

Supplemental Environmental Assessment: Johnson Space Center Building 24 Combined Heat and Power (CHP) Project

Harris County, Texas

February 2015



National Aeronautics and Space Administration Johnson Space Center 2101 NASA Pkwy Houston, Texas 77058

	Supplemental Environmental
	Assessment: Johnson Space
	Center Building 24 Combined
	Heat and Power (CHP) Project
	2101 NASA Pkwy, Houston, Harris County, Texas
Lead Agency:	NASA, Johnson Space Center (JSC)
Proposed Action:	NASA is issuing this Supplemental EA (SEA) with respect to a new design and facility layout for the CHP facility as described in the Environmental Assessment (EA), published in March 2014. The Proposed Action relocates the CHP equipment from being entirely contained within a two-story expansion of the existing Building 24 to a concrete slab and pad foundations outside and north of the existing Building 24, as well as within an additional small building oriented north to south at the northeast corner of the existing Building 24. A parking lot expansion is also included within the Proposed Action. The components of the CHP would remain essentially the same as described in the EA, though the combustion turbines and backpressure turbine would be slightly smaller than originally proposed. The footprint of the proposed CHP addition area is approximately 20,900 square feet, and an expansion of the existing parking lot is approximately 7,000 square feet, for a total disturbance area of 27,900 square feet or 0.64 acres.
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Abstract:

This Supplemental Environmental Assessment (SEA) examines modifications to a proposed CHP facility adjacent to the north side of Building 24 at the NASA Johnson Space Center that was previously described in an Environmental Assessment (EA) published in March 2014. The proposed modifications include:

- A reduction in combustion turbine size from 6.3 megawatts (MW) each to 5.7 MW each,
- A reduction in backpressure turbine size from 1.1 MW to 0.5 MW,
- A reduction in blackstart generator size from 1.0 MW to 0.75 MW,
- Relocation of the CHP equipment from being entirely contained within a two-story expansion of the existing Building 24 to a concrete slab and pad foundations outside and north of the existing Building 24, as well as within an additional small building oriented north to south at the northeast corner of the existing Building 24, and
- The expansion of the existing parking lot north of Building 24.

Based on the information contained within the SEA for the proposed CHP modifications, NASA has determined that the environmental impacts associated with the Proposed Action would not individually or cumulatively have a significant impact on the quality of the environment. Therefore, this SEA serves as the basis for a Finding of No Significant Impact (FONSI) for the Proposed Action.

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LIST OF ACRONYMS

APE	Area of Potential Effect
ARMSEF	Atmospheric Reentry Materials and Structures Evaluation Facility
ATC	Attwater's Prairie Chicken
AQCR	Air Quality Control Region
BMP	Best Management Practice
BTU	British Thermal Unit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHP	Combined Heat and Power
СО	Carbon Monoxide
CO ₂	Carbon Dioxide
CWA	Clean Water Act
dB	Decibels
dBA	Adjusted Decibels (A Weighted Scale)
EFR	Environmental Functional Reviews
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESPC	Energy Savings Performance Contract
ESTA	Energy Systems Test Area
FEMA	Federal Emergency Management Agency
EA	Environmental Assessment
EO	Executive Order
ERM	Environmental Resources Management
ESA	Endangered Species Act
GHG	Greenhouse Gas
GSF	Gross Square Footage
HAP	Hazardous Air Pollutants
HRSG	Heat Recovery Steam Generator
HUC	Hydrologic Unit Code
ICRMP	Integrated Cultural Resources Management Plan
JSC	Johnson Space Center
Kv	Kilovolt
LEED	Leadership in Energy and Environmental Design
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO ₂	Nitrogen Dioxide
NO _X	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Properties
NSPS	New Source Performance Standards
OSHA	Occupational Safety and Health Administration
O3	Ozone
Pb	Lead
PM	Particulate Matter

PCB	Polychlorinated biphenyl compounds
PPM	Parts per Million
PSD	Prevention of Significant Deterioration
PSIG	Pound force per Square Inch
PTE	Potential to Emit
ROW	Right of Way
SAL	State Antiquities Landmark
SEA	Supplemental Environmental Assessment
SECP	Sedimentation and Erosion Control Plan
SESL	Space Environment Simulation Laboratory
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SIP	State Implementation Plan
SO ₂	Sulfur Dioxide
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile Organic Compounds

EXECUTIVE SUMMARY

The National Aeronautics and Space Administration (NASA) has prepared this Supplemental Environmental Assessment (SEA) for modifications to the proposed construction of a combined heat and power system (CHP), also known as cogeneration, for the Johnson Space Center (JSC) previously described in an Environmental Assessment (EA) published in March 2014 (Final EA). The Final EA evaluated the potential environmental impacts associated with the construction and operation of a proposed new CHP at JSC Building 24. Subsequent to the publication of the Final EA, budgetary limitations have resulted in rescoping the project to include the following modifications:

- A reduction in combustion turbine size from 6.3 megawatts (MW) each to 5.7 MW each,
- A reduction in backpressure turbine size from 1.1 MW to 0.5 MW,
- A reduction in blackstart generator size from 1.0 MW to 0.75 MW,
- Relocation of the CHP equipment from being entirely contained within a two-story expansion of the existing Building 24 to a concrete slab and pad foundations outside and north of the existing Building 24, as well as within an additional small building oriented north to south at the northeast corner of the existing Building 24, and
- The expansion of the existing parking lot north of Building 24.

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321, et seq.); the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508); and NASA policy and procedures (14 CFR Part 1216, Subpart 1216.3), this SEA is necessary to evaluate and inform the public of the potential environmental impacts resulting from construction and operation of the modified design for the CHP that differs from that described in the original EA.

NASA's Proposed Action would support compliance with a variety of federal laws and Executive Orders (EO) including the National Energy Conservation and Policy Act of 1978, as amended, the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, EO 13423 – Strengthening Federal Environmental, Energy, and Transportation Management, EO 13514 – Federal Leadership in Environmental, Energy, and Economic Performance, and EO 13624 – Accelerating Investment in Industrial Energy Efficiency. The Proposed Action would provide JSC with increased energy surety, decreased energy intensity to meet energy reduction goals, and increased energy efficiency and would decrease overall greenhouse gas (GHG) emissions attributable to JSC. The proposed system would provide approximately 11.9 MW of onsite power generation, allowing JSC to meet existing energy reduction goals through 2031.

The Department of Energy's (DOE's) Federal Energy Management Program (FEMP) assists Federal agencies with managing their greenhouse gas emissions and has categorized emissions as Scope 1, Scope 2, and Scope 3. The FEMP

defines Scope 1 emissions as GHG emissions from sources that are owned or controlled by a federal agency, also referred to as "site" energy and emissions. Scope 2 emissions refer to emissions that result from the generation of electricity, heat, steam, or cooling that is purchased by a federal agency, also referred to as "source" energy and emissions. Finally, Scope 3 emissions are GHG emissions from sources not owned or controlled by a Federal agency but related to agency activities. It is important to note that only Scope 1 and Scope 2 (site and source) emissions were considered in the energy and emissions reductions referred to within this document.

