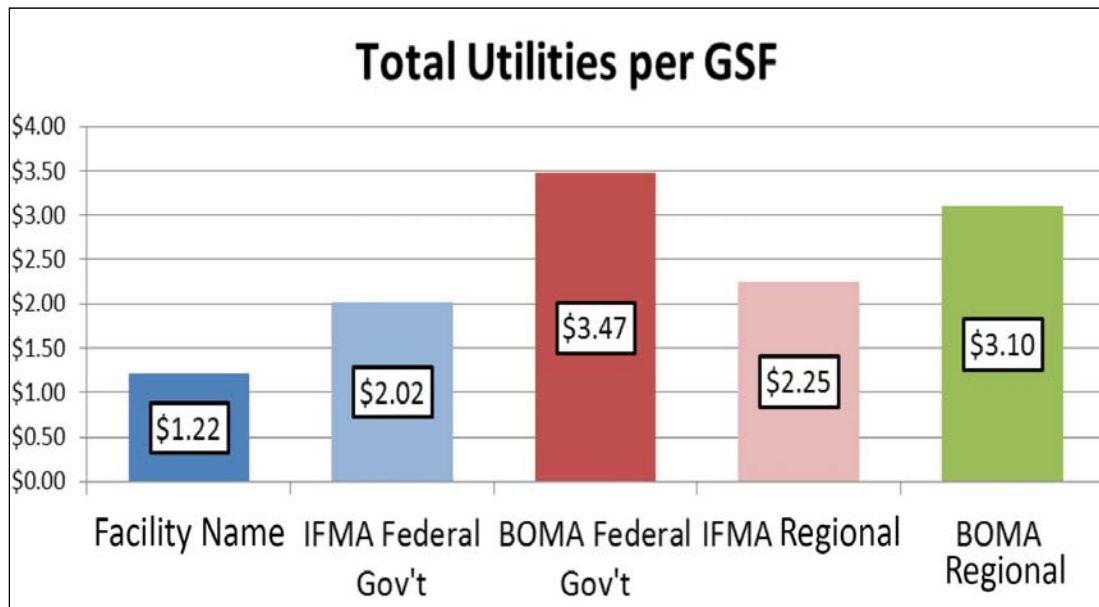


Figure 76 – Annual Utility Cost Comparison Chart

Annual Utility Costs Observation:

- Observations from the above chart are listed here.

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4.2.4.3.5 Annual O&M Costs

- Total O&M costs per GSF are obtained by dividing annual total O&M cost for the facility by Rentable square feet of the facility. The data is compared with BOMA and IFMA, O&M costs per Rentable SF (Federal Gov't and regional) data.

Below is an example of chart for annual total O&M cost per Rentable SF

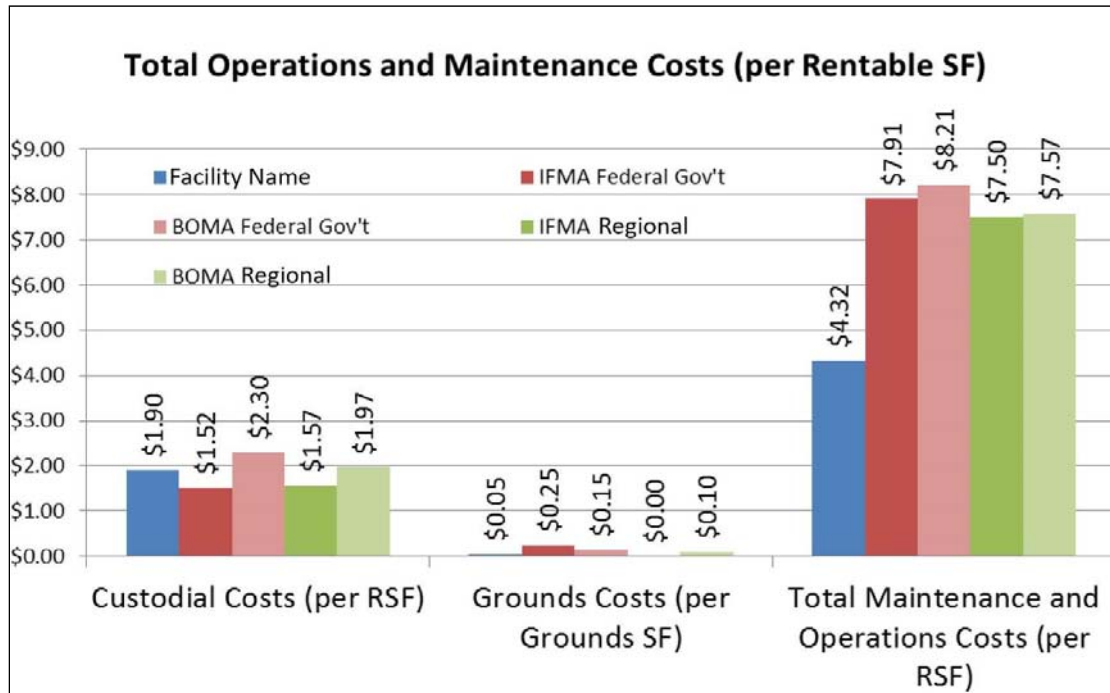


Figure 77 - Total Operations and Maintenance Costs

Annual O&M Costs Observation

- Observations from the above chart are listed here.

4.2.4.4 Building Occupant Satisfaction Evaluation

The building occupant satisfaction findings are obtained through the Building Occupants Survey. The evaluation examines all the Successes, Challenges and Lesson Learned/Best Practices related to building occupants' perceptions and satisfaction with the quality of the indoor environment. The survey data can be captured either on paper or typed directly in to the template.

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Building Occupant Survey Results

The building occupant survey results should be compared against nationwide post occupancy survey benchmarks collected by the Center for the Built Environment (CBE). Below is an example for Occupancy Satisfaction Survey results benchmarked against CBE IEQ survey.

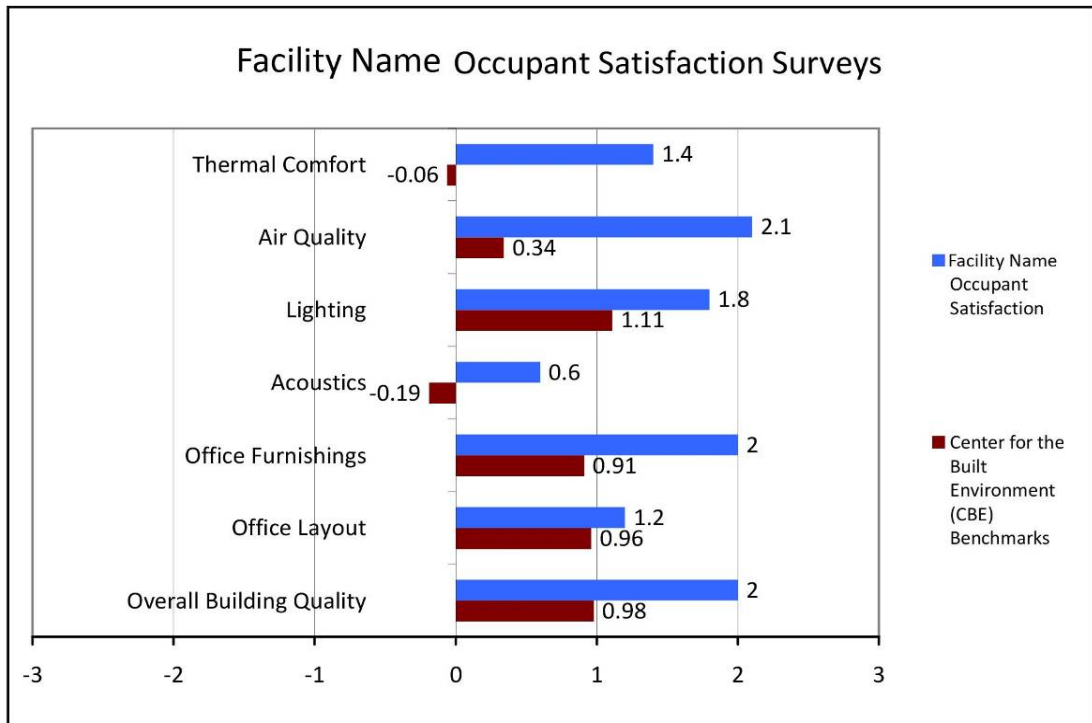


Figure 78 – Facility Name Occupant Satisfaction Surveys

Occupant Satisfaction Survey Observation

The Building Occupant Survey evaluations are categorized into the following sections. Findings for each section should be categorized in Successes, Challenges and Lesson learn/Best Practices.

- Thermal Comfort
- Air Quality
- Acoustic Comfort
- Lighting
- General Office Space

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4.2.5 Conclusions

The conclusion is where overall Successes and Best Practices/Lessons Learned are compiled and consolidated for quick reference.

4.2.5.1 Compiled Successes

Successes are compiled from the findings section of the report, and encompass successful undertakings from the Process Evaluation, Functional Performance Evaluation, and Building Occupant Satisfaction Survey. Successes are positive aspects from any phase of the project which were developed or utilized during the project and recommended to be shared with the other Centers.

4.2.5.2 Compiled Best Practices/Lessons Learn

Best Practices/Lessons are compiled from the findings section of the report, and encompasses Best Practices/Lessons from the Process Evaluation, Functional Performance Evaluation, and Building Occupant Satisfaction Evaluation. Best Practices/Lessons are derived from the Successes and Challenges faced throughout the process of planning and construction at all phases.

4.2.5.3 Summary

Although this Guide focuses on the POE process and its advantages, all chapters of the evaluation procedure play an equally important role in ensuring that buildings perform efficiently and provide comfortable, safe, and productive work environments for the facility managers and occupants. For all of NASA's new sustainable buildings, the POE effort should be incorporated early in procurement, conducted at least one year after building occupancy, and conclude upon Report acceptance. We hope our Centers will share their findings across the Agency to further our knowledge on the impact our investment in sustainability has on users and buildings.

4.2.6 Appendices (Refer to Guidebook Appendix for examples)

- Acronyms
- Table of Figures
- Completed Forms
- Other supporting documents

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4.3 Checklists for To Do Items –Writing the POE Report

- Data review, analysis
- Benchmarking
- Executive summary
 - Are the purposes of the POE clearly stated?
 - Are the results summarized?
 - Are the conclusions & recommendations outlined?
- Introduction
 - Is the purpose of the POE clearly stated?
 - Is the context & background explained?
 - Are the focuses of the report outlined?
 - Are the important concepts & terms defined?
 - Is the POE procedure clearly outlined?
- Findings
 - Are the results explained & interpreted?
 - Are the results benchmarked?
- Conclusion and Recommendation
 - Are the Successes compiled?
 - Are the Lessons Learned/Best Practices compiled?

APPENDIX A - ACRONYMS

A/E:	Architect/Engineer (Team)
BAS:	Building Automation System
BOMA:	Building Owners and Managers Association International
BTU:	British Thermal Unit
CO ₂ :	Carbon Dioxide
CBE:	Center for the Built Environment
CBECS:	Commercial Building Energy Consumption Survey
CFL:	Compact Fluorescent Lightbulb
CoF:	Construction of Facilities
ERV:	Energy Recovery Ventilator
FY:	Fiscal Year
gal:	Gallon
GSA:	Government Services Administration
GSF:	Gross Square Feet
HOA:	Homeowner's Association
HVAC:	Heating, Ventilating and Air-Conditioning
HRU:	Heat Recovery Unit
IFMA:	International Facility Management Association
IT:	Information Technology
kWh:	Kilowatts per hour
lbs:	Pounds
LaRC	Langley Research Center
LEED:	Leadership in Energy and Environmental Design
NASA:	National Aeronautics and Space Administration
O&M:	Operations and Maintenance
PER:	Preliminary Engineering Requirements
PIO:	Planning and Integration Office
PMV:	Performance Measurement and Verification
POE:	Post Occupancy Evaluation
PSF:	Pounds per Square Foot
RSF:	Rentable Square Feet
TPO:	Thermoplastic Polyolefin
UFAD:	Underfloor Air Distribution [System]
VAV:	Variable Air Volume

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APPENDIX C – SAMPLE POE SCOPE OF WORK

Title: Sustainable Buildings Post Occupancy Evaluations
Contract Number: By NASA
HQ T. O. Number: By NASA
POC: Name (Phone)

1.0 General Requirements

The contractor shall provide all labor, materials, transportation and supervision to 1) revise and/or modify sustainable buildings Post Occupancy Evaluation (POE) survey forms (only if necessary), 2) conduct the process evaluation, 3) conduct the POE and 4) write/submit a report for the POE discussing the results.

2.0 Post Occupancy Evaluation Surveys

The contractor shall conduct the post occupancy surveys using developed survey forms under individually attached task order. The contractor shall modify or revise these forms as necessary to accommodate this next step on the POE.

2.1 Survey forms to be used include:

- 2.1.1 Building Occupant Survey (Appendix__)
- 2.1.2 Facility Manager Survey (Appendix__)
- 2.1.3 O & M Personnel Survey (Appendix__)

3.0 Process Evaluation

Using the developed process evaluation form conduct the process evaluation. Set up a meeting with the in-house project team and conduct a process evaluation to include reviews of:

- 3.1 The procurement process
- 3.2 Design process
- 3.3 Construction process
- 3.4 Commissioning
- 3.5 Occupation
- 3.6 The process evaluation shall include:
 - 4.6.1 Communication effectiveness, including maintaining continuity and involving key stakeholders in decisions.
 - 4.6.2 Lessons learned during the project, including any rework necessary as part of quality control and overall continual improvement.
 - 4.6.3 Identification and management of risk.
 - 4.6.4 Team building strategies including partnering, project team.

- 4.6.5 Cost control techniques, including value engineering.
- 4.6.6 Change management strategies, including contingency plans for delays and changes in scope (ie. review change order history).
- 4.6.7 Process improvements and best practices as applicable.
- 4.6.8 Business case analysis
- 4.6.9 Pre-project planning
- 4.6.10 Procurement delivery contract strategy
- 4.6.11 Construction metrics

4.0 Conduct the POE on the following building; ARC, Building **Name/no.**

- 4.1 Gather benchmark data – the latest version of each
 - 4.1.1 CBEC's Data
 - 4.1.2 Energy Star (CO₂ emissions)
 - 4.1.3 IFMA & BOMA O & M Costs
 - 4.1.4 Federal Water Use Index
 - 4.1.5 Center for the Built Environment (occupant satisfaction)
- 4.2 Evaluate pre-site visit information
 - 4.2.1 FEMP Database submission
 - 4.2.2 Energy and water cost and use (from NETS). Also, if an energy model was built during the design phase, compare the results of the model to actual use. Record Energy Star Rating.
 - 4.2.3 O & M Costs
 - 4.2.4 Service order history
- 4.3 Site Visit
 - 4.3.1 Prepare and conduct a kickoff meeting to include all stakeholders.
 - 4.3.2 Conduct a facility walks through conducted by a team of professionals with the following backgrounds: HVAC, plumbing, fire protection, electrical distribution, lighting, interior design, building envelope (roof, windows, walls, exterior), site/landscaping, etc... (ie. all building systems)
 - 4.3.3 During each walk through look at the general layout of the facility, the building systems and the products used for all building systems including but not limited to; HVAC, plumbing, electrical distribution, lighting, fire protection, interior finishes, exterior finishes, windows and roof. All systems shall be evaluated based on suitability, durability, maintenance, control, aesthetics, adaptability and other applicable aspects.
 - 4.3.4 Survey the facility manager.
 - 4.3.5 Conduct maintenance surveys to include grounds, custodial and O & M personnel.
 - 4.3.6 Conduct occupant surveys on 10% of the population in the building or up to 10 people.

- 4.3.7 Collect additional information not captured prior to the trip.
- 4.4 Analyze data and survey results to provide results and recommendations.

5.0 Reports

Write One Report for each POE discussing the results.

- 5.1 Each report shall contain
 - 5.1.1 Executive Summary
 - 5.1.2 Introduction (what, how and future improvements/recommendations of the process)
 - 5.1.3 Results
 - 5.4.3.1 Survey results
 - 5.4.3.2 Process evaluation
 - 5.4.3.3 Walk through
 - 5.4.3.4 Building metrics/benchmarking/modeling (if applicable).
 - 5.1.4 Conclusions/recommendations – as part of this section, highlight 4 or more “must do” items and 4 or more lessons learned that you would not want to repeat on future projects.
 - 5.1.5 Appendix

6.0 Deliverables

- 6.1 Provide a report for the POE conducted on **Building Name/no**
- 6.2 Final submissions shall be submitted electronically on 6 CD's, 6 hard copies of each report.
- 6.3 Electronic files shall be modifiable with commercially available off the shelf software as well as in a format that can be directly posted on the Facilities Engineering Division Website.
- 6.4 In general, the contractor shall allow three weeks for government review.
- 6.5 Note: all of the rights to the products produced under this task order shall become property of NASA.

7.0 Schedule

- 7.1 Award by **Month Day, Year**
- 7.2 Site visits – 2 to 3 days at each site
- 7.3 Draft report - 4 weeks after site visit
- 7.4 Government review – 3 weeks
- 7.5 Final report - 3 weeks after government review

7.6 All deliverables shall be in final form no later than **Date**.

8.0 Proposal

8.1 Provide pricing only.

8.2 At least one person from DOE's National Renewable Energy Laboratory (NREL) will be with NASA on the site visit. They may have follow on questions that may add some time to the meetings, but the impact to the overall site visit is expected to be minimal.

9.0 Although some items may not have been specifically spelled out in this scope of work. The intent of this task order is to have a comprehensive POE of 1 sustainable NASA facility which includes benchmarking, surveys/site visits, facility inspections and reports with no additional work required.

APPENDIX D – PROCESS EVALUATION SURVEY

PROCESS EVALUATION FORM

for

SUSTAINABLE BUILDINGS POST OCCUPANCY EVALUATION (POE) SURVEY for

BUILDING/ FACILITY NAME

Address

City, State, Zip Code

Prepared on Behalf of:



Prepared by:

Firm / Department Name

Address

City, State, Zip Code

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PROJECT INFORMATION

Facility Information:

Facility Description:

Building Systems:

LEED Rating:

Building Sustainability Aspects:

Process Evaluator:

Consulting Engineering:

Date:

WHAT IS THE PROCESS EVALUATION FORM?

What is a Process Evaluation: The Process Evaluation is a survey form for Project Managers intended for a particular project/ facility. The survey asks questions of the Project Managers, Facility Manager, Operations and Maintenance, Construction of Facility personnel, Procurement staff, Architects and Engineers of Record, and other key stakeholders from beginning procurement and design development, through occupancy of the facility.

How to conduct: The Process Evaluation survey is to be conducted in person with NASA Project Managers (and outside consultants if available) for a particular project/ facility. The survey should be filled out by the person presenting the survey on the computer, and preferably in a different color from the default text. All answers are to be anonymous per the person surveyed.

Why Process Evaluation: The Process Evaluation will help NASA and future Project Managers better procure, plan, design, construct, occupy, and utilize facilities. Information gathered by this survey will aid in constructing a survey report which will discuss best practices and lessons learned. The evaluation is not to undermine or disparage any persons or projects, but simply to obtain and accumulate data to assist future and potential projects become better contracted, planned, constructed, and turned over.

INITIATING PROCESS

Key Initiating Process objectives through procurement phases: Develop project chart and identify key stakeholders.

- **Was the “Integrated Design Team” approach from the National Institute of Building Science’s *Whole Building Design Guide* implemented through all stages in the project? (defined at end of form)**

Note:

- **Were baselines established for the energy consumption and efficiency at the pre-project planning phase, or another phase down the line?**

Note:

- **Was LEED/ sustainability a part of the original procurement strategy and contracts, or was it added in later phases of the project? If so, how, if at all, did LEED affect the procurement process?**

Note:

- **Was a project charter established for this project?**

Note:

- **Was a partnering process / sessions held for all key stakeholders to build proper collaboration to complete the work?**

Note:

- **Was this project a design-build or a standard “split” design and construct submission?**

Note:

- **If it was a “split” submission, where there any issues with submissions?**

Note:

- **Were the contracts written for this project appropriate for the project’s requirements?**

Note:

- **What could be done differently next time to ensure a smoother process with regard to procurement strategy and contracts?**

Note:

PLANNING PROCESS

Key Planning Process objectives through project planning phases: Collect requirements for the project; define the scope; define activities; sequence activities; develop schedule; plan quality of project; plan communications; plan risk management; perform qualitative and quantitative risk analysis; and plan procurement for the project.

- **How clearly defined were everyone's roles in the project?**

Note:

- **How well did the facility site selection lend itself to LEED credits? Was there alternate site options whether in or not in consideration which may have been better suited for this project?**

Note:

- **Were all or any of the design document project team members involved with pre-project planning, or was it all done in-house? If project team members were not involved, would it be preferable on future projects to have them involved with respect to LEED?**

Note:

- **Was a LEED Specialist involved with the project?**

Note:

- **Did pre-project planning help alleviate any potential issues with LEED credits or requirements? Would more focus on LEED be beneficial to future project phases?**

Note:

- **Was the scope of work fully realized in pre-project planning, or did it develop through later phases of work?**

Note:

- **How would you describe the building end-result to what was discussed in pre-project/ conceptual planning meetings? For example outstanding, above expectation, meets expectation, needs improvement, unsatisfactory or not applicable. Provide a listing of project goals and description of their level of completion.**

Note:

- **Are there any additional steps or procedures in the pre-planning process that you feel are lacking or missing?**

Note:

NASA Sustainable Buildings POE Survey for

PROCESS EVALUATION FORM

- **Are there any other disciplines/ team members who should have been at the preliminary and schematic design phases who were not present?**

Note:

EXECUTING PROCESS

Key Executing Process objectives through Construction phase: direct and manage project execution; perform quality assurance; develop project team; manage project team; distribute information; manage stakeholder expectations; and conduct procurement.