The CHP facility would be constructed adjacent to the existing Building 24 Central Plant. Current energy demand at JSC requires nearly 135,800,000kilowatt hours (kWh) to be supplied from an offsite energy utility. The CHP system would generate nearly 90,000,000 kWh, satisfying the majority of JSC's FY2020 projected electric demand ranging from 19 MW in the winter to 23 MW in the summer while maintaining a projected import of only approximately 30,000,000 kWh from the electric grid. The CHP system's recoverable thermal energy produces nearly 50,000 pounds per hour of 400 psig, 600°F superheated steam in each of the two heat recovery steam generators (HRSGs). This recovered thermal energy steam production and limited use of an auxiliary duct burner at the HRSG would eliminate the need for firing boilers except during boiler testing, loss of natural gas, or CHP outages. The CHP steam production is fully utilized in both cooling and heating seasons by steam turbine driven chillers and Center- wide heating equipment.

The proposed CHP facility would reduce source energy use at JSC by 23.2 percent and save up to 3.62 million dollars annually (2017 Dollars). The Proposed Action would reduce energy intensity by 51.29 percent. This project would also reduce site and source CO₂e emissions attributable to JSC by approximately 17.6 percent based on projected usage. Other benefits include increased energy surety and decreased dependence on the local electrical grid, ensuring energy for Mission Control and the JSC campus during critical periods of energy usage.

In March 2014, NASA published the Final Environmental Assessment: Johnson Space Center Building 24 CHP Project. The 2014 Final EA analyzed the impacts of NASA constructing the CHP system within an addition and expansion of the existing Building 24 to a larger two-story structure and the footprint of an associated dedicated natural gas pipeline and aqueous ammonia tank. The original CHP design consisted of two nominal 6.3 MW combustion turbines with heat recovery steam generation and a backpressure turbine at 1.1 MW which would generate electricity and reduce high pressure superheated steam down to medium pressure for distribution throughout the Center.

This SEA describes the impacts associated with a newer version of the CHP system that would locate the CHP equipment on a concrete slab and pad foundations outside and north of the existing Building 24, and within an additional small building oriented north to south at the northeast corner of the existing Building 24. The components of the CHP would change to two

combustion turbines at 5.7 MW each and a back pressure steam turbine at 0.5 MW which are each slightly smaller than as described in the Final EA (March 2014). The aqueous ammonia tank, combustion turbines, and heat recovery steam generators would be located outside on the concrete slab. Selective catalytic reduction modules, economizers, blowdown separators, and the main stacks would also be located outside on pad foundations between the concrete slab and Building 24, with the stacks located approximately 20 feet north of the existing building and extending approximately 10 feet above the roof elevation. The backpressure steam turbine and electrical equipment would be housed within the small new additional building located immediately east of the aforementioned CHP equipment. A dedicated high pressure (300 psig) natural gas line approximately one (1) mile in length would be installed within the existing utility ROW along Avenue B and connected to the new facility. CenterPoint Energy would also upgrade approximately 9,700 feet (1.84 miles) of existing offsite natural gas pipeline along Space Center Boulevard and Middlebrook Drive to deliver the high pressure gas to the tie in with the new onsite pipeline.

Installation and operation of the modifications to the CHP system and ancillary equipment would not result in significant changes to the impacts on groundwater, land use, socioeconomics and environmental justice, transportation, hazardous materials and waste management, and health and human safety that were previously evaluated in the Final EA (March 2014), therefore these resources were not evaluated in this SEA.

The proposed modification of the CHP and ancillary facilities would not alter any geological resources. Due to the small construction area, minimal ground disturbance, and the implementation of BMPs, the effects on soil resources are expected to be highly localized and have negligible impacts.

The modifications to the design of the CHP facility would also result in a negligible increase in potential impacts to water quality when compared to the previous design. The larger construction footprint increases the potential for minor impacts from storm water runoff entering drainage ways during landdisturbing construction activities. To mitigate potential effects, the construction would comply with JSC's established Storm Water Pollution Prevention Plan (SWPPP). In addition, a site-specific Sedimentation and Erosion Control Plan (SECP) for the lay-down and any ground disturbance activities would be implemented. During operation of the facility, NASA would ensure that the facility complies with the best management practices (BMPs) established in the JSC SWPPP so that post-construction runoff quality and quantities meet state and federal standards. The modified facility would not be located within a wetland or floodplain and would not be expected to have any impacts on these sensitive resources. Although the construction footprint for the modified design has increased, the impacts to water resources are expected to be negligible due to the implementation of the SWPPP, SECP, and BMPs.

The marginal plant and wildlife habitat impacted by the project is considered undesirable for most species, including those protected by the Endangered Species Act and Migratory Bird Treaty Act. Additionally, most wildlife would be able to avoid the disturbed area for the CHP and parking lot expansion and vegetation impacts are limited to a relatively small, maintained area, therefore impacts to biological resources are considered negligible.

Implementation of the proposed project would have both short-term and longterm negligible impacts to air quality. Short-term adverse effects would result from dust and air emissions during construction, but minimization of these impacts would be achieved through the use of Best Management Practices. Operation of the turbines and other operational equipment and vessels will result in increased onsite greenhouse gas emissions that will require mandatory reporting of JSC GHG emissions under 40 CFR 98 as detailed in the Final EA. However, when balanced with the reduction in source emissions, the proposed action results in an overall reduction in total GHG emissions that represent a long-term beneficial impact.

Construction activities associated with the modified design would generate temporary increases in noise levels similar to what was evaluated in the Final EA (March 2014). NASA would comply with local noise ordinances and state and federal standards and guidelines for potential impacts on humans caused by construction activities, rendering impacts from construction noise both minor and temporary. The relocation of the CHP equipment outside of Building 24 is expected to result in an increase in operational noise levels of approximately 2-3 A-weighted decibels (dBA) from that evaluated in the Final EA. When assessed cumulatively, the additional noise from the exterior turbines combined with the existing noise from Building 24 has been modeled to attenuate to approximately 28 dBA (similar to the sound of a whisper at 5 meters) by the time this noise reaches the facility's fence line. This noise level is well below the lowest limits established in JSC's municipal noise guidelines for night time noise (58 dBA). In addition, modeling of potential noise impacts during construction and subsequent operations at the closest sensitive receptor, the onsite Aaron Cohen Child Care Facility, likewise results in no discernable difference in noise levels at this location. Generally, a 3 dBA increase in noise is barely perceptible to the human ear (Cowan, 1994). Therefore, the additional noise generated from the proposed action would be expected to have negligible impacts.

Based upon the results of field surveys and the finding of no adverse effect during consultation with the State Historic Preservation Office (SHPO), NASA expects that no impacts to cultural and historic resources will result from the proposed action.