- **How clearly defined were the tasks and requirements for LEED credits disseminated by the project architect, or facility project manager?**

Note:

- **How well do you think interdisciplinary problems were handled in the course of the project?**

Note:

- **How efficient and effective were project team meetings?**

Note:

- **How open were all disciplines to using new materials, equipment, etc within the building framework to achieve a LEED rating?**

Note:

- **How difficult were products, materials, finishes, and equipment to obtain to meet LEED requirements? Were they generally available within the region?**

Note:

- **Did sustainable products, finishes, and materials have an effect on writing specifications?**

Note:

- **What in the building envelope design would you change to better meet the requirements of the facility and its personnel?**

Note:

- **What in the building envelope design would you change to better meet the requirements of LEED?**

Note:

- **What about the building plan design would you change to better meet the requirements of the facility and its personnel?**

Note:

- **What about the building plan layout would you change to better meet the requirements of LEED?**

Note:

NASA Sustainable Buildings POE Survey for

PROCESS EVALUATION FORM

- What about the building HVAC design would you change to better meet the requirements of the facility and its personnel?

Note:

- What about the building HVAC design would you change to better meet the requirements of LEED?

Note:

- What about the building plumbing design would you change to better meet the requirements of the facility and its personnel?

Note:

- What about the building plumbing design would you change to better meet the requirements of LEED?

Note:

- What about the building electrical and telecommunications design would you change to better meet the requirements of the facility and its personnel?

Note:

- What about the building electrical and telecommunications design would you change to better meet the requirements of LEED?

Note:

- Were there any materials, building systems, functional layout of spaces, or any other part of the building design required by LEED that were at odds to what the facility use wanted or required? If so, how was this handled?

Note:

- Were any materials or building systems changed out during construction not due to value-engineering/ cost? Did this affect the LEED credits positively or negatively?

Note:

- Are there any other disciplines that were not part of the team at all that should have been involved? For example, outside LEED/ sustainability specialist, building envelope specialist, etc.

Note:

- Would it have been beneficial to have such entities as future building users, operations and maintenance workers, or facility managers present during any early phase of design if they were not present?

Note:

NASA Sustainable Buildings POE Survey for

PROCESS EVALUATION FORM

- **Are there any particular team building strategies which had worked well on this project and can be implemented on similar future projects?**

Note:

MONITORING & CONTROLLING PROCESS

Key Monitoring and Controlling Process objectives through construction phase: monitor and control project work; perform integrated change control; verify scope; control schedule; control costs; perform quality control; report performance; monitor and control risk; administer procurement. Blends into “Executing Process,” but also encompasses physical construction phases of the project.

- **What communication and organizational problems in general were encountered?**

Note:

- **How open were building contractors to accepting new materials, equipment, etc to achieve a LEED rating?**

Note:

- **How open were building contractors to ascertaining and keeping proper information/ paperwork with regard to certain LEED credits, such as recycled content information or waste?**

Note:

- **If issues did arise with contractors regarding LEED paperwork, how were they resolved and how could they be defused early on?**

Note:

- **What communication procedures do you believe worked well for this project, and would like to see implemented on similar future projects?**

Note:

- **Were the sustainable products, finishes, and materials used in this project for LEED credits generally more expensive, less expensive, or negligible in costs?**

Note:

- **Were costs associated with installation and labor of the LEED approved building materials generally more expensive, less expensive, or negligible in costs?**

Note:

- **Were building systems used to attain LEED credits generally more expensive, less expensive, or negligible in costs?**

Note:

- **Were costs associated with installation and labor of these sustainable building systems generally more expensive, less expensive, or negligible in costs?**

Note:

NASA Sustainable Buildings POE Survey for
PROCESS EVALUATION FORM

- **Were any products, materials, or building systems value-engineered for reasons other than cost? If so, why?**

Note:

- **Were there added soft costs required in order to attain LEED credits which proved to be more costly than anticipated? For example, additional labor associated with certain products, more engineering for building systems, extra lead times, etc.**

Note:

- **What cost control techniques did you use on this project which could be implemented to help keep costs down on a similar future project?**

Note:

- **What cost control techniques have you learned from this project which could help keep cost down on a similar future project?**

Note:

- **Were there any contingencies built in to the project schedule for delays?**

Note:

- **Were there any unanticipated delays due to change in scope? If so, how can these delays be decreased?**

Note:

- **Were there any unanticipated delays due to long product lead times? If so, how can these delays be decreased?**

Note:

- **Were there unanticipated additional services contracts added at any point?**

Note:

- **Was there an above-average amount of bulletins or addendums issued during construction this project? If so, why?**

Note:

- **Were change orders more costly than normal when compared to a project of equal scope and size? If so, why?**

Note:

- **What could be done differently next time to decrease the number or bulletins and change orders, if applicable?**

Note:

NASA Sustainable Buildings POE Survey for

PROCESS EVALUATION FORM

- **Were there any issues with the procurement strategy implemented for this project due to unforeseen complexity of the project, including LEED criteria?**

Note:

- **Was the project, in general, on time or on budget?**

Note:

CLOSING PROCESS

Key Closing Process objectives through building turnover: close project, close procurement, and start building occupation.

- **Which credits did you find most difficult to attain?**

Note:

- **Which credits did you find easiest to attain?**

Note:

- **Are there any credits you would not wish to attain on future LEED projects, and if not why?**

Note:

- **Are there any credits you did not receive which you would like to attain on future LEED projects, and if not why?**

Note:

- **Did this facility receive the rating the facility was proposed to acquire?**

Note:

- **What parts of the LEED process was easy, difficult, and time-consuming?**

Note:

- **If LEED certification has already been achieved, how long did it take to get LEED certification after final completion of building and submittal of documents? If not, is certification still on track per the allotted time schedule?**

Note:

- **Were software programs used to assist in gaining LEED credits? If so, what software program(s), which discipline used it, and was it readily available and easy to use?**

Note:

- **What advice or "lessons learned" could you give to others in your situation on the LEED certification process?**

Note:

NASA Sustainable Buildings POE Survey for PROCESS EVALUATION FORM

DEFINITIONS

Building contract: means the written agreement between the Government and the Prime Contractor for the design / construction of the project. The terms of the agreement may provide for the design and documentation of the project by the Prime Contractor, and may also include ongoing maintenance obligations.

Consultancy contract: means the written agreement between either the Prime Contractor and a consultant or the Prime Contractor and a sub-contractor for the delivery of consultancy services (such as design, documentation, cost planning and project scheduling) related to a building project

Integrated Design Team Approach: The Guiding Principles use the WBDG model in its definition of integrated project teams. According to the WBDG, an integrated project team uses an integrated design approach and an integrated team process in all stages of project planning and delivery. Each project should have comprehensive design objectives, including access, aesthetics, cost effectiveness, functionality, historic preservation, productivity, security/safety, and sustainability.

In an integrated process, all team members analyze the project from the perspective of each of these objectives, rather than focusing solely on their own areas of expertise. This approach strives to ensure understanding, shared knowledge, and close cooperation among team members throughout the project. In an example of an integrated process, operations and maintenance (O&M) staff would be included in facility design decisions, allowing them better insight into future maintenance requirements and ensuring that their input is considered in equipment purchase and other decisions. Specific integrated team elements described in NPR 8820.2F include the assignment of a Facility Project Manager (FPM) to lead each CoF project team. The FPM is responsible for organizing, managing, and directing facility project work with the support of a project team. All individuals or organizations responsible for CoF project implementation, including the FPM and project team, are identified in the Facility Project Management Plan.

LEED: Developed by the USGBC (U.S. Green Building Council), *Leadership in Energy and Environmental Design* is a project design rating system which is divided into several rating systems: New Construction (NC), Existing Buildings: Operations & Maintenance (EB: O&M), Commercial Interiors (CI), Core & Shell (CS), Schools (SCH), Retail, Healthcare (HC), Homes, and Neighborhood Development (ND). A project can achieve one of four LEED Ratings by gaining various points or credits: Certified, Silver, Gold, or Platinum.

Procurement strategy: refers to the process used to take a building project from its early planning phases to completion and occupation by the building's users from conceptual phase to occupancy.

Benchmark data references:

- 1.1.1 CBEC's Data
- 1.1.2 Energy Star (CO₂ emissions)
- 1.1.3 IFMA & BOMA O & M Costs
- 1.1.4 Federal Water Use Index

NASA Sustainable Buildings POE Survey for

PROCESS EVALUATION FORM

Description of Performance Rating

Outstanding - consistently meets standards in all areas, often exceeds, sometimes by wide margin

Above Expectations - consistently meets standard in most areas, sometimes exceeds, seldom falls below

Meets Expectations - consistently meets standard in most areas, performs above in some, and needs improvement in some.

Needs Improvement - sometimes fails to meet standards in some areas, seldom goes above

Unsatisfactory - often fails to meet standard, and improvement in performance is required

NASA TERMS

BAS:	(Building Automation System) IT-based systems which controls and monitors building systems, which include lighting, data, HVAC, security, etc.
CoF:	(Construction of Facilities)
CSC:	(Computer Science Corporation) O&M personnel who physically monitor, control, and repair building systems when required. More hands on than the Hot/ Cold personnel.
EMCS:	Energy Management and Control System
FM:	(Facility Manager)
FMOD:	(Facility Maintenance and Operation Division)
Hot/ Cold:	O&M personnel who are the first to arrive when a facility issue occurs.
M&V:	(Measurement and Verification)
O&M:	(Operations and Maintenance)
PER:	(Preliminary Engineering Requirements)
PM:	(Project Manager)

APPENDIX E – FACILITY MANAGER SURVEY

FACILITY MANAGER SURVEY FORM

for

SUSTAINABLE BUILDINGS POST OCCUPANCY EVALUATION (POE) SURVEY for

BUILDING/ FACILITY NAME

Address

City, State, Zip Code

Prepared on Behalf of:



Prepared by:

Firm / Department Name

Address

City, State, Zip Code

FACILITY MANAGER SURVEY NARRATIVE

Who is being interviewed?

The Facility Manager Survey is a survey for the manager of the facility undergoing evaluation. The survey will be conducted in person, and filled out by the interviewer presenting the survey. All responses given will remain anonymous.

Why a Facility Manager Survey?

The Facility Manager Survey will aid NASA to better plan and design future facilities pertaining to overall operations of facilities. Information gathered by this survey will lend support in constructing a Post Occupancy Evaluation final report, which will discuss best practices and lessons learned after facility turnover. The survey and final report is not designed to undermine or disparage the facility or those who had been a part of the Project Team for the facility construction. It is in the best interest of NASA, the Evaluating Team, and the Facility Manager to give honest and open answers and feedback per the survey.

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3. Space Utilization	
4. Finishes	
5. Utilities/ Building Systems	
6. General Facility Operations	

PROJECT INFORMATION

Facility Information:

Facility Description:

Building Systems:

LEED Rating:

Building Sustainability
Aspects:

Process Evaluator:

Consulting Engineering:

Date:

FACILITY MANAGER SURVEY: Personnel Information

What is your workplace experience?

- less than 10 years 11-25 years Over 25 years

What is your job title at the facility?

Note:

How would you describe the work you do at the facility?

Note:

How long have you worked in this facility?

Note:

How many other facilities do you manage?

Note:

FACILITY MANAGER SURVEY: Site

Does the building design consider LEED/sustainable issues (land usage, water usage, retention of natural features, etc)?

Yes No

Note:

Is this facility arranged appropriately in relation to surrounding facilities on/around the site?

Yes No

Note:

Is there public transportation within an appropriate distance to the facility?

Yes No

Note:

Does the facility have an adequate number of parking spaces, including handicap accessible?

Yes No

Note:

Does the facility have alternate fuel parking spaces, and if so is there an adequate amount?

Yes No

Note:

Are you satisfied with the outdoor landscaping around this facility?

Yes No

Note:

Is there adequate exterior signage for the facility? Building signage, parking signage, etc.

Yes No

Note:

FACILITY MANAGER SURVEY: Space Utilization

Does the facility design support its intended use?

Yes No

Note:

Are the spaces (still) being used as designed?

Yes No

Note:

Is the facility an adequate size?

Yes No

Note:

In general, are the spaces within the facility of adequate size?

Yes No

Note:

In general, are the ceiling heights within the facility of adequate height and clearance?

Yes No

Note:

Is the facility flexible enough to meet the demands of the users?

Yes No

Note:

Can the facility accommodate unanticipated uses when required?

Yes No

Note:

Does the design of the facility and layout of the spaces promote ease in way-finding?

Yes No

Note:

Is there adequate room signage within the facility?

Yes No

Note:

NASA Sustainable buildings POE Survey for

FACILITY MANAGER SURVEY FORM

Do you believe the trash collection area was designed well so it doesn't compete with other facility deliveries?

Yes No

Note:

Does the facility have a loading dock? If so, does it meet the facility's requirements?

Yes No

Note:

If there is no loading dock, would one ease maintenance or serviceability of the facility?

Yes No

Note:

Are you satisfied with maneuvering space for delivery trucks to load and unload?

Yes No

Note:

Do you believe the facility allows easy user/ customer interface?

Yes No

Note:

How do you believe the level of noise pollution in public space due to occupant noise in this facility compares to a facility of equal size and scope?

More Less Equal

Note:

Have there been any complaints from building occupants regarding sun glare within workspaces?

Yes No

Note:

FACILITY MANAGER SURVEY: Finishes

Are you satisfied with the floor finishes (aesthetics, durability, suitability)?

Yes No

Note:

Are you satisfied with the wall finishes (aesthetics, durability, suitability)?

Yes No

Note:

Are you satisfied with the ceiling finishes (aesthetics, durability, suitability)?

Yes No

Note:

Are you satisfied with the door provisions (aesthetics, durability, hardware, suitability)?

Yes No

Note:

Are you satisfied with the window provisions (aesthetics, durability, hardware, suitability)?

Yes No

Note:

Are you satisfied with the staircase provisions (aesthetics, suitability)?

Yes No

Note:

Are you satisfied with the handicap ramp provisions (aesthetics, suitability)?

Yes No

Note:

Are you satisfied with the roof finishes (aesthetics, durability, suitability)?

Yes No

Note:

Are you satisfied with the overall quality of finishes in this facility?

Yes No

Note:

NASA Sustainable buildings POE Survey for

FACILITY MANAGER SURVEY FORM

What was the biggest criterion behind finish selection – select one:

- Afforability
- Ease of Maintenance
- Durability
- Aesthetics
- Sustainability
- User Expectations
- Other:

Note:

Was life-cycle cost a consideration (short term savings vs. long term savings)?

- Yes
- No

Note:

Did you experiment with new finish products?

- Yes
- No

Note:

In general, are you satisfied with the finishes durability?

- Yes
- No

Note:

In general, are you satisfied with the ability to keep this facility clean?

- Yes
- No

Note:

FACILITY MANAGER SURVEY: Utilities/Building Systems

In your estimation, over the last year, how much less overall energy usage have you experienced in this building as compared to a similar sized building?

- 5% or less 6-10% 16-20% 21-30% More than 30% Don't know

Note:

In your estimation, over the last year, how much less water usage have you experienced in this building as compared to a similar sized building?

- Less than 20% 20-30% More than 30% Don't know

Note:

Please note if the following accurate line diagrams and information on the indicated utility metering points are available.

- Electrical One-line or Riser Diagram
- Electrical metering points
- HVAC Riser Diagram
- Plumbing System Riser Diagrams
- Water/Gas Metering Points

Note:

Are you satisfied with the mechanical system (HVAC) in this facility?

- Yes No

If no, which of the areas are you not satisfied with?

- Heating, **elaborate:**
- Cooling, **elaborate:**
- Reliability, **elaborate:**
- Controls, **elaborate:**
- Other:**

Note:

If natural ventilation is utilized, is there proper air circulation throughout the spaces and are there "dead spots"?

- Yes No

Note:

What is the frequency of complaints by facility occupants regarding the facility's mechanical system?

- More frequently than average for a facility of the same size
- Average for a facility of the same size
- Less frequently than average for a facility of the same size

Note:

NASA Sustainable buildings POE Survey for

FACILITY MANAGER SURVEY FORM

What is the frequency of service orders relative to the facility's mechanical system?

- More frequently than average for a facility of the same size
- Average for a facility of the same size
- Less frequently than average for a facility of the same size

Note:

What is the frequency of complaints by facility occupants regarding the facility's lighting system?

- More frequently than average for a facility of the same size
- Average for a facility of the same size
- Less frequently than average for a facility of the same size

Note:

What is the frequency of service orders relative to the facility's lighting system?

- More frequently than average for a facility of the same size
- Average for a facility of the same size
- Less frequently than average for a facility of the same size

Note:

What is the frequency of complaints by facility occupants regarding the facility's plumbing system or plumbing fixtures?

- More frequently than average for a facility of the same size
- Average for a facility of the same size
- Less frequently than average for a facility of the same size

Note:

What is the frequency of service orders relative to the facility's plumbing system or plumbing fixtures?

- More frequently than average for a facility of the same size
- Average for a facility of the same size
- Less frequently than average for a facility of the same size

Note:

Does the elevator/escalator system(s) meet the facility's requirements?

- Yes
- No

Note:

Are you satisfied with the quality of electrical systems in this facility?

- Yes
- No

Note:

Are you satisfied with the water and plumbing services in this facility?

- Yes
- No

Note:

NASA Sustainable buildings POE Survey for

FACILITY MANAGER SURVEY FORM

Are sustainable technologies such as photovoltaic panels, heat pumps, wind turbines, etc. installed at the facility? If yes, how satisfied are you with the technologies functioning as per their design requirements?

Yes No

Note:

If sustainable technologies are present, has maintenance been an issue or concern? For example, damage to PV panels from debris, weather, etc.

Yes No

Note:

How do you believe the level of noise pollution in public spaces due to mechanical functions in this facility compares to a facility of equal size and scope?

More Less Equal

Note:

Are you satisfied with the security measures and procedures planned in this facility?

Yes No

Note:

Are the building systems (mechanical, plumbing, electrical, etc.) functioning as intended, and were they appropriate choices?

Yes No

Note:

Are the building systems' (mechanical, plumbing, electrical, etc.) energy and water savings as good as initially assumed?

Yes No Don't Know

Note:

Are you satisfied with the overall quality of the physical structure of this facility?

Yes No

If no, which of the areas are you not satisfied with?

Structural integrity and cracking, **elaborate:**

Insulation and sealing, **elaborate:**

Appearance, **elaborate:**

Roof, **elaborate:**

Other:

Note:

FACILITY MANAGER SURVEY: General Facility Operations

Do you believe decisions based on sustainability issues compromise space utilization, user satisfaction, maintenance or operation?

Yes No

Note:

Was the O&M staff assigned to the facility in sufficient time prior to occupancy?

Yes No

Note:

Are there any equipment service provisions/ warranties within the facility's construction contract?

HVAC Elevators BAS
 Fire system Security system **Other:**

Note:

Have you made any warranty claims?

Yes No

Note:

Were there any latent defects found in the facility that were never discovered through punch list items, or reported by the building contractors which have had a detrimental effect on the facility operations?

Yes No

Note:

What level of participation did you have in the acceptance of the construction punch list items?

Note:

Do you feel satisfied that all items from the punch list were addressed before final acceptance of the facility?

Yes No

Note:

Are O&M staff handling and maintaining facility equipment (particularly sustainable and "green" equipment components) properly?

Yes No

Note:

If no, is additional training for O&M staff needed?

Yes No

Note:

NASA Sustainable buildings POE Survey for

FACILITY MANAGER SURVEY FORM

Are occupants using facility equipment (particularly sustainable and “green” equipment components) properly?

Yes No

Note:

If no, is additional training for building occupants needed?

Yes No

Note:

Have modifications been made to the physical facility or operations of the facility to improve energy efficiency? If so, what annual savings are associated with these savings?

Note:

Have you seen savings from water-use reduction? If so, how much?

Note:

Have you seen savings from electrical-use reduction? If so, how much?

Note:

Have any payback periods yet been reached where applicable?

Note:

Does it appear any payback periods are going to be reached quicker or longer than expected?

Note:

Have any building operations been negatively effected by the implementation of sustainable or “green” technologies?

Note:

Are there any issues relating to the facility which had not been addressed in this survey?

Note:

Is there anything from this project specifically you would like to see incorporated into future projects?

Note:

Is there anything from this project specifically you would not like to see incorporated into future projects?

Note:

APPENDIX F – OPERATIONS & MAINTENANCE SURVEY

OPERATIONS AND MAINTENANCE PERSONNEL SURVEY FORM

for

SUSTAINABLE BUILDINGS POST OCCUPANCY EVALUATION (POE) SURVEY for

BUILDING/ FACILITY NAME

Address

City, State, Zip Code

Prepared on Behalf of:



Prepared by:

Firm / Department Name

Address

City, State, Zip Code

O&M PERSONNEL SURVEY NARRATIVE

Who is being interviewed?

The O&M (Operations and Maintenance) Personnel Survey is a survey for personnel who work on the day-to-day operation, maintenance and repair of the facility undergoing evaluation and its direct surroundings. The survey will be conducted in person, and filled out by the interviewer presenting the survey. All responses given will remain anonymous.

Why an O&M Personnel Survey?