Based on ongoing and future projects as included in the JSC Master Plan, the proposed CHP and parking lot expansion could contribute to cumulative adverse effects on traffic and noise levels within JSC during construction in addition to those described in the Final EA (2014). The scale and short-term nature of these impacts would have no more than a negligible cumulative effect. Operation of the project will result in additional noise that could contribute to slightly higher cumulative noise impacts than detailed in the Final EA; however,

modeling indicates that these impacts are negligible, and JSC proactively manages noise through the use of abatement and hearing protection programs.

The alternatives to constructing the modified CHP system at Building 24 are the construction of the CHP facility as described in the Final EA (March 2014), the construction of the CHP at another location within the JSC campus, or the no action alternative. The modified CHP system described in this SEA is preferred over the originally proposed CHP system due to budgetary constraints that have rendered the original design detailed in the Final EA as not viable. The remaining alternatives were evaluated in the Final EA.

On the basis of the evaluations in this SEA, NASA has determined that the Proposed Action, modifications to the previously proposed CHP facility at the central utility plant on the JSC campus, would have no significant impact on the human environment.

1.0 INTRODUCTION

The National Aeronautics and Space Administration (NASA) is proposing to modify a Combined Heat and Power (CHP) system detailed in a 2014 Environmental Assessment (Final EA) to be installed at the Johnson Space Center (JSC). As part of the decision-making process, NASA, in cooperation with Energy Systems Group, is conducting an analysis to determine the potential environmental impacts of the proposed modifications to the CHP facility. NASA is the lead federal agency for the development of this Supplemental Environmental Assessment (SEA), in accordance with 40 Code of Federal Regulations (CFR) § 1501.3.

Significant benefits to NASA resulting from the Proposed Action include:

- Increased Energy Surety The proposed system will provide approximately 11.9 MW of onsite power generation that can be utilized as an "Island" electric power source if utility power to JSC is lost.
- Energy Intensity Index All federal facilities are required to meet the requirements of the 2005 Energy Policy Act as amended by the 2007 Executive Order (EO) 13423. By implementing the project, JSC will reduce their FY 2014 energy intensity by 109,100 BTU/GSF (51.28 percent reduction) and meet existing energy reduction goals through 2031. While the prescribed energy reductions are on a Federal Agency basis, this project will significantly contribute to NASA's meeting agency-wide requirements.
- Carbon Footprint Reductions The NASA JSC carbon footprint will be reduced by 19,750 metric tons (21,771 short tons) of CO₂ equivalent annually based on projected usage. This equates to a 17.6 percent reduction from the baseline (no action) conditions.
- Legislative compliance This proposed project supports compliance with the National Energy Conservation Policy Act (NECPA), the Energy Policy Act (EPAct) of 2005, the Energy Independence and Security Act (EISA), EO 13423, EO 13514, and EO 13624.

Congress has authorized Energy Savings Performance Contracts (ESPCs) to encourage federal agencies to become more energy-efficient and to reduce their energy costs. NASA JSC is proposing to construct this CHP facility as an ESPC project to achieve the goals outlined above.

This central utility plant (Building 24) currently generates all the steam and the majority of chilled water required for the JSC campus. The steam and chilled water are furnished primarily for building heating, air conditioning, and ventilation reheating for humidity control. The potential for upgrades to this system were identified in a campus energy optimization study developed by Energy Systems Group (formerly Chevron Energy Solutions) for JSC that identified potential energy conservation measures (ECMs) including:

ECM 1: CHP and Boiler Plant Improvements

ECM 2: Biogas System Installation

ECM 3: Chiller Plant Improvements Buildings 24 and 28

ECM 4: Air Compressor Upgrades

ECM 5: Lighting Improvements

ECM 6: Water Conservation Improvements

ECM 7: Vending Machine Occupancy Sensors / Controls

ECM 8: Chiller Replacements - Building 48

From these eight ECMs, NASA selected ECM 1 and ECM 3 for inclusion in this ESPC project. This NASA selection was based upon the most economically viable project having the greatest impact to Center and Agency uptime availability, energy, and environmental goals and objectives. This selection by NASA limited the project to CHP and variable chilled water pumping strategies.

CHP, also known as cogeneration, is a system of generating electricity or mechanical power that produces useful waste heat. The proposed cogeneration system consists of a combustion turbine supplied by natural gas that is used to produce electricity. The exhaust waste heat from the combustion turbine is used to supply heat recovery steam generators (HRSGs) which produce steam. Figure 1 illustrates the existing and post-CHP configuration of JSC's Central Plant.

CHP is endorsed and strongly recommended by the U.S. Department of Energy and the U.S. Environmental Protection Agency (EPA) because of the elevated system efficiency and the significant reduction in regional air emissions. Utilization of electric generation waste heat in the cogeneration process results in efficiency of approximately 70 percent. Standard utility company generation and distribution efficiency averages 33 percent due to the loss of waste heat by rejecting condensed steam through cooling towers and/or nearby bodies of water. The cost effectiveness of a cogeneration system depends upon several factors including electric costs, natural gas costs, and available electric and steam loads.

The proposed modifications to the CHP facility design (hereafter also called the proposed project) would involve the construction of two combustion turbines with duct burners, heat recovery steam generators, a backpressure steam turbine, and associated ancillary equipment. A portion of the CHP system would be constructed outside and north of the existing Building 24 on a concrete slab and concrete footings, and the remaining portion would be housed within a small new building located adjacent to the northeast corner of Building 24. Figure 2 through 4 illustrate the plan and section view of the CHP equipment layout.



FIGURE 2: CHP Equipment Layout (Plan View)



FIGURE 3: CHP Equipment Layout (Section View, Looking South)



FIGURE 4: CHP Equipment Layout (Section View, Looking East)



These modifications would result in a CHP facility that would reduce the energy provided by the offsite electrical utility. This reduction would be accomplished through more efficient steam generation and on-site electrical generation that results in an increase in natural gas usage. The Tables below summarize the proposed changes in energy usage.

TABLE 1.0-1: Electrical Energy Usage and Generation of No Action Alternativevs. Expected Usage of Proposed Action

	Utility	Ge	nerated On-	Site	
Option	Provided (kWh)	CTG (kWh)	BPT (kWh)	Total (kWh)	Total (kWh)
No Action	135,787,189				135,787,189
CHP	29,957,503	86,867,577	2,815,202	89,682,779	119,640,283

 TABLE 1.0-2:
 Steam Generation of No Action Alternative vs. Proposed Action

Option	Existing Boilers (KLBS/YR)	CHP (KLBS/YR)	Total (KLBS/YR)
No Action	246,900		246,900
CHP	539	438,051	438,590

 TABLE 1.0-3:
 Natural Gas Usage of No Action Alternative vs. Proposed Action

Option	Existing Boilers (MMBtu)	CTG GEN (MMBtu)	DUCT BURNER (MMBtu)	Total (MMBtu)
No Action	352,332			352,332
CHP	871	1,006,010	69,474	1,076,355

1.1 PURPOSE AND NEED

The purpose and need of the Proposed Action is to meet the goals and requirements of federal laws and executive orders by creating a system for producing heat and electricity that will reduce energy cost, usage, and intensity while increasing energy surety and generating environmental benefits. The applicable federal laws and executive orders are detailed in the Final EA (March 2014).

1.2 ORGANIZATION AND OBJECTIVES OF THIS SEA

This chapter explains the background, purpose and need for the Proposed Action (Section 1.1), the applicable regulations (Section 1.3), the scope of the analysis (Section 1.4) and the public involvement process followed during development of the SEA (Section 1.5). Chapter 2 discusses NASA's Proposed Action, the proposed Alternative Action, and the No Action Alternative. Chapter 3 describes the affected environment and the potential environmental consequences of the proposed project, Alternative Action, and the No Action Alternative. Chapter 4 discusses cumulative impacts.

1.3. NASA PROCEDURAL REQUIREMENTS

NASA Procedural Requirements (NPR) 8580.1A establishes procedures and responsibilities for complying with the requirements of the National Environmental Policy Act (NEPA), the Council on Environmental Quality's (CEQ) implementing regulations, Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, and NASA Policy Directive (NPD) 8500.1, NASA Environmental Management. NPR 8580.1 outlines the roles and responsibilities of senior NASA personnel in establishing, assigning, and maintaining NEPA program requirements. The timing of the NEPA process, descriptions and criteria for categorical exclusions and records of environmental consideration, and outlines the public scoping process are also discussed. This NPR also outlines the EA and FONSI, EIS, mitigation and monitoring processes. Finally, it describes supplemental documentation, emergency circumstances, classified actions, electronic media policy, evaluation of potential for global environmental effects, and requests for deviation from this NPR.

In accordance with NPR 8580.1A, this SEA has been prepared to supplement the Final EA (March 2014) in compliance with the applicable laws and regulations.

1.4 SCOPE OF THE ANALYSIS

This SEA examines the potential effects of the proposed modification of the CHP design on the same resource areas evaluated in the Final EA (March 2014). A summary of the potential effects evaluated in the Final EA, detail on potential changes, and applicability to the scope of this SEA is provided in the following table.

Resource	Final EA (March 2014)	Potential for Changes from Final EA	SEA Scope Applicability
	Effects		
Groundwater	No Effect	No change	No
Geology and	Negligible	Larger footprint could	Yes
Soils		increase soil impact	
Water Resources	Negligible to	Larger footprint could	Yes
	Minor	increase sedimentation	
		from runoff	
Biological	Negligible to	Larger footprint could	Yes
Resources	Minor	increase vegetation	
		and habitat impact	
Air Quality	Negligible	Change in turbine size	Yes
	(short-term);	and duration of	
	Beneficial	operations could	
	(long-term)	result in emissions	
Noico	Nogligible	Relocation of CHP	Voc
INDISE	negiigibie	facilities outside of	168
		Building 24 could	
		result in increased	
		noise	
Land Use	Negligible	No change	No
Cultural and	Negligible	Relocation of CHP	Yes
Historic		facilities outside of	
Resources		Building 24 could	
		result in additional	
		impacts to visual area	
		of potential effect	
C	NI- Científicant	(APE)	NT-
Socioeconomics	INO Significant	No change	INO
Environmental	impact		
Instice			
Transportation	No Significant	No change	No
mansportation	Impact	i to chunge	
Hazardous	Negligible	No change	No
Materials and			
Waste			
Management			
Human Health	Marginal	No change	No
and Safety	NT 1· ·1 1		N
Cumulative	Negligible	Kelocation of CHP	Yes
Impacts		racilities outside of	
		building 24 could	
		noise parking lot	
		expansion could result	
		in additional traffic	

 TABLE 1.4-1:
 Effects Determinations from the Final EA (March 2014) and Scope of SEA

1.5 PUBLIC INVOLVEMENT

The provisions of NEPA provide the public an opportunity to participate in the environmental review process. NASA has taken measures to maximize public consultation and input during the preparation of the EA and SEA. NASA also has coordinated with federal, state, and local agencies, and project stakeholders, as appropriate. The Department of Energy (DOE) is providing the ESPC contract necessary for NASA to complete this project. DOE declined NASA's invitation to participate as a Cooperating Agency.

1.5.1 Public and Community Involvement

The proposed project is located within the JSC campus and is not expected to have any negative impacts on the greater Clear Lake community. A potential positive impact resulting from the project would be an increase in the amount of electricity available to the public. The ability for JSC to produce their own electricity would reduce the necessity for the campus to purchase electricity from the public utilities, which would result in decreased electrical demand within the area.

NASA solicited public comment on the environmental impacts of the original Proposed Action through:

- 1. Publishing notices of availability of Draft EA in local newspapers;
- 2. Making the Draft EA available for review at local public libraries;
- 3. Consulting with federal, state, and local agencies.

No comments were received prior to publication of the Final EA (March 2014).

Due to the alterations in the design of the Proposed Action subsequent to publication of the 2014 EA, NASA solicited additional public comment on the environmental impacts of these alterations through:

- 1. Publishing notices of availability of the Draft SEA in local newspapers;
- 2. Making the Draft SEA available for review at local public libraries.

No comments were received prior to publication of the SEA.

NASA considers these public scoping efforts as sufficient for this SEA, and thus a formal Public Involvement Plan is not applicable for the proposed action.

1.5.2 Agency Consultations

On August 28, 2013 NASA submitted a preliminary coordination and scoping letter regarding the proposed project to the following regulatory agencies and organizations:

- U.S. Department of Energy
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- Federal Emergency Management Agency
- U.S. Environmental Protection Agency
- National Parks Service
- U.S. Department of Agriculture Natural Resources Conservation Service
- Texas Commission on Environmental Quality
- Texas Parks and Wildlife Department
- Texas Historical Commission
- Texas General Land Office
- Harris County Flood Control District
- Texas Archaeological Society
- Harris County Historical Commission
- Houston-Galveston Area Council

This letter described the Proposed Action and provided the agencies the opportunity to provide any input regarding environmental requirements, constraints, mitigations, or other issues that may apply that the agencies wish to have considered in the 2014 EA. A response from the USDA National Resources Conservation Service (USDA-NRCS) was received on September 23, 2013 indicating no significant adverse impact on the environment. No other agency or public input was received prior to the publication of the Final EA in March 2014.

No additional comments were received prior to publication of the SEA.

2.0 PROPOSED ACTION AND ALTERNATIVES

This section describes NASA's Proposed Action, detailing the modifications to the CHP design. For additional information regarding the original CHP design and alternative actions please reference the Final EA (March 2014).