The O&M Personnel Survey will aid NASA to better plan and design future facilities pertaining to day-to-day operation, maintenance, and repair of facilities. Information gathered by this survey will lend support in constructing a Post Occupancy Evaluation final report, which will discuss best practices and lessons learned after facility turnover. The survey and final report is not designed to undermine or disparage the facility or those who had been a part of the Project Team for the facility construction. It is in the best interest of NASA, the Evaluating Team, and the O&M Personnel to give honest and open answers and feedback per the survey.

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4. Lighting	
5. Electrical, Telecommunications, and Data	
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9. General Facility Maintenance	
10. Custodial Maintenance	
a. Restrooms	
b. General Serviceability	
11. Grounds and Landscaping	

PROJECT INFORMATION

Facility Information:

Facility Description:

Building Systems:

LEED Rating:

Building Sustainability Aspects:

Process Evaluator:

Consulting Engineering:

Date:

O&M SURVEY: Grounds and Landscaping

How satisfied are you with the landscape irrigation system with regards to water conservation?

Very Dissatisfied Very Satisfied

Note:

How satisfied are you with the amount of water required by the exterior landscaping plants?

Very Dissatisfied Very Satisfied

Note:

Which of the following environmentally beneficial (eco-friendly) landscaping concepts been incorporated into the maintenance of the landscaping?

- Native plant species
- Growing zone appropriate plants
- Low/ no mow grass
- Periodic mulching
- Organic fertilizers
- Reduced fertilizing techniques
- Organic or no pesticides
- Organic or no herbicides
- None
- Unknown
- Other:**

What are the most problematic maintenance issues outside of the facility, in any?

- Bird nesting, Elaborate:
- Plaza/ public space maintenance, Elaborate:
- Landscaping, Elaborate:
- Parking areas, Elaborate:
- Exterior light fixtures, Elaborate:
- Water drainage, Elaborate:
- Landscape sprinkler system, Elaborate:
- Sidewalk cracking or heaving, Elaborate:
- Accumulation of ice or snow on sidewalks or at entry, Elaborate:
- No problems present, Elaborate:

NASA Sustainable Buildings POE Survey for
OPERATIONS AND MAINTENANCE PERSONNEL SURVEY FORM

Other:

If environmentally beneficial landscaping concepts have been used, how satisfied are you the landscaping concepts been successful?

Very Dissatisfied Very Satisfied

Note:

How satisfied are you with the ease of performing maintenance on the facility grounds/ landscaping?

Very Dissatisfied Very Satisfied

Note:

Any additional landscaping comments or concerns not covered in this survey?

Note:

O&M SURVEY: Servicing the Facility (Repair Maintenance)

How satisfied are you with design of the trash collection area so it doesn't compete with facility maintenance?

Very Dissatisfied Very Satisfied

Note:

Does the facility have a loading dock? If no, skip the next question.

Yes No

Note:

How satisfied are you with design of the loading dock to meet facility maintenance requirements?

Very Dissatisfied Very Satisfied

If there is no loading dock, would one ease maintenance or serviceability of the facility?

Note:

How satisfied are you with design of the loading dock or loading area design to minimize heating and cooling loss?

Very Dissatisfied Very Satisfied

Note:

How satisfied are you with maneuvering space for trucks to load and unload regardless if there is a loading dock?

Very Dissatisfied Very Satisfied

Note:

How satisfied are you with drainage at the loading dock or loading area?

Very Dissatisfied Very Satisfied

Note:

Does the facility have a freight elevator? If yes, does it meet the requirements of the facility per maintenance? If no, would one ease maintenance or serviceability of the facility?

Yes No

Note:

NASA Sustainable Buildings POE Survey for

OPERATIONS AND MAINTENANCE PERSONNEL SURVEY FORM

If applicable, how satisfied are you with the amount of storage for all items servicing the facility? This includes ladders, tools, etc. permanent to the facility.

Very Dissatisfied Very Satisfied

Note:

If raised flooring is present, are there issues present with access to any mechanical equipment or building systems for maintenance and repair? If so, what are the issues?

Yes No

Note:

Any additional general servicing comments or concerns pertaining to maintenance or repair not covered in this section?

Note:

O&M SURVEY: Facility Operations and Control Systems

Does the facility have a Building Automated System (BAS)? If no, skip the rest of this section.

Yes No

Note:

Are all the control systems located in one space of the facility?

Yes No

Note:

Have any critical control systems been left out of the facility? If yes, what control systems are missing?

Yes No

Note:

Are the control systems able to be operated off-site if required? If no, would this option be beneficial?

Yes No

Note:

Overall, how satisfied are you with the facility control systems as a whole pertaining to operability?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the facility control systems as a whole pertaining to maintenance?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the type of facility control system chosen?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the compatibility of the facility control system chosen?

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OPERATIONS AND MAINTENANCE PERSONNEL SURVEY FORM

Very Dissatisfied Very Satisfied

Note:

Have you found the control systems designed for LEED requirements in this facility require more maintenance and/ or inspections when compared to other facilities without LEED consideration?

Highly Disagree Highly Agree

Note:

Any additional control systems comments or concerns not covered in this section?

Note:

O&M SURVEY: HVAC

Are there provisions for removal and replacement of all major HVAC equipment when required?

Yes No

Note:

Overall, how satisfied are you with the ease and safety to access rooftop units?

Very Dissatisfied Very Satisfied

Note:

Are you satisfied with the amount of HVAC and piping insulation?

Very Dissatisfied Very Satisfied

Note:

Are there multiple types and sizes of air filters required by the HVAC system, and if so are there problems with ordering and storing air filters due to the multiple types and sizes?

Yes No

Note:

How satisfied are you with the HVAC system's zoning?

Very Dissatisfied Very Satisfied

Note:

Does the location of the HVAC outside air intake or the location of any exterior obstruction affect air intake quality? For example, is the intake located near parking or too close to exhaust vents?

Yes No

Note:

Based on the location of the HVAC outside air intake, how easy would it be to introduce chemical or biological agents into the facility?

Very Easy Very Difficult

Note:

If an underfloor air distribution system (UFAD) is used in the facility for the mechanical system, how satisfied are you with the UFAD system?

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Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the HVAC system capacity for the load it serves?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the HVAC system selection?

Very Dissatisfied Very Satisfied

Note:

Have you found the HVAC systems designed for LEED requirements in this facility require more maintenance and/ or inspections when compared to other facilities without LEED consideration?

Highly Disagree Highly Agree

Note:

Any additional HVAC comments or concerns not covered in this section?

Note:

O&M SURVEY: Lighting

How many different types of lamps are used throughout the facility?

Note:

Are all the components required for the light fixtures locally available, or do they require special orders? For example: ballasts and lamps.

Yes No

Note:

Which of the following issues have you had with lamps?

- Storage issues, Elaborate:
- Difficult to maintain, Elaborate:
- Too expensive, Elaborate:
- Not readily available, Elaborate:
- Short average lamp life, Elaborate:
- Other:

Are there issues with the emergency lighting within the facility?

Yes No

Note:

If applicable, how satisfied are you with the lighting motion sensors and timers?

Very Inefficient Very Efficient

Note:

Overall, how efficient would you rate the lighting fixtures?

Very Inefficient Very Efficient

Note:

Overall, how satisfied are you with the lighting fixtures?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the lighting system?

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Very Dissatisfied Very Satisfied

Note:

Have you found the lighting systems designed for LEED requirements in this facility require more maintenance and/ or inspections when compared to other facilities without LEED consideration?

Highly Disagree Highly Agree

Note:

Any additional lighting systems comments or concerns not covered in this section?

Note:

O&M SURVEY: Electrical, Telecommunications, and Data

Overall, are you satisfied with the amount of power receptacles throughout the facility?

Very Dissatisfied Very Satisfied

Note:

Overall, are you satisfied with the amount of data and communications receptacles throughout the facility?

Very Dissatisfied Very Satisfied

Note:

Is there an emergency power generator at the facility? If so, does it meet the requirements of the facility?

Yes No

Note:

Are the electrical switchgears and transformers secure from water penetration?

Yes No

Note:

Are there multiple electrical and data rooms or closets?

Yes No

Note:

Are the electrical rooms and closets secure from unauthorized entry?

Yes No

Note:

Have all the electrical and data panels been properly labeled?

Yes No

Note:

In your opinion, is there sufficient open space and/or capacity to allow for expansion at the electrical and data panels?

Yes No

Note:

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In your opinion, is there sufficient room within the facility to incorporate new technology?

Yes No

Note:

How satisfied are you with the ease of maintenance for the electrical, telecommunications, and data systems?

Very Dissatisfied Very Satisfied

Note:

Are sustainable technologies such as photovoltaic panels, heat pumps, wind turbines, etc. installed at the facility? If yes, how satisfied are you with the technologies functioning as per their design requirements?

Very Dissatisfied Very Satisfied

Note:

If sustainable technologies are present, has maintenance or cleaning been an issue or concern? For example, leaves and debris on PV panels.

Note:

Overall, how satisfied are you with the electrical system?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the telecommunications/ data system?

Very Dissatisfied Very Satisfied

Note:

Any additional electrical, telecommunication, or data comments or concerns not covered in this section?

Note:

O&M SURVEY: Plumbing

Are the plumbing chases easily accessible for maintenance?

Yes No

Note:

What is your opinion of the level of water usage required by the plumbing equipment and fixtures throughout the facility?

Very High Very Low

Note:

Overall, how satisfied are you with the fire protection system?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the plumbing system (piping, hot water heaters, etc.)?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the plumbing fixtures (lavatories, water closets, urinals, etc.)?

Very Dissatisfied Very Satisfied

Note:

Have you found the plumbing systems designed for LEED requirements in this facility require more maintenance and/ or inspections when compared to other facilities without LEED consideration?

Highly Disagree Highly Agree

Note:

Any additional plumbing comments or concerns not covered in this section?

Note:

O&M SURVEY: General Facility Energy Efficiency

Overall, how much do you agree that the local climate was adequately considered in the design of this facility?

Highly Disagree Highly Agree

Note:

Which of the following solar control devices does the facility have?

- Exterior sunshades (louvers, canopies, sunscreens, etc), Elaborate:
- Shading by building overhang, Elaborate:
- Interior blinds, Elaborate:
- Integral Window blinds, Elaborate:
- Window films, Elaborate:
- Landscaping, Elaborate:
- Light shelves, Elaborate:
- No solar control, Elaborate:
- Other:

How satisfied are you with the solar control devices being effective in regulating space temperature?

Very Dissatisfied Very Satisfied

Note:

Are there noticeable hot or cold spots on the north, south, east, west, or any other side of the facility?

- Yes No

Note:

Since occupancy, have there been any modifications to the facility design or operations to improve energy efficiency?

- Yes No

Note:

Since occupancy, have modifications been required to improve energy efficiency within the facility?

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Yes No

Note:

Have changes been made to the Sequence of Operations? If so, why?

Yes No

Note:

Overall, how satisfied are you with the energy efficiency of the facility?