2.1 PROPOSED ACTION

NASA proposes design modifications to a CHP system to be constructed at the JSC. The modifications include:

- A reduction in combustion turbine size from 6.3 megawatts (MW) each to 5.7 MW each,
- A reduction in backpressure turbine size from 1.1 MW to 0.5 MW,
- A reduction in blackstart generator size from 1.0 MW to 0.75 MW,
- Relocation of the CHP equipment from being entirely contained within a two-story expansion of the existing Building 24 to a concrete slab and pad foundations outside and north of the existing Building 24, as well as within an additional small building oriented north to south at the northeast corner of the existing Building 24, and
- The expansion of the existing parking lot north of Building 24.

The modified CHP system described in this section is preferred over the originally proposed CHP system due to budgetary constraints that have rendered the original design detailed in the Final EA (March 2014) as not possible. The proposed action supports the mandates detailed in EP Act of 2005, the EISA of 2007, EO 13423, and EO 13514 to reduce energy use and increase efficiency. Through utilization of a CHP facility to achieve these mandates, JSC also supports the goals of EO 13624 to ensure that the DOE promotes the use of cogeneration.

The goal of the JSC CHP project is to create a system for producing heat and electricity that will reduce energy cost, usage, and intensity while increasing energy surety and generating environmental benefits. The JSC CHP ESPC would construct a combined heat and power system (aka cogeneration system) for the campus consisting of two nominal 5.7 megawatt (MW) combustion turbines with heat recovery steam generators (HRSG). The CHP system would also deploy a backpressure steam turbine at 0.5 MW, which generates electricity and reduces high pressure (400 psia), superheated (600 °F) steam down to medium pressure (125 psia) for distribution throughout the Center. The JSC campus consumes both chilled water and steam throughout the year, thus satisfying the utility demands to cost effectively support a base loaded CHP system. The economics of the JSC CHP are further enhanced by the regional availability of low cost natural gas. The costs for the natural gas would be more than offset by the reduction in electricity purchases from the local utility, resulting in a net decrease in expenditures associated with source energy. All electricity and steam generated by the CHP system would be utilized by JSC. The proposed CHP

would be installed outside and north of the existing Building 24 Central Plant on a concrete slab and footings and partially within a small new building.

Building 24 at JSC is the primary central plant that generates all steam and the majority of chilled water for the campus, supplying the mall area buildings heating, air conditioning, and ventilation reheating for humidity control. Due to the location of the boilers, steam, electricity, and other utility operations within the central plant, the Building 24 site is the most logical location for the CHP facility. The installation of the CHP facility and ancillary equipment would require a small addition adjacent to the north end of the building including a concrete slab, concrete pad foundations, an additional small building, and an expansion of the existing parking lot. An aqueous ammonia tank, the combustion turbines, heat recovery steam generators, the backpressure steam turbine and electrical equipment would be located outside on the concrete slab. Selective catalytic reduction modules, economizers, blowdown separators, and the main stacks would also be located outside on pad foundations between the concrete slab and Building 24, with the stacks located approximately 20 feet north of the existing building and extending approximately 10 feet above the roof elevation.

The CHP facility would also require the installation of approximately one (1) mile of dedicated high pressure (300 psig) natural gas pipeline from an existing ROW along the western boundary of JSC. The proposed pipeline would traverse east along the existing Avenue B ROW, and then south to the proposed CHP facility. Outside the JSC boundary, approximately 9,700 feet (1.84 miles) of existing gas pipeline along Space Center Boulevard and Middlebrook Drive would be upgraded by CenterPoint Energy to provide the necessary high pressure gas to the tie in with the new onsite pipeline.

The CHP would be grid-connected and satisfy the majority of JSC's normal electrical demand while producing 400 psig, 600 °F steam for steam turbine drive chiller operations and site heating load. The CHP would efficiently provide greater control, reliability, quality, and flexibility in the JSC power system, as well as cut costs and enable JSC to meet Federal energy efficiency goals.

The proposed CHP facility would reduce source energy use at JSC by 23.2 percent and save up to 3.62 million dollars annually (2017 Dollars). The Proposed Action would reduce energy intensity by 51.29 percent. This project would also reduce site and source CO₂e emissions attributable to JSC by approximately 17.6 percent based on projected usage. Other benefits include increased energy surety and decreased dependence on the local electrical grid, ensuring energy for Mission Control and the JSC campus during critical periods of energy usage.

2.1.1 Construction of the CHP System

The installation of the CHP system and ancillary equipment would require grading and construction in a small area adjacent to the north end of the building including a concrete slab, concrete foundations, an additional building, and an

expansion of the existing parking lot. The layout of the CHP equipment and structural support steel for piping and ductwork would be suitable for static and dynamic loading.

A concrete slab measuring approximately 55 x 50 feet would be constructed approximately 50 feet north of Building 24. The slab would be surrounded by a combination of screen wall, retaining wall, and chain-link fencing. The existing trees surrounding Building 24 will be preserved, to the greatest extent possible, to provide a natural visual and audial site screen. Additionally, JSC is currently exploring options to acquire additional trees from local, native growers to enhance this existing vegetative buffer. The slab would contain additional pad foundations for the two (2) 5.7 MW combustion turbine generators, duct burners, and heat recovery steam generators.

Additionally, a 12,000 gallon tank containing 19% aqueous ammonia is proposed to be located on the slab northeast of the proposed CHP equipment, and would be connected to the equipment via pipeline. Adequately sized secondary containment would be provided to contain any potential release during operation or aqueous ammonia transfer activities. Aqueous ammonia would be utilized in a selective catalytic reduction to convert NOx to NO₂ and water and reduce overall NOx emissions. JSC currently uses 19% aqueous ammonia at its onsite potable water treatment facility and is therefore familiar with the hazards and safe handling of this material.

Selective catalytic reduction modules, economizers, blowdown separators, and the main stacks would be constructed outside on pad foundations between the concrete slab and Building 24, with the stacks located approximately 20 feet north of the existing building and extending approximately 10 feet above the roof elevation.

The CHP equipment project would also include a single story building comprised of concrete masonry unit (CMU) and containing two small rooms to house the backpressure steam turbine and electrical gear. The building would be constructed on the east side of the CHP equipment layout and oriented north to south adjacent to the northeast corner of Building 24. The new building would have a footprint of approximately 1,320 square feet, and the dimensions for the new building would be approximately 60 feet x 22 feet.

An additional approximately 10 feet x 70 feet paved area would be located along the bollard and chain fence at the east side of the CHP addition, extending from the northwest corner of Building 24 to the northern extent of the concrete slab.

The existing gas line to the Building 24 Central Plant does not supply adequate pressure to support the combustion turbine generators without adding a significant compressor that would constitute a parasitic loss on the power generated. CenterPoint Energy has indicated that a 300 psig gas service to the proposed CHP facility could be extended from an existing ROW immediately west of JSC. The proposed pipeline would proceed east along the existing Avenue B ROW and then south to the proposed CHP facility. Outside the JSC

boundary, approximately 9,700 feet of existing gas pipeline would be upgraded by CenterPoint Energy to provide the necessary high pressure gas. This approach would eliminate the necessity for a compressor and result in electrical savings of approximately two (2) percent of the power produced by the combustion turbines. Final routing of the proposed natural gas line across JSC would be developed in the future in conjunction with CenterPoint energy.

2.2.2 Operation of the CHP facility

Once operational, the proposed CHP facility would produce 11.9 MW of electricity. The electricity generated would be used by NASA JSC directly. There would be no export of electricity to the utility grid. The control of the CHP would maintain a minimum level of import power from the utility. The CHP system would be electrically connected to the JSC system. The interconnection to JSC's 138 kV Ring Bus would require coordination with and approval from the local electric company CenterPoint Energy.

Operation of the combustion turbines and backpressure turbine would be carefully coordinated with site electric demand, steam demand, and chilled water load. Steam generated with the HRSGs would be primarily utilized to support the campus steam demand, but secondarily utilized for in-plant steam usages including the steam turbine drive chillers.

2.3 ALTERNATIVE ACTION CONSIDERED BUT NOT CARRIED FORWARD

The alternative to constructing the CHP facility at Building 24 would be to construct it at another location within the JSC campus. The most logical alternative site was identified adjacent to the Building 221 electric substation. If the CHP facility were located at this site, the construction would require a completely new building and additional infrastructure that would not be required under the Proposed Action. The new building for the Alternative Action would also require a construction footprint in previously undeveloped areas. This would result in the fill and disturbance of a much larger area than the Proposed Action, and would have a greater potential to impact biological resources in the area. Additionally, this alternative does not make use of the existing infrastructure and steam plant. The modifications to the existing infrastructure at Building 24 would be less cost and resource intensive than constructing a completely new structure, steam plant and associated infrastructure.

2.4 NO ACTION ALTERNATIVE

Under the No Action Alternative, the CHP facility and ancillary equipment would not be constructed at JSC. As a result, NASA would not achieve the necessary improvements in energy efficiency outlined in EPAct of 2005, the EISA of 2007, EO 13423, EO 13514, and EO 13624. JSC would continue to utilize the existing steam generation system and rely on additional energy inputs from the local electrical grid. Annual energy usage and costs would continue at or near current levels. Therefore, the No Action Alternative would result in the following impacts to energy metrics when compared to the proposed action:

Energy Metric	Impact of No	Impact of Proposed Action
	Action Alternative	
Source energy	No significant	536 million BTU source energy
usage	change	reduction (23.2 percent)
Annual purchased	No significant	\$3.62 million reduction (2017
energy costs	change	Dollars)
Energy intensity	No significant	109,100 BTU/GSF reduction (51.29
	change	percent)
Combined site and	No significant	13,729 metric ton reduction (12.2
source CO ₂	change	percent)
emissions under		
maximum		
allowable usage		
Combined site and	No significant	19,750 metric ton reduction (17.6
source CO ₂	change	percent)
emissions under		
expected usage ¹		

TABLE 2.0-1: Energy Impacts of No Action Alternative vs. Expected Usage ofProposed Actions

¹ The Federal Energy Management Program (FEMP) assists Federal agencies with managing their greenhouse gas emissions, and has categorized emissions as Scope 1, Scope 2, and Scope 3. The FEMP defines Scope 1 emissions as GHG emissions from sources that are owned or controlled by a federal agency, and are also referred to as "site" energy and emissions. Scope 2 emissions refer to emissions that result from the generation of electricity, heat, steam, or cooling that is purchased by a federal agency, also referred to as "source" energy and emissions. Finally, Scope 3 emissions are GHG emissions from sources not owned or controlled by a Federal agency but related to agency activities. It is important to note that only Scope 1 and Scope 2 (site and source) emissions were considered in the energy and emissions referred to within this document. Please refer to Section 3.5.2 of this document for a detailed emissions analysis.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

All potentially relevant resource areas were initially considered for analysis in this SEA. In compliance with NEPA and CEQ implementing regulations, this SEA focuses on the resource areas most likely to be affected by the alternative evaluated, including geology and soil resources, water resources, biological resources, air quality, noise, land use, cultural and historic resources, socioeconomics and environmental justice, transportation, hazardous materials and waste management, and human health and safety. For each of those resources, the affected environment is first described and the environmental consequences of the proposed project and No Action Alternative are then discussed. Some environmental resources that are often analyzed in an EA have been omitted from this analysis. The basis for such exclusions is given in the section below.

3.1 RESOURCE AREAS DISMISSED FROM FURTHER ANALYSIS

As part of the scoping for the proposed action, several resources previously examined in the Final EA (March 2014) were found to have no potential for additional impacts based upon the modifications to the CHP design. Therefore, these resources were removed from further analysis. These resources included groundwater, land use, socioeconomics and environmental justice, transportation, hazardous materials and waste management, and human health and safety. Details on the potential impacts to these resources are available in the Final EA.

3.2 GEOLOGY AND SOIL RESOURCES

3.2.1 *Affected Environment*

There is no change in the affected environment from that described in the Final EA published in March 2014.

3.2.2 Environmental Consequences of the Proposed Project

The proposed relocation of the CHP equipment, ancillary facilities, and parking lot expansion would disturb approximately 0.64 acres of land. This is an approximately 0.39 acre increase over the footprint described in the Final EA (March 2014). The area immediately north of Building 24 has already been graded and sodded or paved, but would be additionally cleared and graded as needed. BMPs would be used throughout construction to limit potential impacts to the geological and natural environment. The CHP equipment layout would be constructed partially outside on a concrete slab and concrete footings, and partially within a small new building. Installation of the dedicated natural gas line would likely utilize a type of trenchless pipeline installation such as the horizontal auger boring method that minimizes surface impacts. This method would require the temporary disturbance of 25 square foot (5 feet x 5 feet) boring pits located approximately every 300 feet along the existing one mile long utility

ROW for staging the boring equipment. These pits would be backfilled after completion of construction and restored to pre-construction conditions.

The potential impacts of soil contamination from spills and physical disturbance of soils, as well as the construction BMPs that will be implemented to mitigate these risks are unchanged from the descriptions in the Final EA (2014). No ground disturbance outside the footprint of the proposed project is anticipated.

Although the area of soil disturbance due to the proposed modifications is slightly larger than described in the Final EA, the overall area to be impacted by construction remains very small. Due to the small construction area, minimal ground disturbance, and the implementation of BMPs, the effects on soil resources are expected to be highly localized and have negligible impacts. The proposed modification of the CHP and ancillary facilities would not alter any geological resources.

3.2.3 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, there would be no change from existing conditions. Construction activities would not occur, thus no impacts on geology or soil resources would be anticipated.

3.3 WATER RESOURCES

3.3.1 Affected Environment

There is no change in the affected environment from that described in the Final EA published in March 2014.

3.3.2 Environmental Consequences of the Proposed Project

The potential impacts of sedimentation and stormwater runoff to adjacent water resources are unchanged from the descriptions in the Final EA (March 2014). The proposed action results in an increase in the Project footprint, which has the potential to increase the magnitude of these impacts.