Very Dissatisfied Very Satisfied

Note:

Overall, do you feel the facility's needs were met over simply meeting the requirements of LEED?

Yes No

Note:

Overall, how satisfied do you feel the environmental measures taken in the facility design have improved the facility over similar facilities?

Very Dissatisfied Very Satisfied

Note:

Any additional energy comments or concerns not covered in this section?

Note:

O&M SURVEY: Facility Operations Turnover

Were distribution and/ or wiring diagrams prepared and turned over for the following facility systems? For example:

- Computers Security system Fire and life safety Landscape sprinkler systems Servers
- Other:**

Was an OEM manual turned over to the facility?

- Yes No

Note:

Were as-built drawings received at the facility at turnover?

- Yes No

Note:

Do you feel satisfied the OEM manual contains sufficient information to explain the new environmental procedures required from LEED?

- Very Dissatisfied Very Satisfied

Note:

How satisfied are you with the training provided on operating the facility systems to facility personnel?

- Very Dissatisfied Very Satisfied

Note:

Is there any documentation missing from the O&M standpoint which was supposed to be turned over to the facility?

- Yes No

Note:

How satisfied are you with the HVAC balancing before facility turnover?

- Very Dissatisfied Very Satisfied

Note:

Were the facility's plumbing lines adequately flushed before facility turnover?

- Yes No

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Note:

Were the filters in the building changed at building turn-over?

Yes No

Note:

How satisfied were you with the facility being adequately flushed out prior to occupancy?

Very Dissatisfied Very Satisfied

Note:

Did you have any participation in the acceptance of construction punch list items?

Yes No

Note:

Overall, how satisfied are you with the completion of identified construction punch list items fixed before the final acceptance of the facility?

Very Dissatisfied Very Satisfied

Note:

Was the O&M staff assigned to the facility in sufficient time prior to occupancy?

Yes No

Note:

Are there currently any outstanding building warranty issues?

Yes No

Note:

Any additional building turnover comments or concerns not covered in this section?

Note:

O&M SURVEY: General Facility Maintenance

Are you aware of problems with any of the following regarding accessibility for the disabled?

- Public Parking, Elaborate:
- Accessibility to entrance, Elaborate:
- Operability of entry doors, Elaborate:
- Elevators (number or access to), Elaborate:
- Accessible restrooms, Elaborate:
- Countertop heights, Elaborate:
- Kitchenette accessibility, Elaborate:
- Accessible drinking fountains, Elaborate:
- Assembly or conference seating, Elaborate:
- Tactile signage, Elaborate:
- Visual alarms, Elaborate:
- Other:**

Is there an atrium or other two-story space within the facility? If not, skip the next two questions. If so, is accessibility to any of the following maintenance items problematic?

- Lamp replacement, Elaborate:
- Fire detection maintenance, Elaborate:
- HVAC maintenance, Elaborate:
- Miscellaneous equipment access, Elaborate:
- No problems present, Elaborate:
- Other:**

If problems are present, what measures would improve access to equipment within the atrium?

Note:

In non-atrium spaces, is there adequate provision for ceiling access to lighting, HVAC, and other ceiling equipment for repair or maintenance? Which of the following may be problematic pertaining to accessibility?

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- Mechanical grilles or diffusers, Elaborate:
- Ductwork, Elaborate:
- Shutoff valves (gas or water), Elaborate:
- Fire sprinkler equipment, Elaborate:
- Fire detection equipment, Elaborate:
- HVAC: VAV and mixing boxes, Elaborate:
- Fan coil units, Elaborate:
- Clean-outs, Elaborate:
- Light fixtures, Elaborate:
- Electrical junction boxes, Elaborate:
- Communications equipment (WAPs, speakers, etc), Elaborate:
- Other:

If problems are present in the non-atrium spaces, what measures would improve equipment access?

Note:

Do all mechanical rooms, restrooms, janitorial closets, and any other room with water supply have floor drains?

- Yes No

Note:

What are the most problematic maintenance issues within the facility?

- Interior window cleaning, Elaborate:
- Interior wall surfaces, Elaborate:
- Floor surfaces, Elaborate:
- Ceiling surfaces, Elaborate:
- Entrances are not adequate to control debris from users entering the facility, Elaborate:
- Durability of materials, Elaborate:
- Materials require harsh or abrasive chemicals, Elaborate:
- Materials require more specialized and/ or time-consuming cleaning methods (brass, additional glass surfaces, etc), Elaborate:

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No problems present, Elaborate:

Other:

Overall, how satisfied are you with the maintainability of the exterior of the facility?

Very Dissatisfied Very Satisfied

Note:

Is there interior or exterior artwork which causes unusual access to systems for maintenance?

Yes No

Note:

Have there been any problems with mold or mildew due to moisture control issues within the facility?

Yes No

Note:

Does the door keying of the facility meet the requirements of NASA?

Yes No

Note:

How satisfied are you with accessibility to the roof for maintenance and repair?

Very Dissatisfied Very Satisfied

Note:

To your knowledge, does the design of the facility comply with occupational safety and health standards for a safe working environment, such as adequate fall protection and eye wash stations?

Yes No

Note:

Overall, how satisfied are you with the security measures inside the facility?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the security measures around the exterior of the facility?

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Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the construction quality of the facility?

Very Dissatisfied Very Satisfied

Note:

How satisfied are you with the ease of performing maintenance on the facility?

Very Dissatisfied Very Satisfied

Note:

Overall, how satisfied are you with the maintainability within the facility?

Very Dissatisfied Very Satisfied

Note:

In general, are there above-normal costs associated with maintenance of the interior or exterior of the facility?

Yes No

Note:

O&M SURVEY: Custodial Maintenance - Restrooms

Are diaper changing stations present?

- Yes No

Note:

Are feminine product dispensers present in all women's restroom?

- Yes No

Note:

Are any accessories missing from the restrooms?

- Yes No

Note:

What restroom accessories do not meet the facility's needs?

- Trash containers, Elaborate:
- Toilet paper dispensers, Elaborate:
- Paper towel dispensers, Elaborate:
- Electrical hand dryers, Elaborate:
- Soap dispensers, Elaborate:
- Mirrors, Elaborate:
- Other:**

Are all the restroom accessories properly installed at proper height and general location?

- Yes No

Note:

Overall, how satisfied are you with the maintainability of the restrooms?

- Very Dissatisfied Very Satisfied

Note:

O&M SURVEY: Custodial Maintenance - General Serviceability

Are higher traffic areas properly located on the bottom, accessible floor of the facility?

Yes No

Note:

Is there an atrium or other two-story space within the facility? If so, does the atrium create maintenance issue pertaining to custodial work?

Note:

How satisfied are you with the amount of space to sort trash and recyclable materials?

Very Dissatisfied Very Satisfied

Note:

How satisfied are you that building occupants are sorting the recyclables (glass, aluminum, plastics, paper products) appropriately?

Very Dissatisfied Very Satisfied

Note:

Does the facility have ample rodent protection in the trash collection area? Is rodent protection necessary?

Yes No

Note:

How satisfied are you with design of the trash collection area so it doesn't compete with custodial work?

Very Dissatisfied Very Satisfied

Note:

Does the facility have a loading dock? If no, skip the next question.

Yes No

Note:

How satisfied are you with design of the loading dock to meet facility requirements?

Very Dissatisfied Very Satisfied

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If there is no loading dock, would one ease serviceability of the facility?

Note:

How satisfied are you with maneuvering space for delivery trucks to load and unload regardless if there is a loading dock?

Very Dissatisfied Very Satisfied

Note:

How satisfied are you with drainage at the loading dock or loading area?

Very Dissatisfied Very Satisfied

Note:

Does the facility have a freight elevator? If yes, does it meet the requirements of the facility? If no, would one ease maintenance or serviceability of the facility?

Yes No

Note:

How satisfied are you with the amount of storage for all items servicing the facility? This includes cleaning agents, mops, etc permanent to the facility.

Very Dissatisfied Very Satisfied

Note:

Do all custodial closets have floor drains?

Yes No

Note:

Have you found the products and materials used for LEED requirements (low-VOC paints, different floor materials, cleaners) in this facility require more custodial maintenance (time or effort for example) when compared to other facilities with non-LEED (green) products?

Highly Disagree Highly Agree

Note:

What are the most problematic custodial maintenance issues outside of the facility, in any?

Exterior window cleaning, Elaborate:

Bird nesting, Elaborate:

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- Plaza/ public space maintenance, Elaborate:
- Landscaping, Elaborate:
- Water drainage, Elaborate:
- Sidewalk cracking or heaving, Elaborate:
- Accumulation of ice or snow on sidewalks or at entry, Elaborate:
- No problems present, Elaborate:
- Other:**

Overall, how satisfied are you with the ease of maintaining the interior and exterior of the facility?

Very Dissatisfied Very Satisfied

Note:

In general, are there above-normal costs associated with cleaning of the interior or exterior of the facility?

- Yes No

Note:

Any additional custodial maintenance comments or concerns not covered in this survey?

Note:

APPENDIX G – BUILDING OCCUPANT SURVEY

BUILDING OCCUPANT SURVEY FORM

for

SUSTAINABLE BUILDINGS POST OCCUPANCY EVALUATION (POE) SURVEY for

BUILDING/ FACILITY NAME

Address

City, State, Zip Code

Prepared on Behalf of:



Prepared by:

Firm / Department Name

Address

City, State, Zip Code

BUILDING OCCUPANT SURVEY NARRATIVE

Who is being interviewed?

The Building Occupant Survey is a survey for persons who spend the majority of their day within the facility undergoing evaluation. The survey will be conducted either face-to-face and on a computer, or (when necessary) filled out by the interviewee through an electronic questionnaire. The range typical number range for the responses go from -3 (very unsatisfied) through +3 (very satisfied), with 0 being neutral to the subject. All responses given will remain anonymous.

Why a Building Occupant Survey?

The Building Occupant Survey will aid NASA to better plan and design future facilities pertaining to user comfort and environment. Information gathered by this survey will lend support in constructing a Post Occupancy Evaluation final report, which will discuss best practices and lessons learned after facility turnover. The survey and final report is not designed to undermine or disparage the facility or those who had been a part of the Project Team for the facility construction. It is in the best interest of NASA, the Evaluating Team, and the Building Occupants to give honest and open answers and feedback per the survey.

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5. Lighting	
6. General Office Space	

PROJECT INFORMATION

Facility Information:

Facility Description:

Building Systems:

LEED Rating:

Building Sustainability Aspects:

Process Evaluator:

Consulting Engineering:

Date:

BUILDING OCCUPANT SURVEY: Personnel Information

Gender

- Male
 Female

What is your workplace experience?

- less than 10 years 11-25 years Over 25

How long have you worked in this building?

On which floor is your workspace located?

In which area of the building is your workspace located?

To which direction do the windows closest to your workspace face?

Is your workspace located within 15 feet of an exterior wall?