The National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act (CWA) regulates the discharge of any pollutant, including sediments, to waters of the United States. The Texas Commission on Environmental Quality (TCEQ) has assumed the authority to administer this program as the Texas Pollutant Discharge Elimination System (TPDES). The construction of this project will adhere to the conditions outlined in the TPDES Construction General Permit TXR150000 designed to protect surface waters in the Project area.

In addition to adherence to all permit stipulations, the incorporation and maintenance of standard construction erosion and sediment controls, including vegetative stabilization practices, structural practices, storm water management practices required by the site-specific storm water pollution prevention plan (SWPPP), and other controls as necessary, would occur throughout the construction phase of the proposed project. Implementation of these practices and controls would minimize erosion at the construction site and sediment runoff to all water resources in the vicinity of the proposed construction area.

The proposed modifications to the footprint of the CHP and ancillary facilities are not located within the 100-year floodplain. No wetlands occur in the proposed construction areas within the JSC boundary, thus no impacts to onsite wetlands or floodplains are anticipated to occur as a result of the development of the CHP facility.

The proposed action will not result in any changes to potential wetland impacts associated with the offsite pipeline that are detailed in the Final EA.

Although the proposed modifications have the potential to result in a slight increase in runoff during construction and operation of the project that could impact water quality in the vicinity of the proposed project, the implementation and adherence to all permit conditions, BMPs and the SWPPP is expected to minimize adverse impacts to water quality. Construction impacts would be temporary, and operational impacts of the proposed project from the addition of impervious surface area would be long-term and insignificant. The surface area occupied by the CHP would be very small relative to surrounding undisturbed areas. Adequately sized secondary containment will be provided for the units containing 55 gallons or more of oil or hazardous materials, such as the aqueous ammonia tank. No impacts to potable water supplies, the current water balance or surface water management within and proximate to the JSC would occur. Overall, the potential impacts to water resources from implementation of the proposed action would be negligible to minor.

3.3.3 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed CHP facility would not be constructed. Therefore no impacts to water resources would be expected to occur. No operational changes would occur that would impact water resources, including surface water, groundwater, wetlands, or floodplains.

3.4 BIOLOGICAL RESOURCES

3.4.1 *Affected Environment*

There is no change in the affected environment from that described in the Final EA published in March 2014.

3.4.2 Environmental Consequences of the Proposed Project

Under the proposed action, approximately 15,000 square feet or 0.64 acres of developed, landscaped area would be permanently developed and replaced with impervious surfaces to accommodate the CHP facility. This represents an

approximately 0.39 acre increase from the impacts described in the Final EA (March 2014).

The additional area permanently affected by the proposed action is considered 'developed' in that the land has previously been leveled and graded, and native plant communities have been displaced by planted turf and ornamental shrubs and trees. This area is maintained intensively, and provides marginal wildlife habitat. The intensive landscape maintenance, proximity to a high traffic area, and very small size of the area described make this habitat undesirable for most species.

The proposed modification is not expected to result in any additional impacts to wildlife during construction or operation than those detailed in the Final EA The proposed action is not expected to impact protected species.

The marginal plant and wildlife habitat impacted by the project is considered undesirable for most species, including those protected by the Endangered Species Act and Migratory Bird Treaty Act. Additionally, most wildlife would be able to avoid the disturbed area for the CHP and parking lot expansion and vegetation impacts are limited to a relatively small, maintained area, therefore impacts to biological resources are considered negligible.

3.4.3 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed CHP facility and the expansion to Building 24 would not be constructed. Therefore, no changes in biological resources would occur from this alternative.

3.5 AIR QUALITY

3.5.1 Affected Environment

There is no change in the affected environment from that described in the Final EA published in March 2014.

3.5.2 Environmental Consequences of the Proposed Action

Compared to the facility in the original EA dated March 2014, the facility will be using two smaller Solar Taurus 60 turbines with a nominal output of 5.7-MWe each, a smaller 0.5-MW back pressure steam turbine, and a smaller 0.75-MW black start generator. These changes, combined with an increase in permitted allowable operational hours, result in an increase in potential to emit for NO_X and CO and a reduction in PM₁₀, PM_{2.5}, CO₂e and VOC compared to the original proposed action. While there is an increase in emission for NO_X and CO, compared to the previous proposed action, Tables 3.5-1 and 3.5-2 show the proposed project emissions still do not exceed major source or netting permitting thresholds.

Table 3.5-3 shows the difference in CO_2 emissions between proposed project and No Action Alternative. Although the Proposed Action would result in increased site emissions, there is a 12.2 percent reduction in net (combined site and source) CO_2 equivalent emissions for the new proposed project, based on maximum allowable usage, compared to the No Action Alternative.

Pollutant	Original Project PTE (tpy)	New Project PTE (tpy)	Change in PTE (tpy)	Major Modification Threshold	Major Modification
CO	35	35.33	0.33	100	NO
NO _X	4.29	4.91	0.62	40	NO
PM_{10}	10.98	8.60	-2.38	15	NO
PM _{2.5}	10.98	8.60	-2.38	10	NO
CO ₂ e	74,878	73,664	-1,214	75,000	NO

TABLE 3.5-1: Project Emissions and PSD Analysis

TABLE 3.5-2:	Project Emissions	and Non-Attainment	NSR Analysis
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Pollutant	Old Project PTE (tpy)	New Project PTE (tpy)	Change in PTE (tpy)	Netting Triggered
VOC	4.10	2.16	-1.94	NO
NO _X	4.29	4.91	0.62	NO

TABLE 3.5-3:	<i>Comparison of CO</i> ₂ <i>e Between Existing and Proposed Facilities</i>
(Based on Perr	nitted Maximum Allowable Usage)

CO ₂ e Emissions	Existing Boilers	Proposed Turbines	CO ₂ e Change (metric ton)	Percent Change
	(metric ton)	(metric ton)	()	8-
Site (Scope 1)	23,848	68,834	44,986	188.6%
Source (Scope 2)	88,305	29,577	-58,728	-66.5%
Combined Site and Source (Scope 1 and Scope 2)	112,153	98,424	-13,729	-12.2%

General Conformity

There is no change in general conformity for the proposed action.

Other Air Quality Regulations

There is no change in the permitting requirements for the proposed action.

In summary, implementation of the proposed project would have both shortterm and long-term negligible impacts to air quality. Short-term adverse effects would result from dust and air emissions during construction, but minimization of these impacts would be achieved through the use of Best Management Practices. Operation of the turbines and other operational equipment and vessels will result in increased onsite greenhouse gas emissions that will require mandatory reporting of JSC GHG emissions under 40 CFR 98 as detailed in the Final EA. However, when balanced with the reduction in source emissions, the proposed action results in an overall reduction in total GHG emissions that represent a long-term beneficial impact.

3.5.3 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed CHP facility would not be constructed. Therefore, no changes in air quality would occur from this alternative.

3.6 NOISE

Although human response to noise varies, measurements can be calculated with instruments that record instantaneous sound levels in decibels. A-weighted decibel (dBA) is used to characterize sound levels that can be sensed by the human ear. "A-weighted" denotes the adjustment of the frequency range to what the average human ear can sense when experiencing an audible event. The threshold of audibility is generally within the range of 10 to 25 dBA for normal hearing. The threshold of pain occurs at the upper boundary of audibility, which is normally in the region of 135 dBA. Noise levels can become annoying at 80 dBA and very annoying at 90 dBA. To the human ear, each 10 dBA increase seems twice as loud (USEPA, 1981). Cumulative noise increases occur on a logarithmic scale, meaning that, when adding new noise sources to an existing source, the perceived noise level increase is only a fraction of the measured noise source added to the area. In general, doubling a noise source will result in a 3 dBA increase in noise, which is barely perceptible to the human ear (Cowan, 1994).

3.6.1 Affected Environment

There is no change in the affected environment from that described in the Final EA published in March 2014.

3.6.2 Environmental Consequences of the Proposed Action

The potential impacts of construction-related noise on sensitive receptors are unchanged from the descriptions in the Final EA (March 2014).

The proposed action includes the relocation of the CHP facility outside and adjacent to the largest noise generator on JSC, the Building 24 Utility plant which can reach noise levels of 95 dBA within the building, and up to 90 dBA outside the building in the vicinity of the cooling towers and condenser water pumps. The relocation of the equipment outside of Building 24 would result in additional noise in the ambient area.

The standard equipment package offered by the manufacturer selected for equipment supply rates noise produced from the CHP's combustion turbine at 85 dBA. As noted in the Final EA (March 2014), JSC has implemented noise abatement programs such as the "Buy Quiet Program" and "Quiet by Design Program" that establish guidelines for noise generation during new construction and requires that JSC designers and engineers consider noise emissions when purchasing and designing equipment that is expected to generate noise emission levels of concern for hearing conservation (80 dBA or higher).

ESG has modeled CHP equipment noise levels of 85 dBA at three feet from each combustion turbine. The backpressure steam turbine also rated for 85 dBA at 3 feet, will be located inside of a locked room built out of concrete masonry units with attenuated ventilation inlets and outlets, a PPE station, and signage to indicating PPE equipment must be worn inside of this room. The noise levels outside of the CMU walls are estimated to not exceed 50 dBA and therefore will not contribute to the ambient outdoor noise. The combined noise levels of the new CHP equipment add logarithmically to 88 dBA. When combined with existing outdoor noise levels from the Building 24 Utility plant (90 dBA), noise level increases results in an approximate 2dBA overall increase in noise in the proposed CHP area.

JSC's current hearing protection program includes mandatory hearing protection and operator exposure limits geared at preserving the auditory health and safety of the workers. These existing controls are in place at Building 24 to mitigate the adverse health effects of noise within the building. These controls would be implemented in noisy areas around the proposed CHP location to continue to protect worker hearing. Access to these areas would be limited to approved workers who would be made aware of the noise hazard and JSC's hearing protection program requirements prior to entering equipment areas.

The additional noise from the CHP facility is expected to reach approximately 85 dBA, resulting in a minor (~2 dBA) increase to the noise currently generated by the existing facility. This noise has been modeled by ESG to attenuate to approximately 29 dBA at the facility property boundary, which is well below the night time noise standard (58 dBA) provided in the City of Houston Code of Ordinances City of Houston, Texas.

Although the proposed action results in a slight increase in noise when compared to the evaluation in the Final EA (March 2014), modeling indicates that the noise will still attenuate to acceptable levels prior to reaching sensitive receptors. Additionally, existing controls used by JSC at Building 24 will be extended to the new CHP facility to protect workers in the area of potential impact. Due to the noise abatement programs, hearing protection program, and natural attenuation of noise over a distance, the additional noise impacts from the proposed action are expected to be negligible.

3.6.3 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed CHP facility and the expansion to Building 24 would not be constructed. Therefore, no changes in noise levels would occur from this alternative.

3.7 CULTURAL AND HISTORIC RESOURCES

3.7.1 Affected Environment

There is no change in the affected environment from that described in the Final EA published in March 2014.

3.7.2 Environmental Consequences of the Proposed Action

The proposed relocation of the CHP facility outside and adjacent to Building 24 has the potential to impact cultural resources within the expanded footprint of the facility, as well as impact historic resources within the visual Area of Potential Effect (APE) of the proposed action.

The APE for this project is Building 49, Vibration and Acoustic Test Facility; Building 36, Bioengineering and Test Support Facility; Building 32, Space Environment Simulation Laboratory (SESL), a National Historic Landmark; Building 47, which is owned and operated by Southwestern Bell Telephone Company on a land use license; Building 20, Leadership in Energy and Environmental Design (LEED) Office Facility for Transition; Building 44, Communications and Tracking Development Laboratory, eligible for listing on the NRHP under the U.S. Space Shuttle Program; and Building 25, Fire Operations Facility.

A systematic professional archaeological field survey was conducted at JSC. As a result, there exists a low probability that significant NRHP or SAL-eligible archaeological cultural resources exist in the surveyed area and no recorded archaeological sites are located within the Center. Because the footprint of the project would require minimal ground disturbance and the majority of the facility was graded during construction in 1961, no sub-surface archeological resources are anticipated to be impacted by the proposed project.

JSC has consulted with the Texas State Historic Preservation Officer (SHPO) on the proposed undertaking and the SHPO has given a finding of no adverse effect. The proposed project will be constructed in a style concurrent with the existing buildings in the immediate area to mitigate any visual impacts to the NHL or NRHP-eligible properties within the JSC.

Based upon the results of field surveys and the finding of no impact during consultation with the SHPO, NASA expects that no impacts to cultural and historic resources will result from the proposed action.

3.7.3 Environmental Consequences of the No Action Alternative

Under the No Action Alternative, the proposed CHP facility and the expansion to Building 24 would not be constructed. Therefore, no changes in cultural resources would occur from this alternative.

4.0 CUMULATIVE IMPACTS

CEQ regulations stipulate that the cumulative effects analysis in an EA should consider the potential environmental effects resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 CFR 1508.7). The first steps in assessing cumulative effects involve defining the scope of the other actions and their interrelationship with a proposed action. The scope must consider other projects that coincide with the location and timetable of a proposed action and other actions. Cumulative effects analyses must also evaluate the nature of interactions among these actions.

4.1 CUMULATIVE IMPACTS

Based on ongoing and future projects as included in the JSC Master Plan, the proposed CHP and parking lot expansion could contribute to cumulative adverse effects on traffic and noise levels within JSC during construction in addition to those described in the Final EA (2014). The scale and short-term nature of these impacts would have no more than a negligible cumulative effect. Operation of the project will result in additional noise that could contribute to slightly higher cumulative noise impacts than detailed in the Final EA; however, modeling indicates that these impacts are negligible, and JSC proactively manages noise through the use of abatement and hearing protection programs. Cumulative impacts are discussed in detail in the Final EA.

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