Is your workspace located within 15 feet of a window?

How long do you spend in the building during the day?

How long do you spend working at a computer per day?

How would you describe your primary workstation?

- Office Cubicle Front desk/ Intake Laboratory Other

How would you describe the work you do?

- Administrative support Technical Professional Managerial/ supervisory
 Laborer Other

How familiar are you with the LEED rating system?

- Not Familiar -3 -2 -1 0 +1 +2 +3 Very Familiar

NASA Sustainable Buildings POE Survey for

BUILDING OCCUPANT SURVEY FORM

It is important to me to work in a building that reflects concern for the environment?

Disagree Strongly Agree Strongly

How energy and water efficient do you think the building is?

Very Inefficient Very Efficient

Do you know what LEED rating this building received?

Don't Know Certified Silver Gold Platinum

BUILDING OCCUPANT SURVEY: Thermal Comfort

How satisfied have you been with the temperature level in the summer (whether you get too hot or cold) at your workspace?

Very Dissatisfied -3 -2 -1 0 +1 +2 +3 Very Satisfied

How satisfied have you been with the temperature level in the winter (whether you get too hot or cold) at your workspace?

Very Dissatisfied Very Satisfied

How satisfied have you been with the temperature stability (how much the temperature fluctuates during the day) at your workspace?

Very Dissatisfied Very Satisfied

How satisfied have you been with the level of airflow (do drafts make you uncomfortable, or is the air too still) at your workspace?

Very Dissatisfied Very Satisfied

How satisfied have you been with the humidity (do you feel dry or clammy) at your workspace?

Very Dissatisfied Very Satisfied

Overall, how satisfied are you with the thermal conditions of your workspace?

Very Dissatisfied Very Satisfied

Overall, do the thermal conditions (a combination of the above items) of this building interfere with your ability to get your job done, or make it easier?

Interfere Enhance

If you are experiencing thermal discomfort (temperature or humidity), when does it occur? Check all that apply.

- Morning Afternoon Weekends Holidays Monday Mornings
- Always Other

NASA Sustainable Buildings POE Survey for

BUILDING OCCUPANT SURVEY FORM

If you are experiencing thermal discomfort (temperature or humidity), which of the following best describes it? Check all that apply.

- | | | |
|--|--|---|
| <input type="checkbox"/> Too much/too little air movement | <input type="checkbox"/> Incoming sunlight heats up space | <input type="checkbox"/> Heat from office equipment |
| <input type="checkbox"/> Drafty windows | <input type="checkbox"/> Vented air is too hot | <input type="checkbox"/> Vented air is too cold |
| <input type="checkbox"/> My workspace is hotter than other areas | <input type="checkbox"/> My workspace is colder than other areas | <input type="checkbox"/> Hot floors |
| <input type="checkbox"/> Hot walls | <input type="checkbox"/> Cold floors | <input type="checkbox"/> Cold walls |
| <input type="checkbox"/> Thermostat is inaccessible/controlled by others | <input type="checkbox"/> Other | |

BUILDING OCCUPANT SURVEY: Air Quality

How satisfied have you been with the odor (do smells distract you or limit your ability to perform your required tasks) at your workspace?

Very Dissatisfied Very Satisfied

How satisfied have you been with the level of dust (airborne or stationary) at your workspace?

Very Dissatisfied Very Satisfied

When moving around your office, how satisfied have you been with the consistency (are the conditions the same in all parts of the workspace) of air quality at your workspace?

Very Dissatisfied Very Satisfied

If you are dissatisfied with the air quality in your work area, is it:

Stuffy/Stale Odorous

If the air is odorous, is it due to:

Tobacco smoke Photocopiers/ Printers Food Carpet/ Furniture Systems Paint/ Wallcoverings
 Unknown Other

Overall, how satisfied are you with the air quality of your workspace?

Very Dissatisfied Very Satisfied

Overall, do you agree the air quality of your workspace allows you to perform you tasks to the best of your ability?

Highly Disagree Highly Agree

BUILDING OCCUPANT SURVEY: Acoustic Comfort

How satisfied have you been with the level of air conditioning noise at your workspace?

Very Dissatisfied Very Satisfied

How satisfied have you been with the levels of noise from outside the building (road traffic, aircraft, trains, pedestrians, events, etc.) at your workspace?

Very Dissatisfied Very Satisfied

How satisfied have you been with the level of general equipment noise (lifts, machinery, HVAC system, etc.) at your workspace?

Very Dissatisfied Very Dissatisfied

How satisfied have you been with your sound privacy (ability to have conversations without your neighbors overhearing and vice versa) at your workspace?

Very Dissatisfied Very Dissatisfied

How satisfied have you been with the amount and level of distracting noise (sudden or sustained noises coming from within the building or other occupants) at your workspace?

Very Dissatisfied Very Satisfied

Overall, how satisfied are you with the acoustics of your workspace?

Very Dissatisfied Very Satisfied

Overall, how much do you agree the acoustics of your workspace allows you to perform your tasks to the best of your ability?

Highly Disagree Highly Agree

BUILDING OCCUPANT SURVEY: Lighting

**Which of the following controls do you have over the lighting in your workspace?
Check all that apply.**

- Light switch Light dimmer Window shades Task light (desk lamp) None of the above
 Other

If you are dissatisfied with the lighting in your workspace, which of the following contribute to your dissatisfaction? Check each that apply.

- Too dark Too bright Not enough daylight Too much daylight
 Too much electric lighting Electric lighting flickers Not enough electric lighting Electric lighting is an undesirable color
 No task lighting Shadows on the workspace Too much glare Reflection in the computer screen
 None of the above Other

If the office lighting is controlled by motion sensors and timers, do you feel the lighting stays on for too long or short of a period?

- Too long Too short Just right

If the office lighting is controlled by motion sensors and timers, do you feel the sensors detect your motion adequately for the light to turn on/turn off?

- Yes No

If the office lighting is controlled by motion sensors and timers, is the lighting zoned properly in the open office area (i.e. will one occupied area result in a relatively distant unoccupied area's lights to remain on?)

- Yes No

Overall, in total, how satisfied are you with the lighting quality (artificial and natural) of your workspace?

- Very Dissatisfied Very Satisfied

Overall, in total, how much do you agree the lighting (artificial and natural) of your workspace allows you to perform your tasks to the best of your ability?

- Highly Disagree Highly Agree

BUILDING OCCUPANT SURVEY: General Office Space

How satisfied have you been with the amount of work and desk space available for you to perform your job function?

Very Dissatisfied Very Satisfied

How satisfied have you been with the amount of work storage available to you in relation to performing your job function?

Very Dissatisfied Very Satisfied

How satisfied have you been with the amount of personal storage available for you?

Very Dissatisfied Very Satisfied

How satisfied have you been with the location and arrangement of general office equipment (storage, printers, fax, copiers, etc.)?

Very Dissatisfied Very Satisfied

How satisfied have you been with the accessibility of the recycling bins for your glass, aluminum, plastic, and paper products?

Very Dissatisfied Very Satisfied

How satisfied are you with the visibility and organization of the recycling bins for your glass, aluminum, plastic, and paper products (i.e. is it well labeled)?

Very Dissatisfied Very Satisfied

How satisfied have you been with your proximity to a view (being able to see the outdoors), available?

Very Dissatisfied Very Satisfied

How satisfied have you been with the quality of the view outside the building, if available?

Very Dissatisfied Very Satisfied

How satisfied have you been with the comfort of your office furnishings (chair, desk, computer, equipment, etc)?

Very Dissatisfied Very Satisfied

NASA Sustainable Buildings POE Survey for

BUILDING OCCUPANT SURVEY FORM

How satisfied have you been with the appearance and quality of your office furnishings (chair, desk, computer, equipment, etc.) at your workstation?

Very Dissatisfied Very Satisfied

How satisfied have you been with your ability to adjust your furniture to meet your needs?

Very Dissatisfied Very Satisfied

Overall, how satisfied are you with your workstation layout?

Very Dissatisfied Very Satisfied

Overall, how much do you agree your workstation layout allows you to perform your tasks to the best of your ability?

Highly Disagree Highly Agree

Overall, how satisfied are you with the office layout?

Very Dissatisfied Very Satisfied

Overall, how much do you agree the office layout allows you to perform your tasks to the best of your ability?

Highly Disagree Highly Agree

How frequently do you experience the following conditions at your primary workstation and office space, which do not occur outside the workplace?

Tired eyes	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Dry or irritated eyes	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Sinus congestion	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Stuffy or runny nose	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Headache	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Unusual tiredness, fatigue or drowsiness	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Difficulty concentrating	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Cough	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Dry or itchy skin	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Sore or dry throat	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Dizziness or light headedness	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Nausea	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never
Shortness of breath	<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> A few times a year	<input type="checkbox"/> Never

NASA Sustainable Buildings POE Survey for

BUILDING OCCUPANT SURVEY FORM

Overall, would you say that the environmental conditions in your primary workspace in this building help or hinder you in your work compared to the building in which you most recently worked?

Makes work much more difficult Makes work much easier

Have you experienced, or have known another coworker to experience, being relocated within this facility due to facility constraints or issues? If yes to either, please elaborate.

Have you been absent more often, or have you seen more absenteeism, within this facility than the previous facility? If yes, please elaborate.

How would you rate the overall quality of the building?

Very Unsatisfactory Very Satisfactory

If you have any additional comments that you would like to make about any aspect of your work environment?

APPENDIX H – FIELD OBSERVATION - EXTERIOR

**NASA Sustainable Buildings POE Survey for
FIELD OBSERVATION FORM - EXTERIOR**

General Facility Information

Facility Name:	
Date and Time:	
Observation Participants:	

Exterior of Facility Conditions

Sidewalks		Parking		Landscaping	
Description (materials, etc)		Description (materials, etc)		Description	
Suitability (Y/N)		Maintainability		Plant types	
Maintainability		Light Fixtures		Maintainability	
Aesthetics		Comments		Drainage	
Comments				Light Fixtures	
				Aesthetics	
				Comments	

Main Entry		Facade-1		Facade-2		Facade-3		Facade-4	
Description		Description (location, service, etc)							
Signage Issues		Materials							
Maintainability		Materials Suitability (Y/N)							
Visibility to Public Quality		Maintainability							
Aesthetics		Windows Suitability (exterior portion)							
Comments		Doors Suitability (exterior portion)							
		Building Light Fixtures							
		Aesthetics							

**NASA Sustainable Buildings POE Survey for
FIELD OBSERVATION FORM - EXTERIOR**

Comments		
Create additional tables for each exterior facade location per actual conditions at each facility.		

Roof-1	Roof-2	Roof-3
Description and Materials (type, pitch, etc)		
Drain Slope (shallow slope, pooling, etc)		
Drains, Scuppers, & Downspouts		
Snow or ice issues? (banking, ice damming, etc)		
Parapets & Copings		
Suitability (Y/N)		
Maintainability (trash, leaves, etc)		
Roof top Penetration Detailing		
Roof top HVAC Equipment Detailing		
Aesthetics (if applicable)		
Comments		
Create additional tables for roofs per actual conditions at each facility.		

Additional Exterior Notes

APPENDIX I – FIELD OBSERVATION - INTERIOR

**NASA Sustainable Buildings POE Survey for
FIELD OBSERVATION FORM - INTERIOR**

General Facility Information

Facility Name:	
Date and Time:	
Observation Participants:	

Interior Conditions & Evaluation

Flooring Finishes		Flooring Finishes	Flooring Finishes
Description			
Suitability (Y/N)			
Durability			
Maintainability (easy to clean, etc)			
Aesthetics			

Flooring Finishes		Flooring Finishes	Flooring Finishes
Description			
Suitability (Y/N)			
Durability			
Maintainability (easy to clean, etc)			
Aesthetics			

Ceiling Finishes		Ceiling Finishes	Ceiling Finishes
Description			
Suitability (Y/N)			
Durability			
Maintainability (easy to clean, etc)			
Aesthetics			

NASA Sustainable Buildings POE Survey for

FIELD OBSERVATION FORM - INTERIOR

Wall Finishes		Wall Finishes	
Description			
Suitability (Y/N)			
Durability			
Maintainability (easy to clean, etc)			
Aesthetics			

Casework		Casework	
Description			
Suitability (Y/N)			
Durability			
Maintainability (easy to clean, etc)			
Aesthetics			

Doors		Windows/ Storefront		Natural Daylighting		Artificial Lighting	
Description (type and hardware)		Description (style, hardware, etc)		Amount		Description (fixture and lamp types)	
Suitability (Y/N)		Suitability (Y/N)		Daylighting Controls (blinds, etc)		Suitability (Y/N)	
Durability		Durability		Suitability (Y/N)		Controls	
Security (when applicable)		Security (when applicable)				Maintainability (easy to clean, etc)	
Maintainability (easy to clean, etc)		Maintainability (easy to clean, etc)					
Aesthetics		Aesthetics					
		Operable?					

NASA Sustainable Buildings POE Survey for

FIELD OBSERVATION FORM - INTERIOR

Doors		Doors		Doors	
Description (type and hardware)	Description (style, hardware, etc)	Description (type and hardware)	Description (style, hardware, etc)	Description (type and hardware)	Description (style, hardware, etc)
Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)
Durability	Durability	Durability	Durability	Durability	Durability
Security (when applicable)	Security (when applicable)	Security (when applicable)	Security (when applicable)	Security (when applicable)	Security (when applicable)
Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)
Aesthetics	Aesthetics	Aesthetics	Aesthetics	Aesthetics	Aesthetics

Plumbing Fixtures		Furniture		Electrical		Data		Mechanical Systems	
Description	Description	Description	Issues (receptacles, adequacy, etc)	Issues (receptacles, adequacy, etc)	Issues (receptacles, adequacy, etc)	Issues (receptacles, adequacy, etc)	Issues (receptacles, adequacy, etc)	Controls	Controls
Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)							
Durability	Durability	Durability							
Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)							
Aesthetics	Aesthetics	Aesthetics							

Elevators/ Escalators		Stairs - Egress		Stairs - Main/ Communication	
Description	Description	Description	Description	Description	Description
Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)	Suitability (Y/N)
Durability	Durability	Durability	Durability	Durability	Durability
Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)	Maintainability (easy to clean, etc)
Aesthetics	Aesthetics	Aesthetics	Aesthetics	Aesthetics	Aesthetics

**NASA Sustainable Buildings POE Survey for
FIELD OBSERVATION FORM - INTERIOR**

Additional Room Notes

APPENDIX J – SAMPLE MEETING AGENDAS & SCHEDULES

PROJECT TEAM OUT-BRIEF AGENDA
POST OCCUPANCY EVALUATION (POE) CENTER NAME-BUILDING NAME/NO.

Project Name: Post Occupancy Evaluation Center Name-Building name/no.

Date: Month Day, Year

Time: Duration

Meeting Location: Building Name, Floor, Room No.

The following items are discussion topics for the POE Project Team Out-brief meeting:

- Introductions – of those persons not present in the kick-off meeting or interviews
- Next Steps
 - Project Schedule – benchmark / milestone dates and project report prepared by Firm/Department
 - Draft Report – 4 weeks Month Day, Year (Submission Date)
 - Government Review – 3 weeks Month Day, Year (Receiving Date)
 - Final Report – 3 weeks Month Day, Year (Submission Date)
- Identify, how/from whom do we obtain additional information outside of this meeting?
- Open forum/Discussions
 - Questions
 - Comments
 - Concerns

PROJECT TEAM IN-BRIEF MEETING AGENDA

POST OCCUPANCY EVALUATION (POE) CENTER NAME – BUILDING NAME/NO.

Project Name: Post Occupancy Evaluation Center Name- Building name & number

Date: Month Day, Year

Time: Duration

Meeting Location: Building, Floor, Room no.

The following items are discussion topics for the POE Project Team Kickoff meeting:

- Team Introduction – name, company, project role
- NASA to review project objectives and priorities (Pete Aitcheson)
 - NASA's POE goals
- Project Communication – best communication method for each team member, best time to reach you
- Evaluation of the Overall Agenda / Schedule for Survey
- Project Schedule – benchmark / milestone dates and project report prepared by Firm/Department
 - Draft Report – 4 weeks – Month Day, Year (Submission Date)
 - Government Review –3 weeks – Month Day, Year (Receiving Date)
 - Final Report –3 weeks – Month Day, Year (Submission Date)
- Project Reviews –Identify who should NASA HQ send additional copies at NASA building for Draft Report review?
- Existing Document Review Expectations
 - RFQ, Construction Drawings (as-built), Record Specifications, Final LEED Submission, Utility Data and Bills, Value Engineering, Change Orders Documentation, Bulletins (affecting scope of work), O&M Work Orders, O&M Costs (mechanical systems and custodial), Lessons Learned Report
 - Identify, how/from whom do we obtain additional information outside of this meeting?
- Open forum/Discussion

NASA POST OCCUPANCY EVALUATION (POE) Visit Agenda:
Center Name, Building Name/number – Month Day, Year

7:30 am - Gain access to Center - Schedule herein to remain flexible

I. In-brief – Kick-off, Review of Scope of Work

- a. Tuesday (8:00am-9:00am **Room #**)
 - i. Objectives, Process, Expectations, Schedule.

II. Quick walk-through of Building

- a. Tuesday (9:15am-9:45am)
 - i. Quick tour and highlights of building to get POE Team acquainted with facility.

III. Document Collection and Review

- a. Tuesday (10:00-11:00am **Room #**)
 - i. Quick Review of physical Drawing Set for POE Team. Collect CDs of PDFs with as-builts, utilities data (water, electricity, gas, etc.), operations and maintenance costs, specifications, LEED documentation, historical work orders (bulletin or change order list), and lessons learned and best practices gathered through the project design process.
 - 1. All information to be provided electronically when possible.
 - 2. NASA to gather additional documents after site visit as required.

IV. Process Evaluation

- a. Tuesday (1:30-4:30 pm **Room #**)
 - i. Team members from AE and LEED AP (if available); NASA Project Design Team for Project including Project Manager, Facility Manager, O&M personnel involved on Project Design, and Construction Manager; and others pertinent to the design of the facility.

V. Survey Assignments

- a. Wednesday Team 1 (9:00-11:30am **Room #**) Facility Manager(s) Survey
 - 1. Facility/Building Manager and Facility/Building Manager Alternate of **Building**.
- b. Wednesday Team 1 (1:30-3:30am **Room #**) Operations & Maintenance Survey
 - 1. O&M personnel with day-to-day HVAC, electrical/telecom, plumbing, and other applicable building systems.
- c. Wednesday Team 1 (4:00pm-4:30pm **Room #**) O&M Survey – Custodial/Site
 - 1. Custodial and Site personnel involved with the upkeep of interior and exterior maintenance.
- d. Wednesday Team 2 (9:00pm-4:30pm **Room #**) Building Occupant Survey – 10 building occupants

VI. Site Visit and Tour

- a. Thursday (8:00am-10:00am)
 - i. POE Team to be escorted for facility tour – FM, PM, and one OM personnel.
- b. Thursday Team 2 (8:00am-10:00am **Room #**)
 - i. Continue Building Occupant Surveys (if necessary).

VII. Out-brief

- a. Thursday (10:00am-10:30am **Room #**)
 - i. Summary of Events, Follow up communication / outstanding issues, Open Forum.

VIII. General Logistics

- a. Access (keys, escorts), Facilities Personnel, Internet Access at Facility

**NASA POST OCCUPANCY EVALUATION (POE) Conference Call for:
Center Name, Building Name/No. – Month Day, Year**

I. Overview of POE

- a. What is the POE?
 - i. The Post Occupancy Evaluation (POE) is to help develop a report with a focus towards assessing the sustainability aspects of facilities. This will help NASA better plan, develop, construct, occupy, and maintain LEED facilities.

II. Discuss Agenda for POE Site Visit

- a. Any issues with dates, personnel, or anything else? Typical work day hours?
- b. List of Building Occupants to be interviewed – schedule? Just show up at desk?

III. Recommended drawings to be provided to POE Team. Digital preferable.

- a. Before visit on week of (Month Day, Year): PDFs of site plan, floor plans, and design analysis.
- b. Before, during, or after visit: CDs of PDFs with as-built, utilities data (cost and consumption amounts of water, electricity, gas, steam, chilled water, etc. per month for minimum 1 year), specifications, LEED documentation, “bulletin” or “change order” list, building brochures/ literature, historical work orders, and operations and maintenance costs (broken down costs for minimum 1 year).
- c. Additional, when available: Lessons learned and best practices gathered through the project design process by the Design Team and/or NASA.

IV. Contact information

- a. Where to meet for all meetings and interviews – prefer within Building to evaluate- Name/no.
- b. Main point of contact for POE Team at Building to Evaluate- Building Name/no.?
- c. Escorts for walkthrough?
 - i. Facility/Building Manager and one OM personnel familiar with the building systems preferable.
- d. Badges and other security information

Date:

National Aeronautics and Space Administration (NASA)
300 East Street, SW, Suite 5H79
Washington, DC 20546

RE: NASA Post Occupancy Evaluation (POE) at Facility Name & No.

Dear Address,

The proposed schedule is as follows:

Schedule		Dates Range
Award/ Start Date		07/03/2012
Site Visit	3 days	09/18/2012 – 09/20/2012
Draft Report	4 weeks	09/21/2012 – 10/19/2012
NASA Review	3 weeks	10/19/2012 – 11/09/2012
Final Report	3 weeks	11/09/2012 – 12/04/2012

**Schedule to remain flexible per centers' requirements.

**All dates are based off Time Commitment Services Proposal.

Please review the project schedule and provide any thoughts or comments.

Best Regards,